



**BOARD OF
INTERMEDIATE EDUCATION
ANDHRA PRADESH**

ZOOLOGY-II

WORK BOOK (ENGLISH MEDIUM)



Sri. V. RAMAKRISHNA I.R.S

PREFACE



**I HEAR AND I FORGET; I SEE AND I REMEMBER;
I DO AND I UNDERSTAND; I THINK AND I LEARN;**



The Board of Intermediate Education, Andhra Pradesh, Vijayawada made an attempt to provide ‘Work Books’ for the first time to the intermediate students with relevant and authentic material with an aim to engage them in academic activity and to motivate them for self-learning and self-assessment. These workbooks are tailored based on the concepts of “Learning by Doing” and “Activity Oriented Approach” to sharpen the students four core skills of learning – *Understanding, Interpretation, Analysis and Application*.

The endeavor is to provide ample scope to the students to understand the underlying concepts in each topic. The workbooks enable the students to practice more and acquire the skills to apply the learned concept in any related context with critical and creative thinking. The inner motive is that the students should shift from the existing rote learning mechanism to the conceptual learning mechanism of the core concepts.

I am sure that these compendia are perfect tools in the hands of the students to face not only the intermediate Public examinations but also the other competitive examinations.

My due appreciation to all the course writers who put in all their efforts in bringing out these work books in the desired modus.

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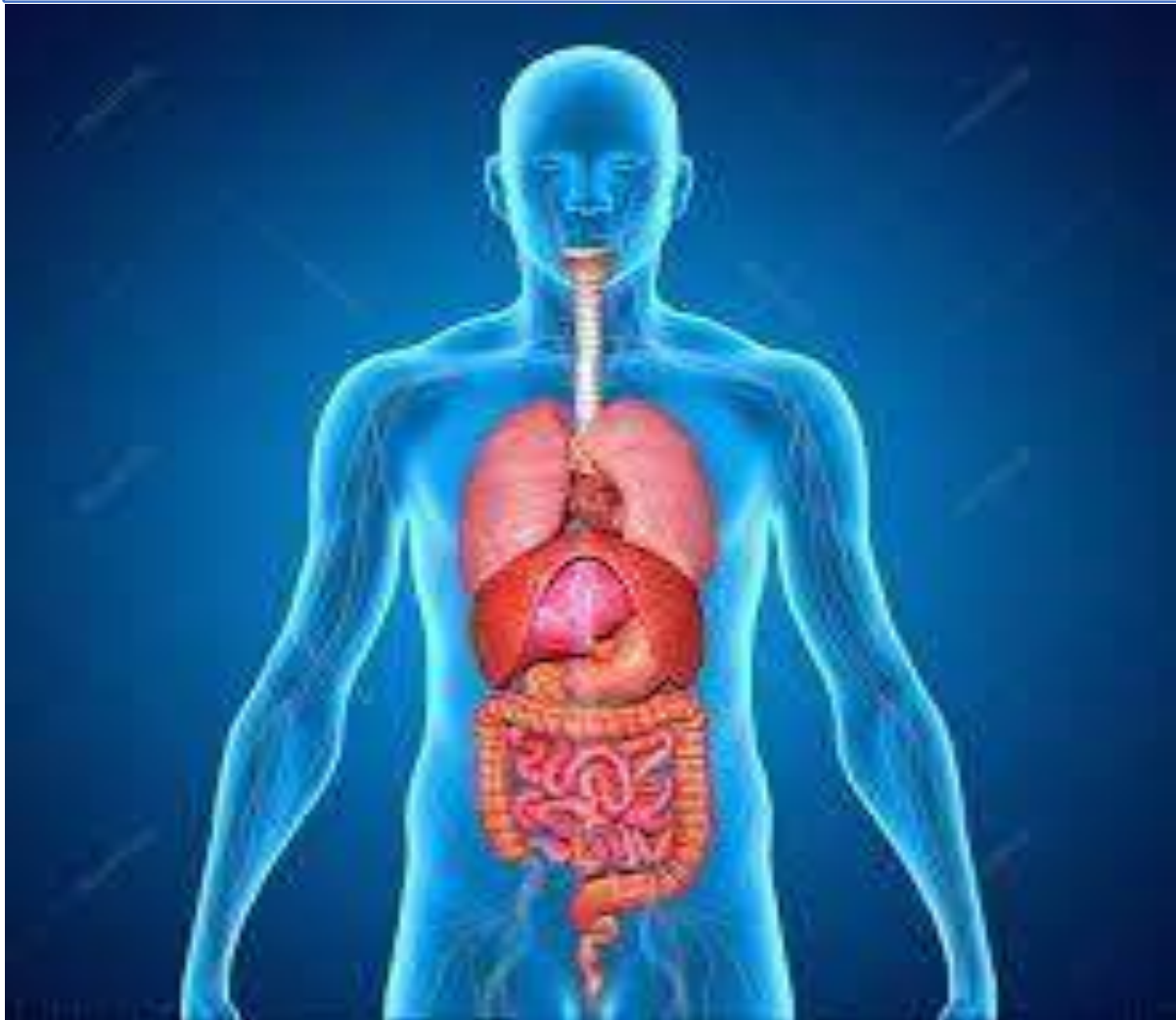
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UNIT – I

HUMAN ANATOMY AND PHYSIOLOGY - I



UNIT – IA

HUMAN DIGESTION AND ABSORPTION

MAJOR LEARNING OBJECTIVE

- *Students will be able to identify ,understand, apply the knowledge of the human digestion system and the process of absorption.*
- *Students will be able to appreciate why digestive system is called “The Fuel Provider and Life Sustainer”*

LEARNING OUTCOMES:

- Be able to name the organs that make up the digestive system.
- Be able to describe the major functions of each organ in the digestive system..
- Be able to explain the role of secretions of digestive glands in the digestive process.
- Be able to list the end products of carbohydrate, protein, fats and nucleic acids digestion and the way they are absorbed.
- Be able to describe the function of chylomicrons.
- Be able to describe the role of gastro-intestinal hormones
- Be able to know the calorific values of the Carbohydrates, proteins and fats
- Be able to know the causes of disorders of the digestive system

ADDITIONAL READING MATERIAL

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book
2. Defining key words
3. Identifying the parts of the digestive system
4. List the types of teeth
5. Define the characteristics of teeth
6. Label parts of L.S. of tooth, Papillae on the tongue
7. Naming the locations of various sphincters
8. Writing the characteristics of four layers of alimentary canal
9. Naming the enzymes involved in digestion
10. Filling the table under appropriate heads
11. Answer True or False
12. Completion of each sentence or statement/filling the blanks
13. Multiple Choice Questions for Competitive exams
14. Assertion & Reasoning Questions
15. Assignment Questions to answer
16. Hands on Experiences for you – Try It!!!
17. Medical and other Careers in Digestive System Related Fields
18. Answers to the activities and note making

INSTRUCTIONS TO LECTURER

- Ask the students to take aid of the textbook and to work with a partner
- Explain each part of the worksheet & Come up with some examples to help
- Clarify doubts of the students before starting the work book

INSTRUCTIONS TO STUDENTS

- First read the text book thoroughly and logically.
- While attempting the activities analyze them.
- While attempting the multiple choice questions, make notes on the other options too

ADDITIONAL READING MATERIAL:

(Adopted from NCERT Textbook)

PROTEIN ENERGY MALNUTRITION (PEM)

Dietary deficiencies of proteins and total food calories are widespread in many underdeveloped countries of South and South-east Asia, South America, and West and Central Africa. Protein-energy malnutrition (PEM) may affect large sections of the population during drought, famine and political turmoil. This happened in Bangladesh during the liberation war and in Ethiopia during the severe drought in mid-eighties. PEM affects infants and children to produce **Marasmus and Kwashiorkar**.

Marasmus is produced by a simultaneous deficiency of proteins and calories. It is found in infants less than a year in age, if mother's milk is replaced too early by other foods which are poor in both proteins and caloric value. This often happens if the mother has second pregnancy or childbirth when the older infant is still too young. In Marasmus, protein deficiency impairs growth and replacement of tissue proteins; extreme emaciation of the body and thinning of limbs results, the skin becomes dry, thin and wrinkled. Growth rate and body weight decline considerably. Even growth and development of brain and mental faculties are impaired.

Kwashiorkar is produced by protein deficiency unaccompanied by calorie deficiency. It results from the replacement of mother's milk by a high calorie low protein diet in a child more than one year in age. Like marasmus, kwashiorkor shows wasting of muscles, thinning of limbs, failure of growth and brain development. But unlike marasmus, some fat is still left under the skin; moreover, extensive oedema and swelling of body parts are seen.

ACTIVITIES:

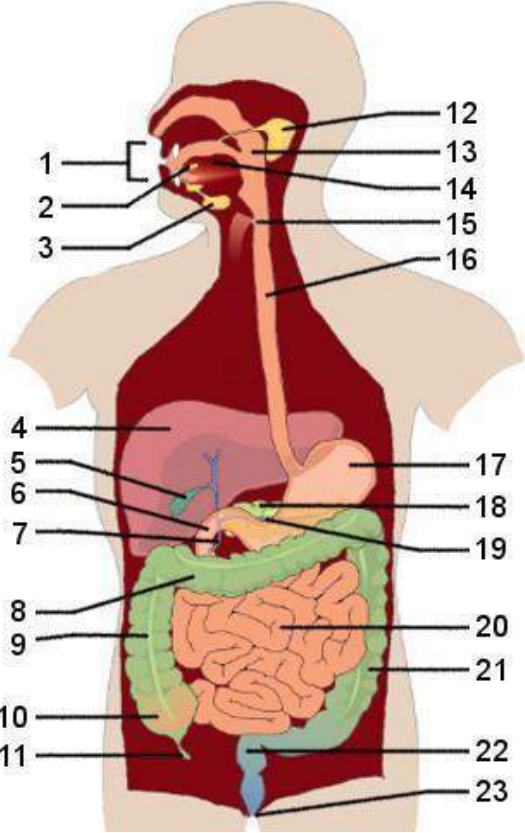
1. Locate and rewrite the difficult key words from the text book

1	9	17
2	10	18
3	11	19
4	12	20
5	13	21
6	14	22
7	15	23
8	16	24

2. Defining key words: (Search through the Text and write)

1. UVULA	
2. ALVEOLUS	
3. GINGIVA	
4. EPIGLOTTIS	
5. EXCORIATION	
6. ERYTHROCLASTIC ORGAN	
7. HAEMOPOETIC ORGAN	
8. FACILTATIVE TRANSPORT	
9. EXOCYTOSIS	
10. ASSIMILATION	

3. Identify numbered parts in column2

	3.
	5.
	6.
	8..
	10.
	12.
	15.
	17.
	18.
	22.
<p>Note: First identify all the parts. Then name numbered parts in column 2.</p>	

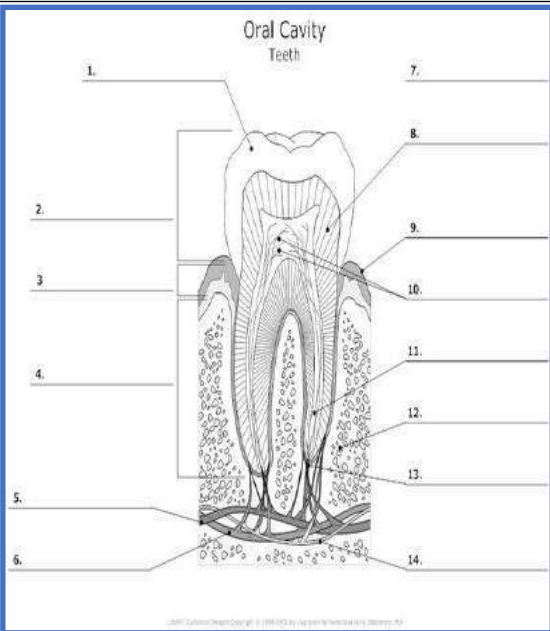
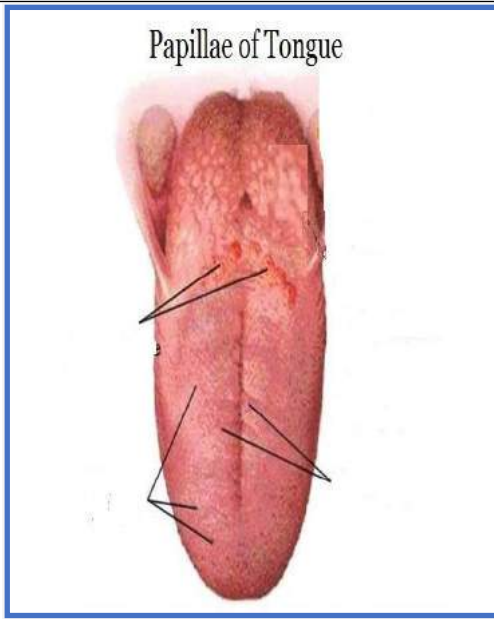
4. List the types of teeth and their function

Name of the teeth	Function
1	
2	
3	
4	

5. Define the characteristics of teeth

1. ORIGIN OF TEETH	
2. THECODONT	
3. DECIDUOUS TEETH	
4. DIPHYDONT	
5. HETERODONT	

6. Label parts

L.S. of tooth	Three types of papillae
	

7. Name the locations of various sphincters

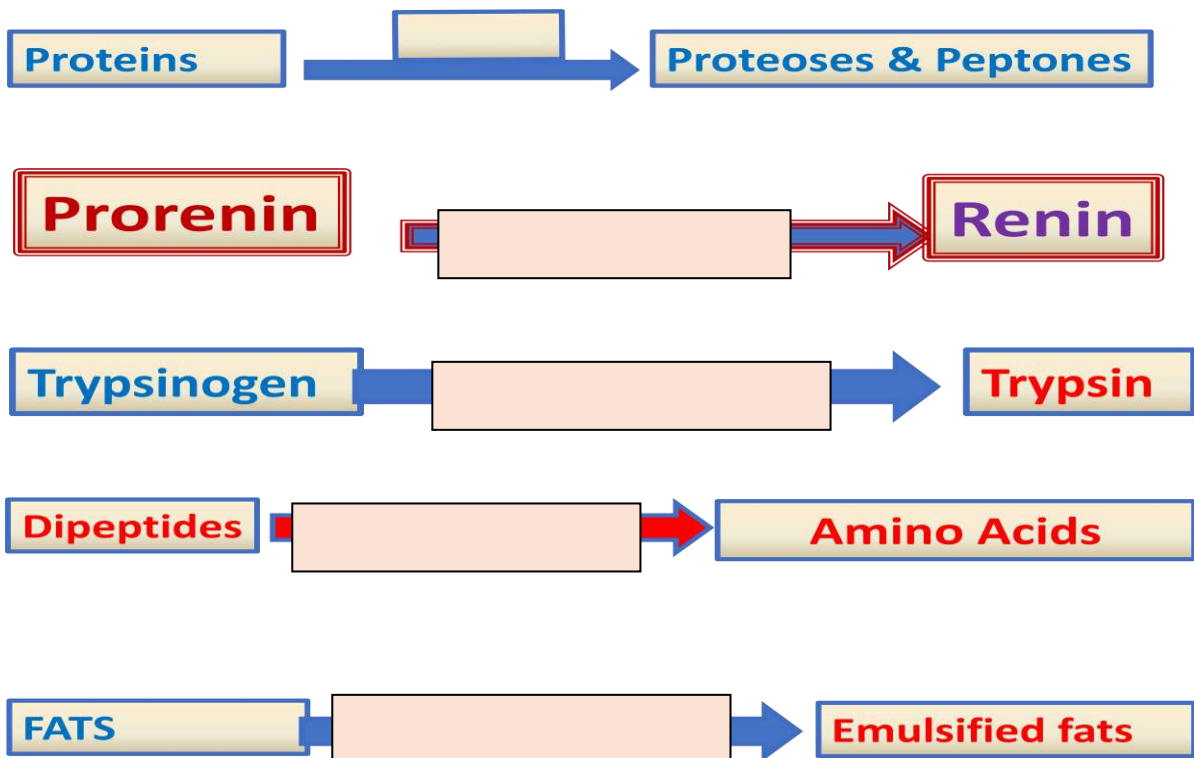
1. Pyloric Sphincter	
2. Cardiac Sphincter	
3. Sphincter of Oddi	
4. Internal Anal sphincter	
5. External Anal sphincter	

8. Mention the characteristics of four layers of alimentary canal

1. Serosa	
2. Muscularis Externa	
3. Sub-mucosa	
4. Mucosa	

Draw outline diagram of T.S.of Gut

9. Naming the enzymes involved in digestion (Fill in the boxes)



10. Filling the table under appropriate heads

SUMMARY OF ABSORPTION IN PARTS OF DIGESTIVE SYSTEM

MOUTH	STOMACH	SMALL INTESTINE	LARGE INTESTINE

11. Answer True or False

Sl. No.	Statement	True/False
1	Small intestine is larger than large intestine.	
2	Bacteria and germs found in food are killed by digestive juice.	
3	The circular folds of the small intestine enhance absorption by causing the chyme to spiral, rather than to move in a straight line, as it passes through the small intestine.	
4	Milk teeth come after permanent teeth.	
5	Blood carries the digested food to all parts of the body.	
6	Pepsinogen is the precursor to the gastric enzyme for protein digestion and is secreted by the parietal cells.	
7	Food is contained in the gastrointestinal tract from the time of ingestion until it is completely digested and the waste prepared for elimination.	
8	The major role of absorption in ileum is to reclaim bile salts to be recycled back to liver.	
9	Chylomicrons are transported into the lacteals in the villi by plasmolysis.	
10	Peristaltic movements of the intestine are fast and powerful.	
11	The lactic acid formed during anaerobic muscle contraction is converted into glycogen in the liver by Cori Cycle	
12	Pancreas is the chief organ of Detoxification of toxic substances that enter our body through food.	
13	The pH of Succus entericus is 2.	
14	Castle's intrinsic factor is responsible for the absorption of Vitamin E.	
15	Large intestine is called Vermiform Appendix.	
16	Villi are the "Universal Tooth Brush".	
17	Ameloblasts are "Endodermal in Origin"	
18	External Anal sphincters are formed by "Voluntary Striped muscles".	
19	Serosa is made up of thin "mesothelium".	
20	Crypts of Leiberkuhn are present between the bases of villi.	
Answers at the end....		

12. Complete each sentence or statement.

1	The esophagus and the stomach are lined with a thick, slippery substance called ____
2	Chemical digestion in the stomach is helped by the strong acid called_____acid.
3	The_____stores bile and releases it through a tube into the small intestine.
4	Nutrient molecules pass from the small intestine into the bloodstream through tiny structures called_____.
5	Enzymes are proteins that help in the kind of digestion called_____digestion.
6	When you swallow, a flap of tissue called the_____prevents food from entering your windpipe.
7	One of the roles of the_____intestine is to prepare waste material for elimination.
8	Nutrients that are needed for tissue growth and repair, can serve as an energy source, and take part in chemical reactions within cells are known as_____.
9	_____enzyme begins chemical digestion in mouth.
10	_____process involves muscle contractions that move food through the esophagus.
11	Tongue is attached to the floor of the oral cavity by a fold of tissue called _____
12	Tonsils are_____tissues present in the pharynx.
13	The dentine of tooth is secreted by _____
14	The three parts of small intestine are Duodenum ,_____and Ileum.
15	_____are the structural and functional units of the liver.
16	_____are the large phagocytic cells that lie in the sinusoids of hepatic chords.
17	The anti-coagulant synthesized by the liver is _____
18	Trypsin itself can activate Trypsinogen into Trypsin. This process is called _____
19	The undigested, unabsorbed substances that remain in the intestine is called _____
20	The abnormal frequency of bowel movement and increased liquidity of the faecal discharge is known as _____
	Answers at the end

13. Multiple Choice Questions: (LEVEL-1)

1. The dentition not found in man.			
a. Heterodont	b. Diphyodont	c. Thecodont	d. Lophodont
2. Hardest part of our body is			
a. Skull	b. Brain	c. Teeth	d. Cartilage
3. Ectodermal cells that secrete enamel are			
a. Osteoblasts	b. Odontoblasts	c. Ameloblasts	d. Chondroblasts
4. How many teeth appear during the life span of an individual			
a. 12	b. 20	c. 28	d. 32
5. The total number of canines in the permanent dental set of humans is			
a. 4	b. 6	c. 28	d. 32
6. The element that hardens the tooth enamel			
a. Iodine	b. Sodium	c. Flourine	d. Calcium
7. Bulk of the tooth in a mammal is made of			
a. Root	b. Dentine	c. Enamel	d. Pulp cavity
8. The part of alimentary canal which passes through diaphragm			
a. Pharynx	b. Esophagus	c. Stomach	d. Small intestine
9. Tongue is attached to the floor of buccal cavity by			
a. frenulum	b. mesentery	c. lingual papilla	d. falciform ligament
10. The structure that prevents the entry of food into trachea during deglutition in mammals is			
a. palate	b. larynx	c. pharynx	d. epiglottis
11. Reverse flow of food in the stomach is prevented by			
a. Uvula	b. Pyloric sphincter	c. Ileocaecal valve	d. Cardiac sphincter
12. In which layer of stomach is gastric glands located			
a. serosa	b. mucosa	c. sub-mucosa	d. muscularis mucosa
13. Glisson's capsule is associated with			
a. Salivary glands	b. Liver	c. Spleen	d. pancreas
14. Submaxillary glands pour their secretions through			
a. Stenson's duct	b. Wharton's duct	c. Nasopalatine duct	d. Bartholin's duct
15. Brunner's glands are found in			
a. Wall of rectum	b. mucosa of ileum	c. submucosa of stomach	d. submucosa of duodenum
16. Crypts of Lieberkuhn secrete			
a. Bile juice	b. Gastric juice	c. Saliva	d. Succus entericus
17. Hepatocytes secrete			
a. Lipase	b. Bile with enzymes	c. Bile without enzymes	d. Gastric juice with enzymes
18. Which of the following represent bile salts?			
a. Bilirubin, Biliverdin	b. Bilirubin, Hemoglobin	c. Glycocholates, taurocholates	d. Bicarbonates, bilirubin
19. Hydrochloric acid in the stomach is secreted by			
a. Chief cells	b. Parietal Cells	c. Zymogen cells	d. Neck cells
20. Which of the following digestive juices have the minimum pH?			
a. Bile	b. Saliva	c. Gastric Juice	d. Pancreatic juice

21. Which two enzymes are present in human gastric juice?			
a. HCl & Rennin	b. Pepsin & Rennin	c)Trypsin & Erepsin	d)Trypsin & Rennin
22. Which cells of gastric mucosa secrete pepsinogen?			
a. Goblet	b. Parietal	c. Oxyntic	d. Chief
23. Zymogen cells (also called Chief cells or Peptic cells) of gastric glands secrete:			
a. Pepsin	b. Trypsin	c. Pepsinogen	d. Chymotrypsin
24. Essentially the word 'digestion' means:			
a) Burning of food	b)Oxidation of food	c)Hydrolysis of food	d)Breakdown of food
25. Curdling of milk in stomach occurs by the action of:			
(a) Rennin	(b) trypsin	(c) erepsin	(d) chymotrypsin
26. Rennin acts on milk proteins and converts:			
(a) Caseinogen to casein	(b) casein into paracasein	(c) Caseinogens to paracasein	(d) paracasein into caseinogen
27. Lactose is hydrolysed into:			
a) Fructose only	b) glucose only	c) glucose+fructose	d) glucose +galactose
28. The main function of lacteals in villi of human small intestine is the absorption of			
(a) Glucose and vitamins	(b) fatty acids and glycerol	(c) Water and mineral salts	(d) amino acids and glucose
29. Carboxy peptidase is an enzyme secreted by:			
(a) Stomach	(b) pancreas	(c) intestine	(d) gall bladder
30. In which of the following, putrefying bacteria are present?			
(a) Liver	(b) colon	(c) Stomach	(d) Intestine
31. Proteolytic enzymes present in the pancreatic juice are:			
(a) Pepsin	(b) elastase	(c) salivary amylase	(d) chymotrypsin
32. The factor which governs the absorption of digested food by intestinal villi is:			
a) Peristalsis	b) Osmosis	c) Emulsification	d) Selective absorption
33. During digestion lymphatics of intestine become filled with fat globules giving white colour to the lymph which is called: (CBSE)			
a) Bilirubin	b) Chyle	c) Chyme	d) Cistron
34. The hardest substance in our body is enamel because it contains			
(a) High organic matter	(b) high inorganic content	(c) High blood supply	(d) high oxygen level
35. 'vomiting' is a reflex action controlled by			
(a) Cerebellum	(b) cerebrum	(c) Medulla oblongata	(d) spinal cord
36. Maximum energy is available on complete oxidation of:			
a) Glucose	b) Fat	c) Protein	d) Organic acids

37. Formation of glucose from protein is:			
a) Gluconeogenesis	b) Glycogenolysis	c) Glycogenesis	d) Glycolysis
38. Human digestive juices lack			
a) Lactase	b) Amylase	c) Cellulase	d) Sucrose
39. Which of the following lacks proteins?			
a) Pancreatic juice	b) Saliva	c) Bile	d) Intestinal juice
40. Calorific value of fats is			
a. 6.0 K.cal	b. 7.5 K.ca.	c. 4.0. K.cal	d. 9.0 K.cal

Multiple Choice Questions: (LEVEL-2)

41. In man though both air and food go through the pharynx, food does not normally enter the wind pipe because during swallowing of food; (CBSE)															
(a) The epiglottis covers glottis	(b) Cartilage of santorini closes the larynx	(c) Glottis covers the epiglottis	(d) arytenoid covers the glottis.												
42. The main importance of villus is that it:															
(a) Secretes enzymes	(b) acts as nerve transmitter	(c) Absorbs only protein material	(d) increases surface area for the absorption of digested food												
43. An adolescent human below 17 years of age normally has dental formula as:															
a) 2120/2120	b) 2122/2122	c) 2132/2132	d) 2232/2232												
44. The epithelial cells lining the stomach of vertebrates is protected from the damage by HCL because:															
(a) HCL is too dilute	(b) HCL is neutralized by stomach	(c) The epithelial cells are resistant to the action of HCL	(d) The epithelial cells are covered by a mucous secretion												
45. Which group contains biocatalysts?															
(a) Erepsin, Amylase, Rennin	(b) Rhodopsin, Pepsin, Steapsin	(c) Myosin, Oxytocin, Adrenaline	(d) Glucose, Amino acids, Fatty acids												
<p>46. The following is a scheme showing the fate of carbohydrates during digestion in the human alimentary canal. Identify the enzymes acting at stages indicated as A, B, C and D. Choose the correct option from those given:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 25%;">Starch</td> <td style="text-align: center; width: 25%;">Lactose</td> <td style="text-align: center; width: 25%;">Maltose</td> <td style="text-align: center; width: 25%;">Sucrose</td> </tr> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">B</td> <td style="text-align: center;">C</td> <td style="text-align: center;">D</td> </tr> <tr> <td style="text-align: center;">Galactose</td> <td style="text-align: center;">Glucose</td> <td style="text-align: center;">Fructose</td> <td style="text-align: center;">Glucose + Fructose</td> </tr> </table>				Starch	Lactose	Maltose	Sucrose	A	B	C	D	Galactose	Glucose	Fructose	Glucose + Fructose
Starch	Lactose	Maltose	Sucrose												
A	B	C	D												
Galactose	Glucose	Fructose	Glucose + Fructose												

(a) A=amylase, B=maltase, C=lactase, D=invertase	(b)A=amylase, B=maltase, C=invertase, D=lactase	(C) A=amylase, B=invertase, C=maltase, D=lactase	(D)A=amylase, B=lactase, C=maltase, D=invertase
47. Chylomicrons are			
a) Undigested proteins	b) Undigested carbohydrates	c) Fat droplets coated with phospholipids	d) Fats droplets coated with glycoproteins
48. Secretion of gastric juice is controlled by:			
(a) Gastrin	(b) Enterogastrin	(c) Cholecystokinin	(d) None of the above
49. Excessive stimulation of vagus nerve (also called “Pneumo-gastric nerve) in humans may lead to: (CBSE)			
(a) Hoarse voice	(b) peptic ulcers	(c) Efficient digestion of proteins	(d) irregular contractions of diaphragm
50. One of the following stimulates the movement of villi to increase absorption			
a)Enterocinin	b)Villikinin	c)Cholecystokinin	d)Enterogastrone
51. Secretion of “Succus Entericus” is stimulated by			
a)Enterocinin	b)Villikinin	c)Cholecystokinin	d)Enterogastrone
52. A dental disease characterized by mottling of teeth is due to presence of a certain chemical element in drinking water. Which is that element? (CBSE)			
(a)Boron	(b) Chlorine	(c) Fluorine	(d) Mercury
53. Stool of a person contains whitish grey colour due to malfunction of which of the following organs?(CBSE)			
(a) Liver	(b) Spleen	(c) Kidney	(d) Pancreas
54. Which enzyme digests peptides releasing amino acids one by one?			
a) Pepsin	b) Steapsin	c) Peptidases	d) Aminopeptidase
55. Marasmus is caused by:			
a) Obesity	b) Dwarfism	c) Prolonged starvation	d) Deficiency of vitamin
56. Which is incorrectly matched:			
a) Rennin-Liver	b) Ptyalin-Mouth	c) Pepsin-Stomach	d) Trypsin-Intestine
57. If the chyme of a person who had orally consumed starch as food is analyzed before it enters the duodenum, it will show the presence of:			
a) Maltose and glucose	b) Dextrin and maltose	c) Starch, dextrin and maltose	d) Starch, dextrin and glucose
58. The first process in digestion and assimilation of fats is:			

a) Emulsification	b) Enzymatic action	c) Absorption by lacteals	d) Storage in adipose tissue
59. Continued consumption of diet rich in butter, red meat and eggs for a long period may lead to (CBSE)			
a) Vitamin A toxicity	b) Kidney stones	c) Hypercholesterolemia	d) Urine with ketonic bodies
60. Epithelial cells intestine involved in food absorption have on their surface:			
a) Pinocytic vesicles	b) Phagocytic vesicles	c) Zymogen granules	d) Microvilli
61. Kwashiorkor is caused due to deficiency of			
a) Calories	b) Hormones	c) Zwitterions	d) Essential aminoacids
62. Caloric value for carbohydrates, proteins and fats is:			
a) 50 cal, 4.68 cal and 80 cal respectively	b) 40 cal, 80 cal and 100 cal respectively	c) 4.1 Kcal, 5.65 Kcal and 9.45 Kcal respectively	d) 5.6 Kcal, 100Kcal and 30Kcal respectively
63. Study the following question, Match glands and their location , choose the correct option			
Glands		Location	
A. Crypts of lieburkuhn B. Pancreas C. Adrenal gland D. Gastric gland		a. Loop of duodenum b. Stomach c. Intestine d. Kidney	
(a) A=a, B=d,C=c, D=a	(b) A=a,B=c,C=d,D=b	(c) A=c,B=a,C=b,D=d	(d) A=c,B=a,C=d,D=b
64. Match the terms in column A with suitable terms in column B:			
Column A		Column B	
i) Pepsin ii) Bile salts iii) Lipase iv) Ptyalin		a) Fats b) Casein c) Micelle d) Starch	
a) i – b; ii-c; iii-a; iv-b	b) i-c; ii-a; iii-d; iv-b	c) i-b; ii-c; iii-b; iv-a	d) i-c; ii-d; iii-a; iv-b
65. tudy the following question, choose the correct option			
Column-1		Column-2	
A. Goblet cells B. Lysozyme C. Saliva D. Oxyntic cells		1. Antibacterial agent 2. Mucus 3. HCl 4. Sublingual gland	
(a) A=1,B=1, C=4,D=2	(b) A=1,B=3, C=4, D=2	(c) A=2,B=3,C=1,D=4	d) A=2,B=1,C=4,D=3

<p>66. Study the following question, choose the correct option</p> <table border="0"> <tr> <td style="text-align: center;">Structure</td> <td style="text-align: center;">Description</td> </tr> <tr> <td>A. Stomach</td> <td>1. Vestigial organ</td> </tr> <tr> <td>B. Duodenum</td> <td>2. Heterocrine organ</td> </tr> <tr> <td>C. Vermiform appendix</td> <td>3. U-shaped organ</td> </tr> <tr> <td>D. Pancreas</td> <td>4. J shaped organ</td> </tr> </table>				Structure	Description	A. Stomach	1. Vestigial organ	B. Duodenum	2. Heterocrine organ	C. Vermiform appendix	3. U-shaped organ	D. Pancreas	4. J shaped organ
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<p>68. Study the following question, Match glands and their location , choose the correct option..</p> <table border="0"> <tr> <td style="text-align: center;">Papillae</td> <td style="text-align: center;">Shape</td> </tr> <tr> <td>A. Vallate</td> <td>1. mushroom shaped</td> </tr> <tr> <td>B. Fungiform</td> <td>2. Leaf shaped</td> </tr> <tr> <td>C. Foliate.</td> <td>3. Surrounded by a wall.</td> </tr> <tr> <td>D. Filiform</td> <td>4. Filament shaped</td> </tr> </table>				Papillae	Shape	A. Vallate	1. mushroom shaped	B. Fungiform	2. Leaf shaped	C. Foliate.	3. Surrounded by a wall.	D. Filiform	4. Filament shaped
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C. Foliate.	3. Surrounded by a wall.												
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a) A=4 B=2 C=1 D: 3	(b) A=3 B= 1 C=2 D=4	(c) A=2 B=3 C=1 D: 4	d) A=3 B=2 C=4 D=1										
<p>69. Select the correct match of the digested product in human in column A with their absorption site and mechanism in column B</p> <table border="0"> <tr> <td style="text-align: center;">Column – A</td> <td style="text-align: center;">Column – B</td> </tr> <tr> <td>A. Glycine & Glucose</td> <td>a. Small intestine & Active absorption</td> </tr> <tr> <td>B. Fructose & Na+</td> <td>b. Small intestine & Passive absorption</td> </tr> <tr> <td>C. Glycerol & fatty Acids</td> <td>c. Duodenum & movement of Chylomicrons</td> </tr> <tr> <td>D. Cholestrol & maltose</td> <td>d. Large intestine & Active absorption</td> </tr> </table>				Column – A	Column – B	A. Glycine & Glucose	a. Small intestine & Active absorption	B. Fructose & Na+	b. Small intestine & Passive absorption	C. Glycerol & fatty Acids	c. Duodenum & movement of Chylomicrons	D. Cholestrol & maltose	d. Large intestine & Active absorption
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D. Cholestrol & maltose	d. Large intestine & Active absorption												
A	B	C	D										
<p>70. Which of the following glandular secretions involved in digestion would be most likely released initially as inactive precursors?</p>													
a. Protein digesting enzymes	b. Fat solubilizing bile salts	c. Acid neutralizing bicarbonate	d. hormones such as gastrin										
<p>71. Lipids which can be found in oil based salad dressings and ice cream, during digestion are splitted into:</p>													
a. Fatty acids & Glycerol	b. Glycerol & Amino acids	c. Glucose & fatty Acids	d. Glucose & amino acids										
<p>72. Enterokinase is</p>													
a) a hormone that prevents the secretion of gastric juice	b) an enzyme that activates the	c) an enzyme that activates the proteolytic	d) hormone that prevents the										

	enzymes of pancreatic juice	enzymes of the succus entericus	secretions pancreatic juice
73. Find the wrong statement out with respect to the esophagus			
a)Thin long tube	b)Extends posteriorly	c)Passes through diaphragm	d)Opens into thorax
74. Pyloric sphincter is not associated with			
a)Stomach	b)Duodenum	c)Intestine	d)Esophagus
75. Which of the following is not correct with respect to “muscularis”			
A. It has inner circular and outer longitudinal B. Oblique muscle layer may also be present in some parts C. Muscle has striations D. It is the 2nd part from out side to inside.			
A	B	C	D
76. Symbiotic micro organisms are found in			
a) Caecum	b) Villi	c) Stomach	d) Uvula
77. Mucosa – what does not hold true?			
A. Lines the lumen of alimentary canal B. Rugae in stomach C. Villi in small intestine D. Villi give Dpearance in intestine			
A	B	C	D
78. Villi are not			
a) Multicellular	b) Form brush border appearance	c) Have macroscopic projections	d) Increase the surface area
79. Bolus from oral cavity to oesophagus..... stomach. Which of the process/movements are responsible for it?			
a)Deglutition and Segmentation	b)Deglutition and Peristalsis	c)Peristalsis and segmentation	d)Peristalsis and Deglutition
80. Intrinsic factor is secreted by .			
a) Parietal cells/Chief cells	b) Oxyntic/peptic cells	c) Oxyntic/Parietal cells	d) Chief/peptic cells

Multiple Choice Questions: (LEVEL-3)

81. Two friends are eating together on a dining table. One of them suddenly starts coughing while swallowing some food. This coughing would have been due to improper movement of			
(a) Diaphragm	(b) Uvula	(c) Tongue	(d) Epiglottis
82. The hard chewing surface of teeth helping in mastication of food is called			
(a) Dentine	(b) Frenulum	(c) Enamel	(d) Root

83. Oblique muscle layer of alimentary canal is present			
a) In between serosa and sub-mucosa of stomach b) In between sub-mucosa and mucosa of stomach c) In between serosa and longitudinal muscle layer of small intestine d) below the mucosal layer			
84. The juice containing the sodium glycocholate is released under the influence of			
(a) secretin	(b) Enterokinin	(c) Cholecystokinin	(d) Enterogastrin
85. Consider the following statements: Assersion (A): Polypeptidase acts on the peptide linkages of proteins and breaks them into smaller molecules. Water molecules are necessary for this reaction. Reason(R): All digestive enzymes belong to hydrolase class. Now select your answer from the answer code given below:			
A) Both [A] and [R] are true and [R] is the correct explanation of [A]			
B) Both [A] and [R] are true but [R] is not the correct explanation of [A]			
C) [A] is true but [R] is false		D) [R] is true but [A] is false	
86. Which of the following carries glucose from small intestine to liver			
a) Hepatic artery	b) Pulmonary vein	c) Hepatic portal vein	d) Hepatic portal artery
87. All of the following are true of secretions from Salivary glands , except that they			
a) Help to control bacterial population in the mouth b) Help to lubricate the oral cavity and its contents c) Contains enzyme for the digestion of complex carbohydrates d) Contain enzymes for the digestion of simple sugars			
88. Water is absorbed in the jejunum, ileum, and colon and excreted in the feces. Arrange these in order of the amount of water absorbed and excreted from greatest to smallest			
(a) Colon;Jejunum;ileum;feces (b) Feces; colon;ileum;jejunum (c) Jejunum; ileum; colon;feces (d) Colon; ileum;jejunum; feces			
89. What type of activity can be expected in oral cavity during digestion of starch?			
1. Formation of bolus 2. Formation of monosaccharides 3. Presence of electrolytes like K ⁺ and HCO ₃ ⁻ 4. Presence of all the types of amylases			
a) 1, 2 ,3,4,	b) 2,4 only	c) 1,3 only	d) 2 only
90. Where can we find Brunners glands in the alimentary canal and also match it with its characteristic feature			
a. Serosa of stomach– Outer most layer of the alimentary canal and is madeup of a thin mesothelium with some connective tissue b. Muscularis of small intestine – It is formed by smooth muscles usually arranged in to outer longitudinal and inner circular muscles. c. Sub-mucosal layer of duodenum – formed of loose connective tissue containing nerves, blood vessels and lymph vessels. d. Mucosal layer of stomach – The inner most layer forms irregular folds called rugae in between which there are many microscopic glands.			
91. Make the correct statement regarding the Glisson’s capsule.			
a. It is made up of thin connective tissue. b. It is covering around the lobes of liver c. It is the covering around each lobule d. Both A & C			

92. Without functioning parietal cells, which of the following would you expect for an individual?			
(a). Not to be able to initiate protein digestion in stomach (b). Not to be able to initiate mechanical digestion in stomach (c). Only to be able to digest fats in the stomach (d). Not to be able to produce Pepsinogen.			
93. Mark correct statement for Lacteal Channels			
A. These are present in the mucosal layers of the complete alimentary canal starting from esophagus to anus			
B. These are specialized blood capillaries present within the mucosal folds of small intestine			
C. It is another name of lymphatic vessels present in villi			
D. These carry chylomicrons from blood vessels to lymphatic vessels			
(a) A,B,C,D,	(b) B,C,D, Only	(c) C,D Only	(d) C Only
94. Which of the following property is not related to stomach?			
a) Churning Movement b) Formation of Chyme c) Presence of pepsin and rennin as proteolytic enzymes d) Presence of lymphatic vessels in the mucosal folds called rugae.			
95. How does the digestion of fat differ from that of carbohydrates?			
A. Processing of fat does not require any enzymes where as processing of carbohydrates does. B. Fat absorption occurs in the stomach where as carbohydrate absorption takes place in small intestine C. Carbohydrates need to be emulsified before digestion where as fats does not. D. Most absorbed fat first enters the lymphatic system where as the carbohydrates directly enter the blood.			
96. What are the symptoms common for Marasmus and kwashiorkor?			
1. Thinning of limbs; 2. Failure of growth and bone development			
2. Skin becomes dry and wrinkled			
3. Extensive oedema			
a) 1,2,3,4,	b) 1,2 only	c) 3 only	d) 4 only
97. What happens in gastric disorder?			
a) Reduction in digestion	b) Nausea & Vomiting	c) Increase in Digestion	d) Both A & B
98. Assertion (A): Disaccharides are converted into monosaccharides by erepsin.			
Reason(R): Lipase converts di and monoglycerides into fatty acids and glycerol			
A) Both [A] and [R] are true and [R] is the correct explanation of [A]			
B) Both [A] and [R] are true but [R] is not the correct explanation of [A]			
C) [A] is true but [R] is false		D) [R] is true but [A] is false	
99. Select 'True' or 'false' option for the below statements			
A. Teeth are embedded in the bones of mandibles. B. Oesophagus and trachea open into larynx. C. Human have diphyodont type of dental arrangement D. Digestive tract starts from anterior cavity, called as oral cavity.			
a) FFTF	b) FFFT	c) TTFF	d) TFTF
100. Select 'True' or 'false' option for the below statements			
A. Papillae are present in the region of oesophagus. B. Colon has ascending, transverse and descending regions C. Carbohydrates are digested in the stomach. D. Pancreas has a U-shaped structure.			
a) TFTF	b) TTFF	c) FTFT	d) FFTT

14. ASSERTION AND REASON QUESTIONS

Instructions;

- (a) If both (A) and (R) are true and (R) is the correct explanation of (A)
 (b) If both (A) and (R) are true but (R) is not the correct explanation of (A)
 (c) If (A) is true, but (R) is false; (d) If (A) and (R) are false.

1. (A) Thick layers of muscles are present in the wall of alimentary canal. (R) Muscles help in mixing food with enzymes in the alimentary canal
2. (A) Polypeptidase acts on the peptide linkages and breaks them into smaller molecules and water molecules are necessary for this reaction. (R) All digestive enzymes are hydrolases.
3. (A). Dentine is mesodermal in origin. (R) Dentine is secreted by odontoblasts cells.
4. (A). Brunner's glands help in easy passage of food. (R). Brunner's glands secrete mucus.
5. (A) Bile has no enzymes. (R). Bile does not have any role in digestion.
6. (A) Malnutrition involves under nutrition as well as over nutrition (R) In both types there is deficiency of some vital ingredients of food
6. (A): In alcoholic drink the alcohol is converted into glucose in liver (R): Liver cells are able to produce glucose from alcohol by fermentation
8. (A) An adult man has more number of teeth than a child (R) Teeth in human beings are thecodont
9. (A): Gastric juice helps in absorption of B12 (R): Gastric juice contains Intrinsic factor of Castle
10. (A) Bile has no enzymes. (R). Bile does not have any role in digestion.

15. Assignment Questions (Answer in separate note book)

VSAQ**	1	Give the dental formula of adult human being.
**	2	Bile juice contains no digestive enzymes. Yet, important for digestion. How?
***	3	What would happen if, HCL were not secreted in the stomach?
**	4	Explain the terms Thecodont dentition and the Diphyodont dentition.
**	5	What is Auto – catalysis? Give two examples.
*	6	What is Chyme?
***	7	Name the different types of salivary glands & their locations in human body.
**	8	Name the different kinds of papillae present on the tongue of human being.
*	9	Distinguish between deglutition and mastication.
**	10	Name two hormones secreted by the duodenal mucosa.
SAQ***	11	Draw a neat labelled diagram of L.S. of tooth.
**	12	If you take butter in your food, how does it get digested and absorbed in the body? Explain.
*	13	Describe the process of digestion of proteins in the stomach.
LAQ ***	1	Explain the Digestive System of man with neat labelled diagram.

16. Hands on Experiences for you – Try It!!!

1. Experiment to test the presence of starch in a given material and to reveal its biological importance and chemical nature.

Method:

1. Some potato tubers (or green leaves) are peeled, sliced and crushed.
2. Take the crushed material in a test tube and pour in it about 5 ml of distilled water and then a few drops of potassium iodide solution. Note the change in colour.

2. Benedict's Test for Glucose & Sucrose

Procedure of Benedict's Test

1. Approximately 1 ml of sample is placed into a clean test tube.
2. 2 ml (10 drops) of Benedict's reagent (CuSO_4) is placed in the test tube.
3. The solution is then heated in a boiling water bath for 3-5 minutes.
4. Observe for color change in the solution of test tubes or precipitate formation.

Result Interpretation of Benedict's Test

If the color changed into green, then there would be 0.1 to 0.5 percent sugar in solution.

If it changes color to yellow, then 0.5 to 1 percent sugar is present.

If it changes to orange, then it means that 1 to 1.5 percent sugar is present.

If color changes to red, then 1.5 to 2.0 percent sugar is present.

And if color changes to brick red, it means that more than 2 percent sugar is present.

Negative Benedict's Test: No color change (Remains Blue). Reducing sugars absent.

Example: Sucrose.

3. Denaturation Tests for identifying proteins:

Denaturation of proteins causes the protein structure to degrade and subsequently the protein loses its shape. An egg is a great model for protein denaturation because the white is composed mostly of the protein albumin. In this activity, you are going to examine how different conditions affect albumin protein and if they are able to denature it.

Steps

1. To start, get four bowls. Break one egg into the first bowl, separating the white from the yolk. Discard the yolk but keep the white.
2. Now, separate the white into four equal parts and put one part into each of the bowls.
3. In bowl 1, put nothing on the egg white. **This is your control.**
4. For bowl 2, make ice cold water with a few ice cubes and cold tap water. Place it in the freezer for 10 minutes, then put 1 cup of ice cold water over the egg white (2).
5. For bowl 3, boil water in a kettle or in the microwave. When the water is boiling put 1 cup of boiling water over the egg white in bowl 3.
6. In bowl 4, add 1 cup of vinegar to the egg white.
7. Now, wait about 30 minutes and record your results
8. **Analyze and Deduce Yourself:**
 1. Which egg whites were denatured by the condition you applied and how did you know?
 2. What types of conditions are able to denature proteins?
 3. Why do you think you got the results you did for bowl 2?
 4. Why is it important to have bowl 1, the control in this experiment?

4. Emulsion Test For Lipids in any food stuff:

1. Place two spoons of the food sample (test substance) into a test tube or 2 ml if the sample is liquid.
2. The test substance is mixed with 2 ml of ethanol.
3. An equal volume of distilled water is added.
4. A *milky-white emulsion forms* if the test substance contains lipids.

5. Observe the table – Try it – Analyze the conclusions:

Food	Iodine test	Benedict's test	Emulsion lipid test
Beef	Orange-brown	Blue	Milky white
Vegetable Oil	Orange-brown	Blue	Milky white
Rice	Blue-black	Blue	Colourless
Breakfast cereal	Blue-black	Orange	Milky white

Conclusions:

The colour changes show that beef is the only food tested that contains protein. Beef, vegetable oil and breakfast cereal contain lipids. Both rice and breakfast cereal contains starch. Breakfast cereal is the only food tested that contains reducing sugars.

17. Medical Careers in Digestive System Related Fields

Eating and enjoying food is one of life's most fundamental pleasures. Because of this, diseases and disorders of the digestive system can have a disproportionate impact on enjoyment and quality of life. Many are also life-threatening or cause debilitating chronic pain. Doctors in several specialties treat digestive system diseases, either as their main area of expertise or as a secondary part of their practice.

Gastroenterology : Gastroenterology is the medical specialty most broadly concerned with diseases and conditions of the digestive system process. Gastroenterologists treat diseases occurring throughout the entire system, from the esophagus to the rectum. These include common complaints such as recurrent heartburn or ulcers, and longer-term chronic illnesses such as Crohn's or celiac disease. Gastroenterologists first qualify in internal medicine, then spend three further years in a gastrointestinal fellowship.

Liver, Pancreas and Biliary Specialists: The liver and pancreas have a profound influence on the digestive system through their regulation of bile and insulin levels. These organs are studied and treated by hepatologists and endocrinologists. *Hepatologists* are specialists in liver conditions, often working collaboratively with surgeons or oncologists to provide care before and after transplants, tumor removal, or other procedures. Endocrinologists treat disorders of the glandular systems, and often focus on conditions of the liver, pancreas and biliary system that affect digestion.

Proctologist : A proctologist is a surgical specialist with a focus on diagnosing and treating disorders of the colon, rectum and anus. Proctologists often are seen for complex lower digestive tract issues or when surgery is needed to treat the patient.

Endocrinologists: These people treat people who suffer from hormonal imbalances, typically from glands in the **endocrine system** or certain types of cancers. The overall goal of treatment is to restore the normal balance of hormones found in a patient's body.

Oncologists and Radiation Oncologists:

Oncologists are specialists in surgical and non-surgical treatment of cancers. Many cancers occur in the digestive tract, from tumors of the throat and stomach to lethal pancreatic cancers. Oncologists treat cancers surgically, or through alternatives including chemotherapy and radiation.

Radiation oncologists specialize in the application of radiation therapy, working carefully to minimize damage to healthy tissues. Treatment is often collaborative, with gastroenterologists or hepatologists advising the oncologist and providing care to the patient before and after these procedures.

Surgeons : Aside from cancers, the digestive system organs are subject to a number of conditions that lend themselves to surgical correction, from anal fissures to diverticulitis and obstructions of the bowel. These are typically treated by general surgeons or colorectal surgeons, though surgeons from other specialties such as oncology or otolaryngology might also be consulted or invited to participate as needed.

Laparoscopic Surgeon: Laparoscopy is a type of surgical procedure that allows a **surgeon** to access the inside of the abdomen (tummy) and pelvis without having to make large incisions in the skin. This procedure is also known as keyhole **surgery** or minimally invasive **surgery**.

Registered Dietician: These are experts in food and nutrition. They can recommend and manage an eating plan for your digestive problem. This can help you control your symptoms and make sure that you get enough key nutrients. The eating plan can also help you improve your overall health and maintain a healthy weight.

Nurse practitioner: These healthcare providers work closely with people to help diagnose, treat, and manage their health conditions. They can also help people adapt to digestive problems, answer questions, and prescribe medicines. They often work with gastroenterologists. And they may specialize in digestive problems with a special focus on disease prevention and health maintenance.

Physician assistant (PA): These healthcare providers do many of the same things as doctors, but under doctor supervision. Some PAs oversee the treatment and management of digestive problems. They also prescribe medicines and answer questions. They can help you deal with any problems you might have.

A Therapist or Mental health professional: If you have a digestive disease, you may need help managing your emotions. You may become stressed, anxious, or even depressed. These experts can help you relieve the stress that comes from your illness.

Yoga therapists: Ancient yogis understood that good digestion is key to radiant health and sought to understand the mind-body connection. Yoga therapists tend to view the digestive system as a very sensitive mirror of the mind and will encourage a client with digestive issues to examine overall lifestyle choices, emotions and other mental components in the healing process. These therapists prescribe specific regimens of postures, breathing exercises, and relaxation techniques to suit individual needs. Yoga comprises a wide range of mind/body practices, from postural and breathing exercises to deep relaxation and meditation. Yoga therapy tailors these to the health needs of the individual.

Ayurvedic Practitioner: Ayurvedic professionals practice preventive healthcare and health promotion, using diet and lifestyle. Ayurvedic medicine is one of the world's oldest holistic (“whole-body”) healing systems. It was developed more than 3,000 years ago in India. It's based on the belief that health and wellness depend on a delicate balance between the mind, body, and spirit.

Naturopathic physician: They are trained as primary care providers who diagnose, treat and manage patients with acute and chronic conditions, while addressing disease and dysfunction at the level of body, mind and spirit.

18. Answers to the activities

Activity-11

Note: Correct Statements are given in the brackets.	
1	True
2.	False (Bacteria and germs found in food are killed by acid produces in stomach.)
3	True
4	False (Permanent teeth come after milk teeth.)
5	True
6	False (Pepsinogen is the precursor to the gastric enzyme for protein digestion and is secreted by the “ Peptic /Chief Cells ”.)
7	True
8	True
9	False (Chylomicrons are transported into the lacteals in the villi by Exocytosis.)
10	False (Peristaltic movements of the intestine are slow.)
11	True
12	False (Liver is the chief organ of Detoxification of toxic substances that enter our body through food.)
13	False (The pH of Succus entericus is 7.5 to 8.0)
14	False (Castle’s intrinsic factor is responsible for the absorption of Vitamin B12)
15	False (A narrow finger like projection of the large intestine is Vermiform Appendix.)
16	False (Tongue is the “Universal Tooth Brush”)
17	False (Ameloblats are “Ectodermal in Origin”)
18	True
19	True
20	True

Activity-12

1	Mucus	2	Hydrochloric	3	Gallbladder	4	villi	5	Chemical
6	Epiglottis	7	Large	8	Protein	9	Salivary amylase	10	Peristalsis
11	Frenulum	12	Lymphoid	13	Odontoblasts	14	Jejunum	15	Hepatic lobules
16	Kupffer Cells	17	Heparin	18	Autocatalysis	19	Roughage	20	diarrhea

Activity-13 – MULTIPLE CHOICE QUESTIONS

Que. No	Ans.	Explanation/Notes
LEVEL - 1		
1	D	Lophodont teeth have elongated ridges called lophs that run between cusps. Examples: tapir, manatees, many rodents
2	B	
3	C	
4	B	
5	A	
6	C	
7	B	
8	B	
9	A	
10	D	
11	B	
12	B	
13	B	
14	B	
15	D	
16	D	
17	C	
18	A	
19	B	
20	C	
21	B	
22	D	
23	C	
24	C	
25	A	

26	B	
27	D	
28	D	
29	C	
30	B	
31	D	
32	D	
33	B (CBSE)	Chyle is a milky fluid containing fat droplets which drains from the lacteals of the small intestine into the lymphatic system during digestion.
34	B	
35	C	
36	B	
37	A	
38	C	
39	C	
40	D	
LEVEL - 2		
41	A	
42	D	
43	B	
44	D	
45	A	
46	D	
47.	D	
48	A	
49	B	
50	B	
51	A	
52	C	
53	A	<ul style="list-style-type: none"> • Bilirubin is broken down to urobilinogen and stereobilinogen. Yellowish brown colour of stool is due to the stereobilinogen.

		<ul style="list-style-type: none"> Due to the malfunctioning of liver, insufficient production of stereobilinogen leads to white stool.
54	D	
55	C	
56	A	
57	C	Analyse:
58	A	
59	C	
60	D	
61	D	
62	C	
63	D	
64	A	
65	D	
66	C	
67	A	
68	B	
69	B	
70	A	
71	A	
72	B	
73	D	
74	D	
75	C	
76	A	
77	B	
78	C	
79	B	
80	C	
LEVEL - 3		
81	D	

82	C	
83	A	
84	C	
85	A	
86	C	
87	D	
88	C	
89	C	
90	C	
91	D	
92	A	
93	D	
94	D	
95	A	
96	B	
97	D	
98	D	
99	A	
100	C	

Activity-14 - ASSERTION AND REASON QUESTIONS

1	a	2	a	3	a	4	a	5	c
6	c	7	b	8	b	9	a	10	c

UNIT – I

HUMAN ANATOMY AND PHYSIOLOGY - I



UNIT – IB

BREATHING AND EXCHANGE OF GASES

MAJOR LEARNING OBJECTIVE

- *Students will be able to identify ,understand, apply the knowledge of the “Human Respiratory System and the Process of Exchange of Gases”*
- *Students will be able to appreciate why respiratory system is called “**The Calorie Burner**” and “**Energy Provider**”*

LEARNING OUTCOMES:

- Be able to name the organs that make up the respiratory system.
- Be able to describe the major functions of each organ involved in respiratory system.
- Be able to understand, explain, and appreciate the mechanisms in breathing, transport and exchange of gases.
- Be able to define key concepts in Respiratory Volumes, Respiratory Capacities, Bohr Effect and Chloride shifts
- Be able to define and interpret ‘Oxygen-Hemoglobin Dissociation Curves’
- Be able to appreciate the ‘Regulation process of Respiratory Movements’
- Be able to know about the disorders of Respiratory system.

ADDITIONAL READING MATERIAL

1. Spirometer

2. COVID-19

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book
2. Defining key words
3. Label the parts of the Respiratory system
4. Reading the text and understanding the parts of “Larynx”
5. Labeling the parts of “Pulmonary Lobule”
6. Expand the abbreviations & rewrite the characteristics of Respiratory Volumes and Capacities
7. Writing a brief note on Trachea, Bronchi and Bronchioles
8. Filling in the blanks & boxes in ‘Oxygen-Hemoglobin Dissociation Curves’
9. Filling in the boxes in the diagram of ‘Carbon dioxide Transport’
10. Prepare the Concept map on “Disorders of Respiratory System”
11. Answer True or False
12. Completion of each sentence or statement/filling the blanks
13. Multiple Choice Questions for Competitive exams
14. Assertion & Reasoning Questions
15. Assignment Questions to answer
16. Hands on Experiences for you – Try It!!!
17. Medical and other Careers in Respiratory System Related Fields
18. Answers to the activities and note making

INSTRUCTIONS TO LECTURER

- Explain each part of the worksheet & Come up with some examples to help
- Clarify doubts of the students before starting the work book

INSTRUCTIONS TO STUDENTS

- First read the text book thoroughly and logically.
- Always try to attempt this workbook with a friend cooperatively
- While attempting the activities analyze them carefully
- While attempting the multiple choice questions, make notes on the other options too

ADDITIONAL READING MATERIAL: (Adopted from Wikipedia)

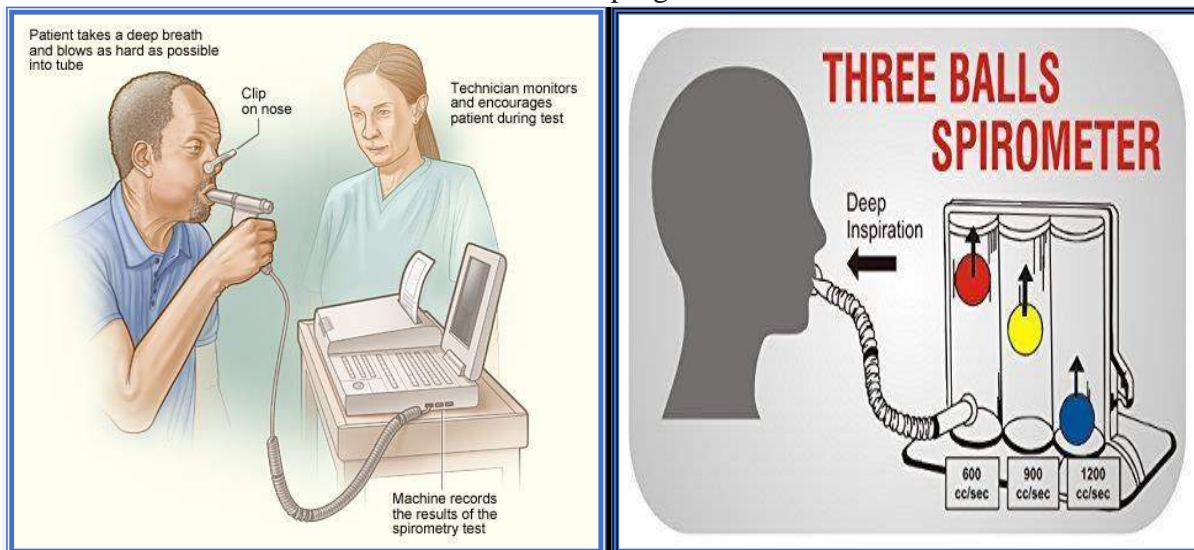
The Spirometer :

A **spirometer** is an apparatus for measuring the volume of air inspired and expired by the lungs. A spirometer measures ventilation, the movement of air into and out of the lungs. The spirogram will identify two different types of abnormal ventilation patterns, obstructive and restrictive. There are various types of spirometers which use a number of different methods for measurement (pressure transducers, ultrasonic, water gauge).

A spirometer is the main piece of equipment used for basic Pulmonary Function Tests (PFTs). Lung diseases such as asthma, bronchitis, and emphysema can be ruled out from the tests. In addition, a spirometer is often used for finding the cause of shortness of breath, assessing the effect of contaminants on lung function, the effect of medication, and evaluating progress for disease treatment.

A **spirometer** is also used to

- Diagnose certain types of lung disease (such as asthma, bronchitis, and emphysema)
- Find the cause of shortness of breath
- Measure whether exposure to chemicals at occupations affects lung function
- Check lung function before someone has surgery
- Assess the effect of medication & Measure progress in disease treatment



An **incentive spirometer** or **Three Balls Spirometer** is a medical device used to help patients improve the functioning of their lungs. It is provided to patients who have had any surgery that might jeopardize respiratory function, particularly surgery to the lungs themselves,^[1] but also commonly to patients recovering from cardiac or other surgery involving extended time under anesthesia and prolonged in-bed recovery. The incentive spirometer is also issued to patients recovering from pneumonia or rib damage to help minimize the chance of fluid build-up in the lungs. It can be used as well by wind instrument players, who want to improve their air flow.

The COVID-19 (CORONA VIRUS):

Corona virus disease (COVID-19) is an infectious disease caused by a newly discovered corona virus. Most people infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness.

The best way to prevent and slow down transmission is be well informed about the COVID-19 virus, the disease it causes and how it spreads. Protect yourself and others from infection by washing your hands or using an alcohol based rub frequently and not touching your face. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, so it's important that you also practice respiratory etiquette (for example, by coughing into a flexed elbow).

COVID-19 affects different people in different ways. Most infected people will develop mild to moderate illness and recover without hospitalization. People with mild symptoms who are otherwise healthy should manage their symptoms at home. On average it takes 5–6 days from when someone is infected with the virus for symptoms to show, however it can take up to 14 days. Infected should seek immediate medical attention if serious symptoms.

Most common symptoms: Fever, Dry cough, Tiredness.

Less common symptoms: Aches and pains, Sore throat, Diarrhea, Conjunctivitis, Headache, Loss of taste or smell, A rash on skin or discoloration of fingers or toes.

Serious symptoms: Difficulty breathing or shortness of breath, Chest pain or pressure, Loss of speech or movement.

Following prevent infection and slow transmission of COVID-19:

- Wash your hands regularly with soap and water, or clean them with alcohol-based hand rub.
- Maintain at least 1 metre distance between you and people coughing or sneezing.
- Avoid touching face, Cover your mouth and nose when coughing or sneezing.
- Stay home if one feels unwell,
- Refrain from smoking and other activities that weaken the lungs.
- Practice physical distancing by avoiding unnecessary travel and staying away from large groups of people
- Yoga may play significant role in the psycho-social care and rehabilitation of COVID-19 patients in quarantine and isolation. They are particularly useful in allaying their fears and anxiety.
- Practicing Yoga, Pranayama, kriya like breathing exercises will strengthen lungs.

At this time, there are no specific vaccines or treatments for COVID-19. However, there are many ongoing clinical trials evaluating potential treatments. WHO will continue to provide updated information as soon as clinical findings become available.

Government of India is taking all necessary steps to ensure that we are prepared well to face the challenge and threat posed by the growing pandemic of COVID-19 the Corona Virus. With active support of the people of India, we have been able to contain the spread of the Virus in our country. The most important factor in preventing the spread of the Virus locally is to empower the citizens with the right information and taking precautions as per the advisories being issued by Ministry of Health & Family Welfare.

ACTIVITIES:

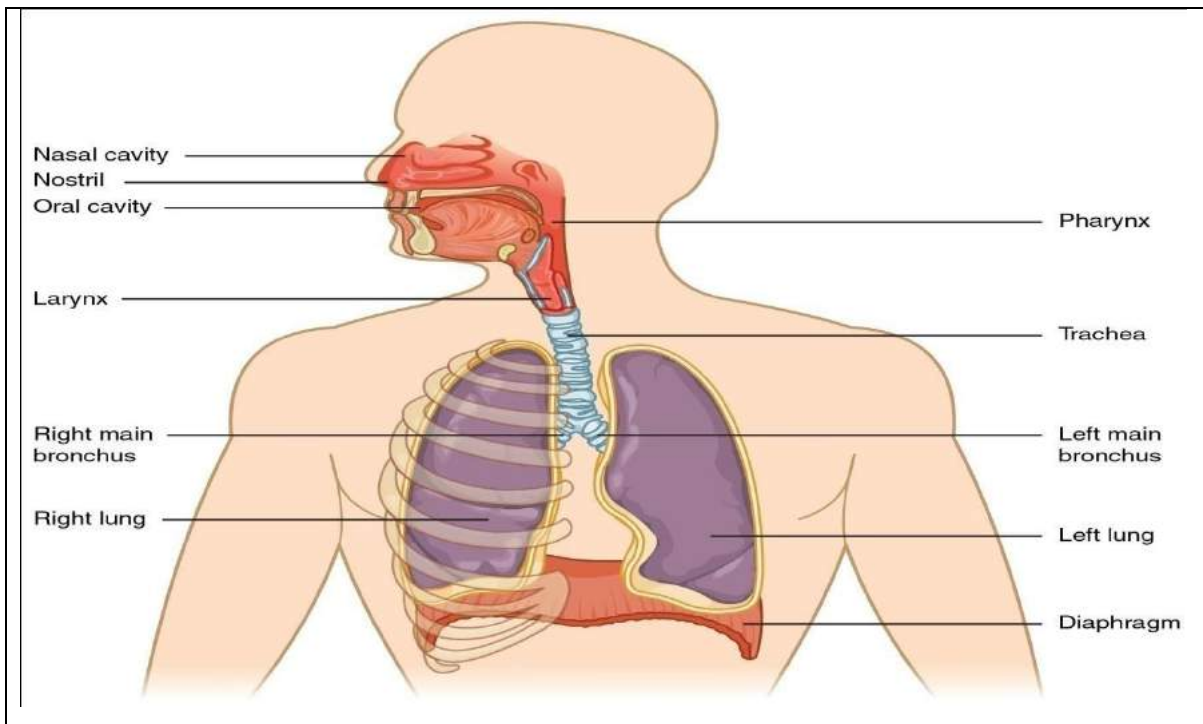
1. Locate and rewrite the difficult key words from the text book

1	9	17
2	10	18
3	11	19
4	12	20
5	13	21
6	14	22
7	15	23
8	16	24

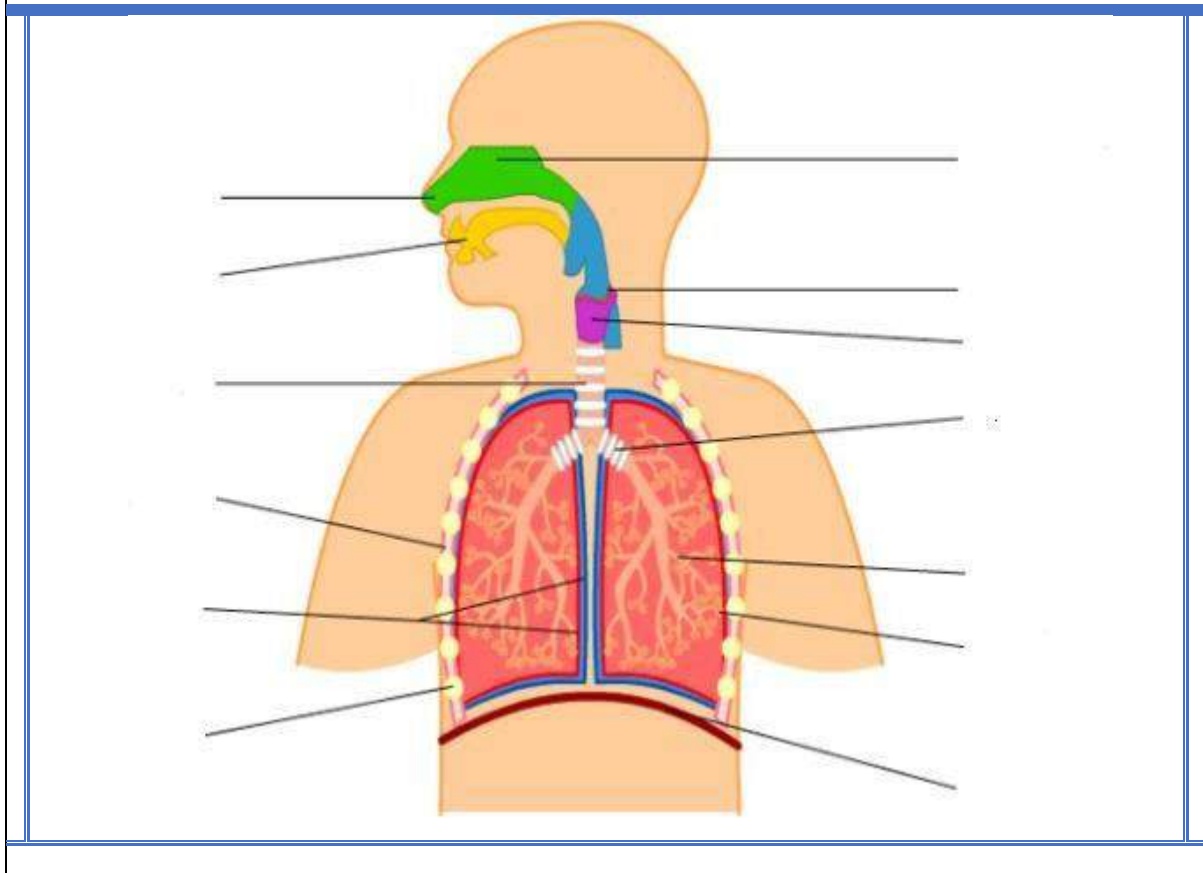
2. Defining key words: (Search through the Text and write)

1. PNEUMOTAXIC CENTRE	
2. ADAM'S APPLE	
3. PLEURAL FLUID	
4. RIMA GLOTTIDIS	
5. BOHR EFFECT	
6. HAMBURGER'S SHIFT	
7. PULMONARY VENTILLATION	
8. DIFFUSION MEMBRANE	
9. MOUNTAIN SICKNESS	
10. INTRA-PULMONARY PRESSURE	

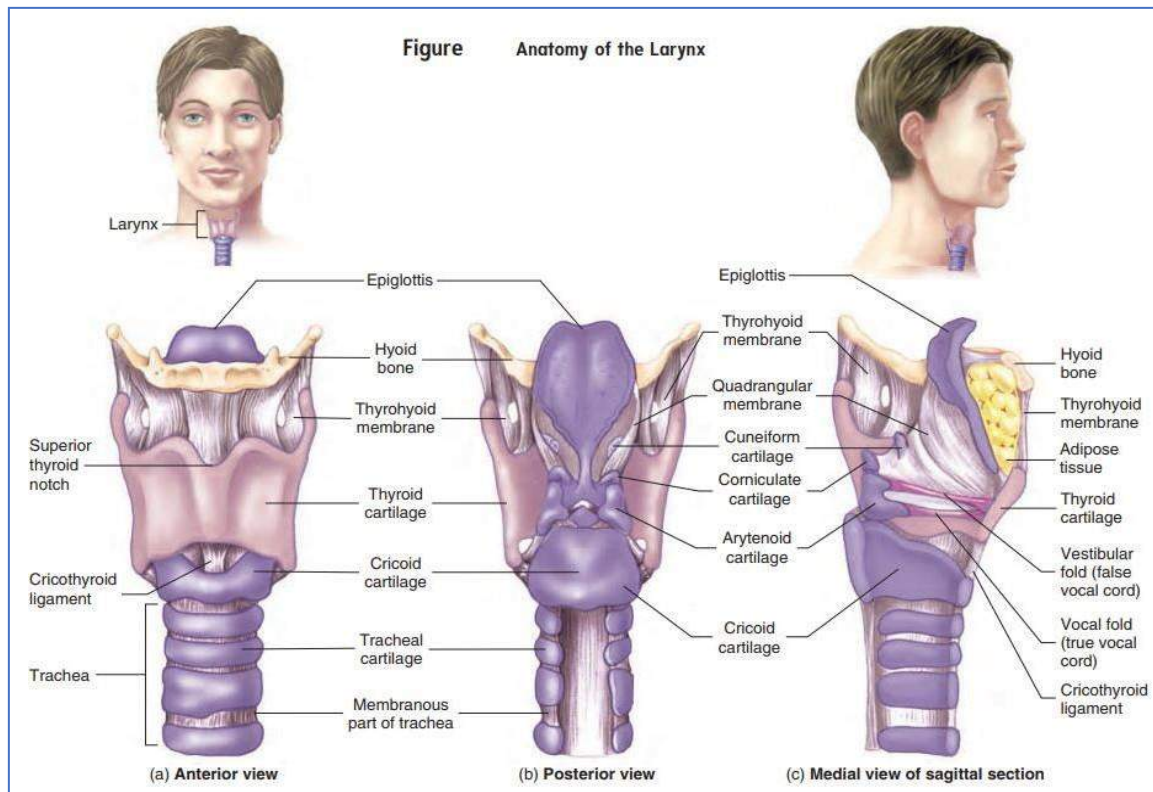
3. Label the parts of the Respiratory system : (Follow the note)



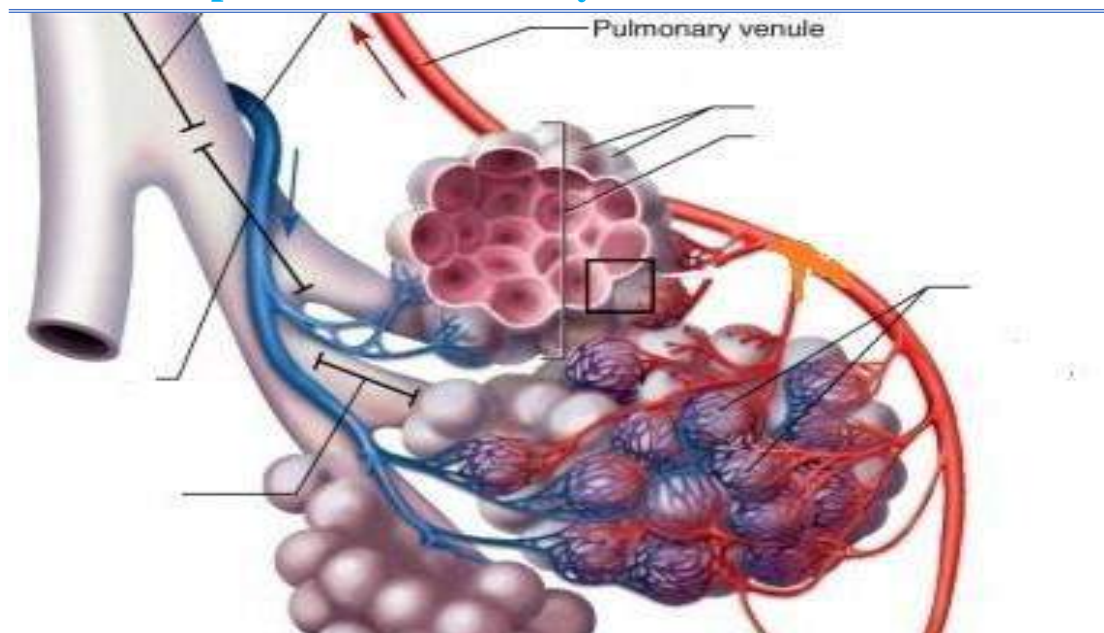
Note: Observe the above diagram, You need to identify the parts that are neither labeled in the text book nor in the above diagram, but mentioned in detail in the text book



4. Reading the text and understanding the parts of “Larynx”



5. Label the parts of “Pulmonary Lobule”:

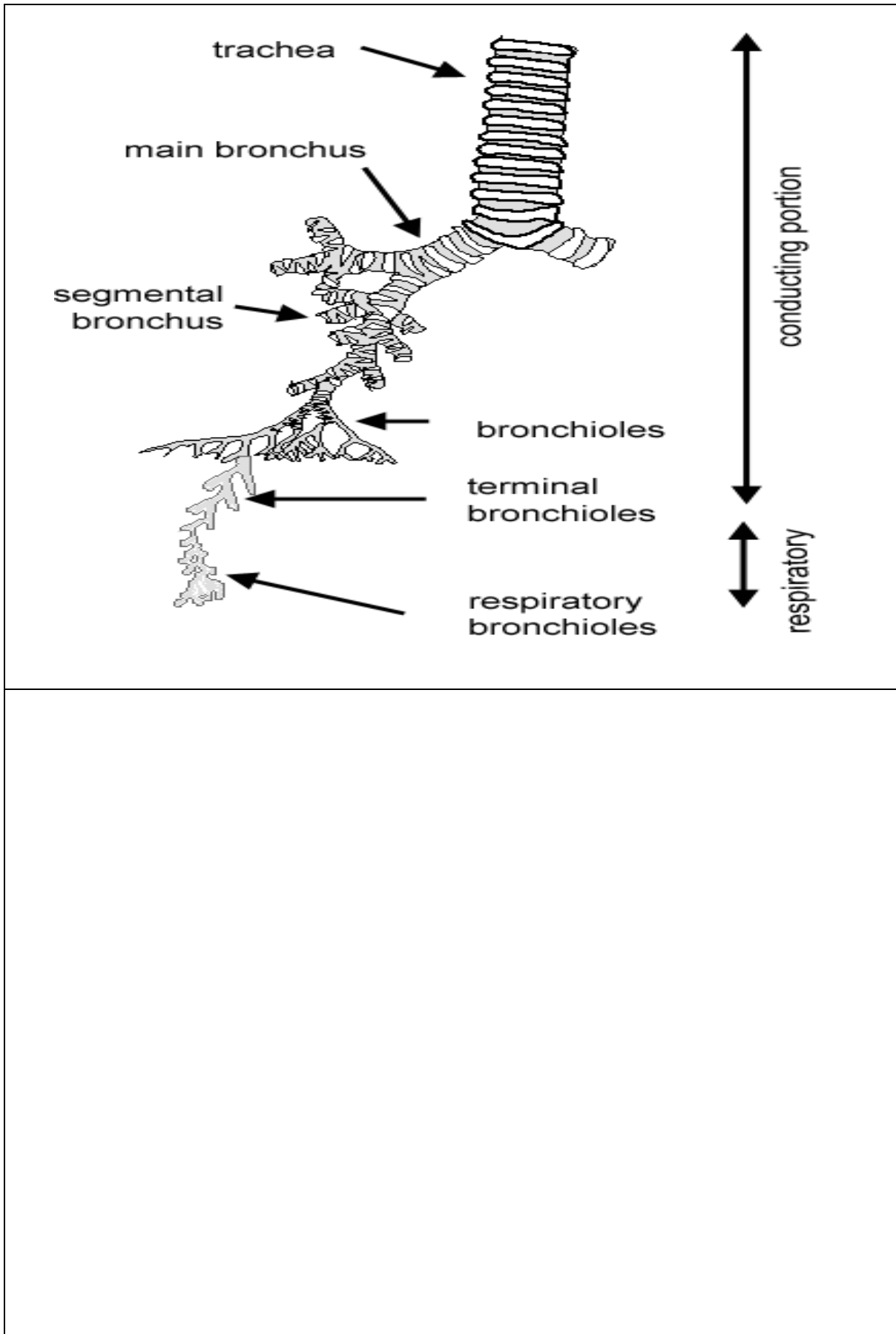


Think it over: Why **“Pulmonary Venule”** is shown in **red colour** and **“Pulmonary Arteriole”** in **blue color**?

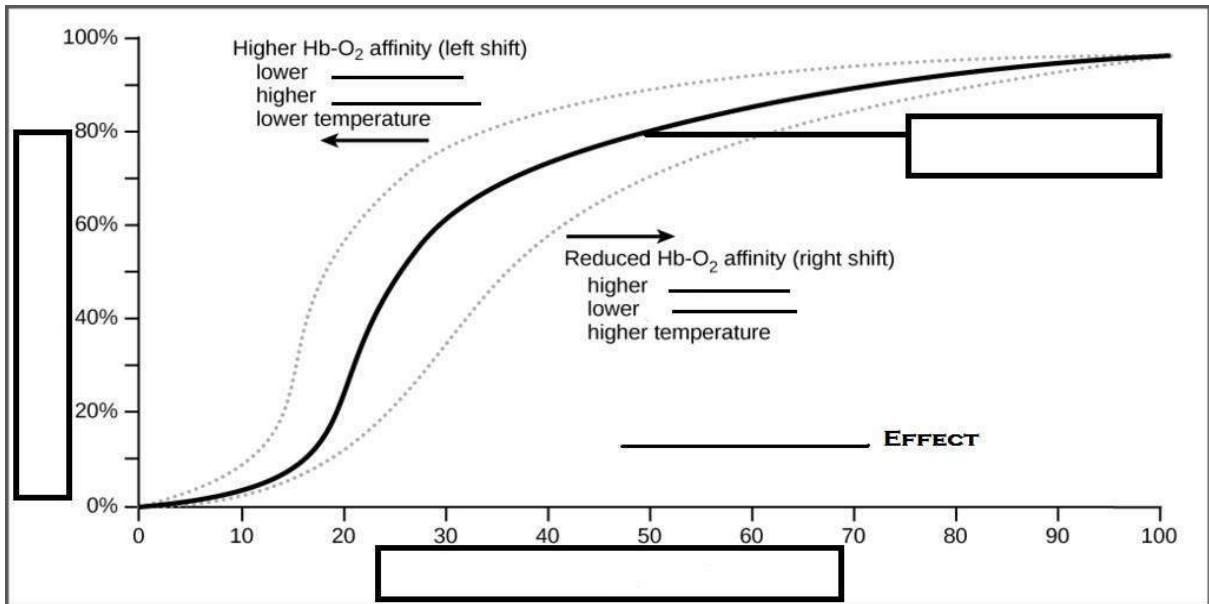
6. Expand & Rewrite the characteristics of Respiratory Volumes and Capacities:

	Expand	Define
TV		
IRV		
ERV		
RV		
IC		
FRC		
VC		
TLC		
pO₂		

7. Write a brief note on Trachea, Bronchi and Bronchioles:



8. Fill in the blanks & boxes in the following ‘Oxygen-Hemoglobin Dissociation Curves’



Define Oxygen-Hemoglobin Dissociation Curve:

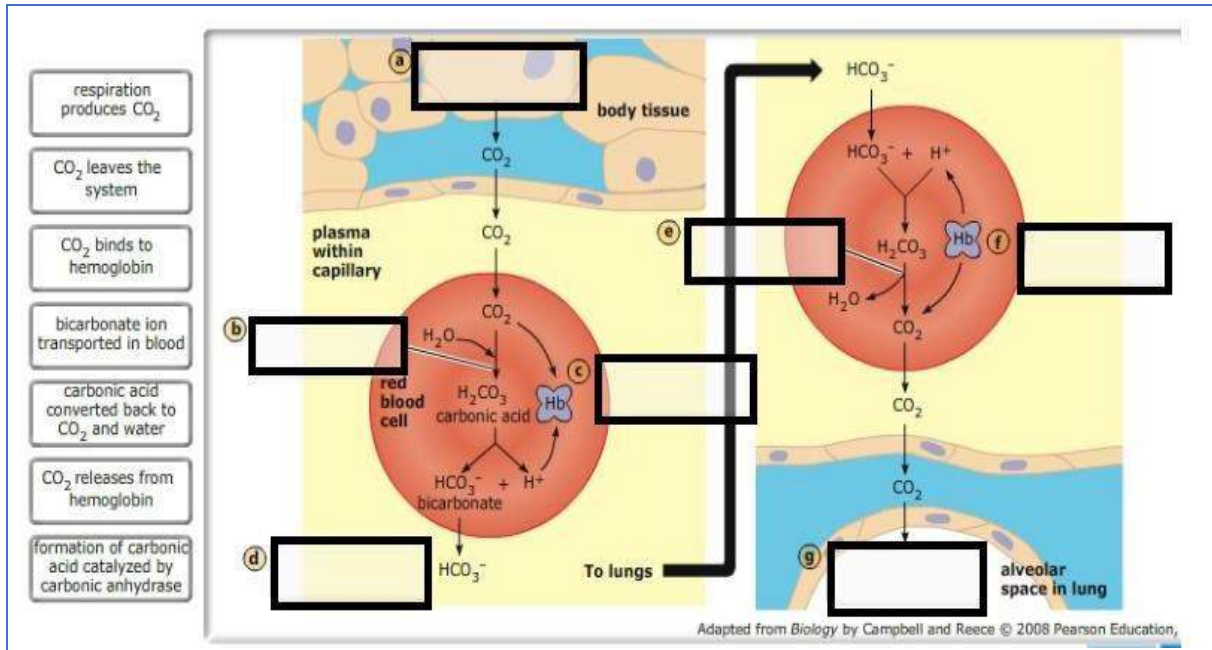
Define Sigmoid Curve:

Define Bohr Effect:

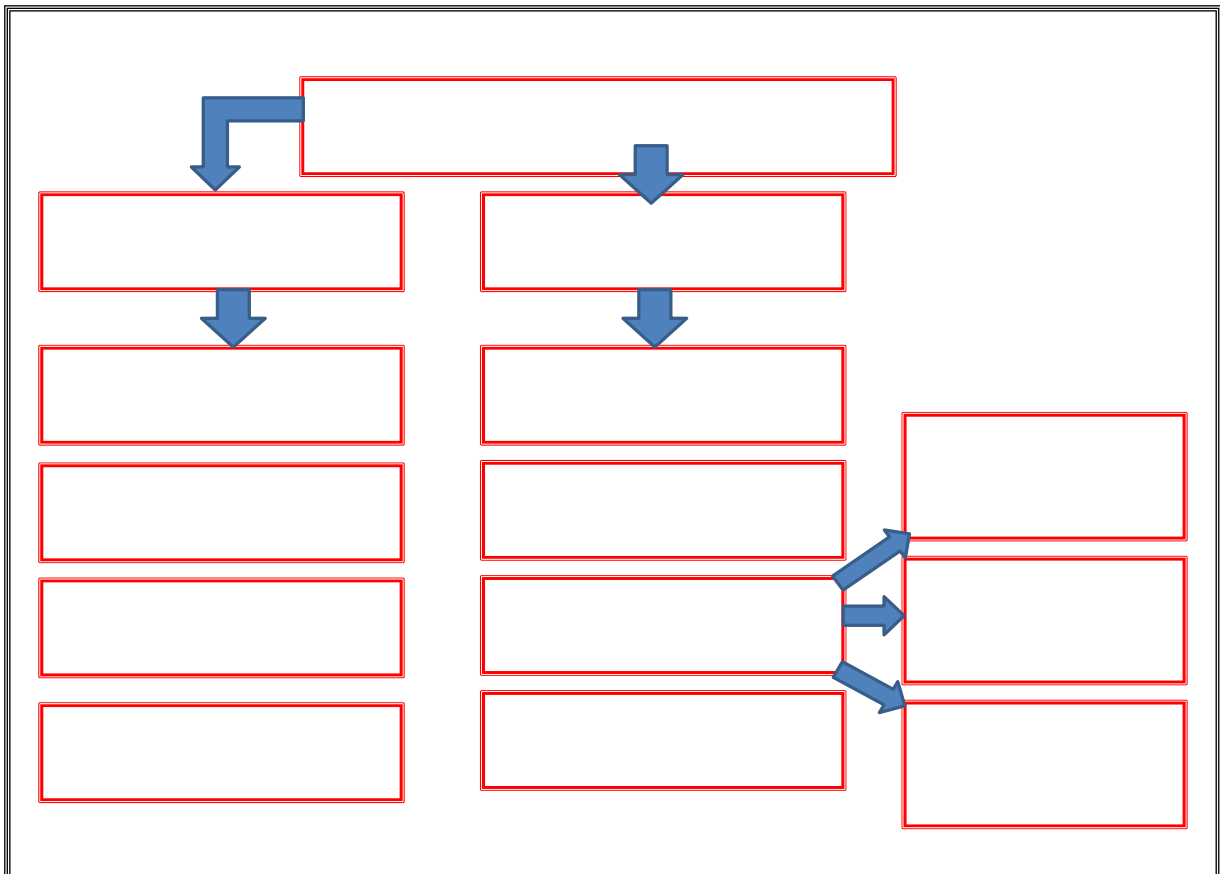
Explain Right Shift:

Explain Left Shift:

9. Fill in the boxes in this diagram of 'Carbon dioxide Transport'



10. Prepare the Concept map on "Disorders of Respiratory System"



11. Answer True or False:

Sl. No.	Statement	True/False
1	When the diaphragm contracts, it pulls the ribs together and reduces the size of the thoracic cavity and expels air.	
2	The bronchi, bronchioles and alveoli all function as air distributors.	
3	The hollow nasal cavity is separated by a midline partition, the conchae, dividing it into a right cavity and left cavity.	
4	The laryngopharynx ends at the oesophagus.	
5	The oropharynx moves up and down during swallowing to prevent food or liquid from entering the trachea.	
6	Inspiration can occur if the 'intra-pulmonary pressure' is less than the atmospheric pressure.	
7	The mid ventral part of the thyroid cartilage forms the laryngeal prominence called Adam's Apple.	
8	The lungs are situated in the thoracic chamber which is anatomically a air circulating chamber.	
9	The "diffusion membrane" has three layers: 1. Squamous epithelium of alveolar wall, 2. The endothelium of the alveolar capillaries and 3. Cementum in between them.	
10	Each hemoglobin molecule can carry a maximum of "Four Oxygen Molecules".	
11	A special centre in the Cerebral region of the brain is called "Respiratory Rhythm Centre".	
12	The exchange of Chloride and Bicarbonate ions between RBC and Plasma at the tissues is called "Hamburger's Phenomenon".	
13	Hemoglobin can act as a buffer at physiological pH, because of its high content of "Histamin".	
14	About 25% of CO ₂ combines with free amino group of hemoglobin and forms carboxyhemoglobin in a reversible manner.	
15	"Pneumoconiosis" is due to inhalation of iron particles. It is also a kind of "Siderosis"	

16	COPD stands for “Chronic Olfactory Pulmonary Diseases”. Emphysema is an example.	
17	Receptors associated with “Aortic Arch” and “Carotid Artery” recognize changes in Oxygen and Hydrogen ion concentrations.	
18	In the case of asthma the allergen causes release of Histamine and other inflammatory substances that cause constriction of bronchi.	
19	Carbonic anhydrase is the enzyme that catalyses the formation of bicarbonate ion.	
20	Release of alveolar air to the exterior is an active process.	
Answers at the end		

12. Completion of each sentence or statement/filling the blanks:

Sl. No.	Sentences
1	Inspired air leaves the pharynx by passing through a narrow opening called the
2	The glottis is surrounded and protected by the
3	The components of the bronchial tree dominated by smooth muscle tissue are called the
4	Within a pulmonary lobule, the terminal bronchioles branch to form several
5	The alveolar epithelium consists primarily of unusually thin and delicate
6	The primary function of pulmonary ventilation is to maintain adequate
7	During inhalation, the lungs expand, and there is a drop in
8	The most important muscles involved in inhalation are the external intercostals muscles and the
9	The rate of diffusion of gases varies according to factors such as concentration gradient and the
10	The amount of air that remains in the lungs after a maximal exhalation is the

11	In the hemoglobin molecule, the oxygen molecules specifically bind to the
12	The effect of pH on the hemoglobin saturation curve is called the
13	Co ₂ molecules bound to exposed amino groups of the globin portions of hemoglobin molecules to form
14	When respiration is suspended due to exposure to toxic vapors of chemical irritants, reflex activity may result in
15	Changes in blood pressure modify activities of the respiratory centers due to _____ in the aortic or carotid sinuses
16	.....center in the pons helps increase the intensity of inhalation during quiet breathing
17	A chronic progressive condition characterized by shortness of breath and an inability to tolerate physical exertion is
18	The layer of connective tissue between the respiratory epithelium and the underlying bones of cartilages is the
19	The portion of the nasal cavity containing epithelium with coarse hairs is the
20	The amount of air reaching the alveoli each minute is called the

13. Multiple Choice Questions for Competitive exams

1. Skin of man cannot act as respiratory organ because			
A. It is dry	B. It is not thin	C. It is not permeable	D. All of these
2. In cockroach inspiration is brought about by			
A. Contraction of tergo - sternal muscles B. Relaxation of tergo-sternal muscles C. Relaxation of abdominal muscles and it is a passive process D. Both B & C			
3. In birds exchange of gases occurs			
A. First in the lungs and then in air sacs B. First in the air sacs and then in lungs C. Simultaneously in lungs and air sacs D. In the lungs only and not in air sacs			
4. In frog, cutaneous respiration takes place			
A. Only in water when pulmonary respiration does not take place B. Only in water, but along with pulmonary respiration			

C. Only on land D. Always
5. In the birds exchange of gases takes place in
a. Alveoli b. Parabronchi c. Air sacs d. All of these
6. The process of respiration is concerned with
A. Intake of oxygen B. Liberation of oxygen C. Liberation of carbon dioxide D. D. Liberation of energy
7. Which one of these statements is correct
A. All the animals need O ₂ for respiration B. In all animals O ₂ is transported by blood C. All animals take O ₂ from water or air through gills or lungs D. All animals require a medium for cellular respiration
8. In man which of the following structure is analogous to the spiracles of cockroach?
a. Alveoli b. Bronchioles c. Lungs d. Nostrils
9. Conchae are located in
a. Trachea b. Bronchioles c. Ventricle d. Nasal chambers
10. Glottis is opening in the floor of
a. Diaphragm b. Pharyngeal cavity c. Trachea d. None of these
11. Adams apple is another name for
a. Sound box in birds b. Sound box in man c. Epiglottis d. Thyroid cartilage
12. Ring like cartilage of larynx is known as
a. Thyroid cartilage b. Arytenoid cartilage c. Cricoid cartilage d. Cartilage of Santorini
13. Which of the following prevents collapsing of trachea?
a. Muscles b. Diaphragm c. Ribs d. Cartilaginous rings
14. Trachea is lined with incomplete rings of
a. Fibrous cartilage b. Calcified cartilage c. Elastic cartilage d. Hyaline cartilage
15. The covering of the lung is called
a. Pericardium b. Perichondrium c. Pleural membrane d. Peritoneum
16. The terminal bronchiole is lined by
a. Simple squamous epithelium b. Ciliated columnar or cuboidal epithelium c. Stratified epithelium d. Pseudostratified epithelium
17. In alveoli surfactant is produced by
a. Type I pneumocyte b. Type II pneumocyte c. Kupffer's cells d. Dust cells
18. Common factor in the trachea of mammals and insects is
a. Ciliated inner lining b. Paired nature c. Non-collapsible wall d. C-shaped rings

19. Which of the following is paired cartilage?
a. Cricoid b. Arytenoid c. Thyroid d. Epiglottis
20. The phospholipid acting as surfactant i.e., reduces surface tension and keeps the lungs inflated and prevent alveolar collapsing is
a. Cephalin b. Lecithin c. Sphingomyelin d. Cerebroside
21. "Cartilages of santorini" are present on
a. Ventral and lateral walls of the larynx b. The tips of cricoid cartilage c. The tips of arytenoid cartilages d. Posterior side of Trachea
22. Identify the largest cartilage from the following
a. Thyroid b. Cricoid c. Arytenoid d. Cartilages of santorini
23. Epiglottis arises from this cartilage of larynx
a. Cricoid b. Arytenoid c. Thyroid d. All the above
24. The space between the two vocal cords is called
a. Glottis b. Rima glottides c. Epiglottis d. Turbinals
25. In man lungs are made up of
a. Two lobes in left and right both b. Left by two lobes and right by three lobes c. Right by two lobes and left by two lobes d. Both are made up of three lobes
26. If a man from sea coasts of Kerala goes to Mount Everest
a. His breathing rate and heart-beat will increase b. His breathing rate and heart-beat will decrease c. His breathing rate will increase, but heart beat will decrease d. His breathing rate will decrease but heart beat will increase
27. Hyperventilation leads to the stoppage of breathing for a brief period. This is due to
a. Increase in oxygen content b. Decrease in blood carbon dioxide content c. Increase in blood carbon dioxide content d. Decrease in oxygen content
28. Oxygen dissociation curve of hemoglobin is
a. Sigmoid b. Hyperbolic c. Linear d. Hypobolic
29. Bohr Effect is related with
a. Reduced oxygen level in hemoglobin b. Reduced carbon dioxide level in blood c. Reduced carbon level in lymph d. Oxidized phosphorus level in blood
30. Chloride shift helps in transporting
a. O ₂ b. CO c. CO ₂ d. HCO ₃ +H ⁺
31. The combination of hemoglobin with O₂ in the blood can be promoted by
a. Decreasing O ₂ concentration b. Increasing O ₂ concentration c. Increasing CO ₂ concentration

d. Decreasing CO ₂ concentration
32. Low oxygen tension in the blood causes (CBSE)
a. Coughing b. Hiccups c. Sneezing d. Yawning
33. Hamburgers phenomenon is related to the
a. Shifting of Cl ⁻ ions from RBC into blood plasma and HCO ₃ ⁻ into RBC from blood plasma
b. Shifting of HCO ₃ ⁻ ions from RBC into blood plasma and Cl ⁻ into RBC from blood plasma
c. Shifting of H ⁺ ions from RBC into blood plasma and Cl ⁻ into RBC from blood plasma
d. Shifting of HCO ₃ ⁻ ions from blood plasma into RBC and H ⁺ from RBC into blood plasma
34. Protective respiratory blast is (CBSE)
a. Hiccapping b. Coughing c. Sneezing d. None of these
35. During transportation of CO₂ from the tissues to the lungs, about 23% of CO₂ is transported in the form of carbamino compound through
a. Erythrocytes only b. blood plasma only
c. Erythrocytes & blood plasma d. Leucocytes only
36. Pneumonia can be caused by
a. Bacteria (Streptococcus pneumoniae)
b. Protozoan c. Fungi d. All of these
37. When the separating wall of the alveoli breaks-up and the gas exchange area of the lung is reduced ; the state is known as
a. Pneumonia b. Tuberculosis
c. Emphysema d. Cough
38. Asbestosis or silicosis is characterized by proliferation of fibrous tissue in
a. Respiratory tract b. Upper part of lung
c. Lower part of lung d. Pulmonary capillary
39. Which of the following pulmonary volume can't be measured by spirometer directly?
a. Tidal volume b. Vital capacity
c. Inspiratory capacity d. Residual volume
40. The functional residual capacity (FRC) is equivalent to
a. RV + ERV b. TV + IRV c. VC + RV d. TV + RV
LEVEL – 2 (Most of the questions are NEET oriented)
41. If the tidal volume is 500ml and the breathing rate is 12 per minute, then the alveolar ventilation rate is
a. 500 ml x 12 b. $\frac{500}{12}$ ML c. 350ml x 12 d. $\frac{12}{500}$ ML
42. Which of the following is incorrect match?
a. Tidal volume - 500 ml during normal breathing
b. Vital capacity - 5000 ml during normal breathing
c. Eupnoea - Normal breathing
d. Orthopnoea - Breathing difficulty in horizontal position

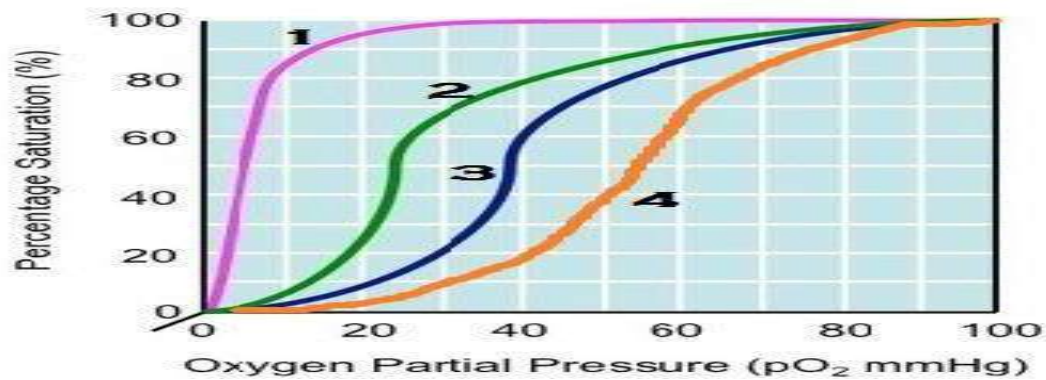
43. Which of the following statement holds true for hemoglobin if the PCO₂ increases?
<ul style="list-style-type: none"> a. It must be exposed to a higher partial pressure of oxygen in order to become fully saturated b. It will tend to release its oxygen at higher partial pressure of carbon dioxide. c. It becomes less efficient at taking up oxygen and more efficient at releasing it. d. All of these
44. In an organism utilizing carbohydrates as source of energy anaerobically, the R.Q. is likely to be... (CBSE)
a. 0.7 b. 1.0 c 0.9 d. Infinity
45. If oxyhaemoglobin dissociation curves are drawn for maternal and foetal hemoglobin, which of the following is true? (CBSE)
<ul style="list-style-type: none"> a. Maternal curve will be on the right side b. Foetal curve will be on the right side c. Both will overlap each other d. It will depend upon level
46. A person met with an accident and died instantly without injury to heart brain, stomach and kidney. Which one of the following is the reason of death? (CBSE)
<ul style="list-style-type: none"> a. intestine became twisted b. Red blood cells became coagulated c. Stomach stopped digestion d. Diaphragm got punctured.
47. R. Q. means: (CBSE)
<ul style="list-style-type: none"> a. Volume of O₂ consumed/minute b. Volume of CO₂ consumed/minute c. Ratio of CO₂ output and O₂ intake d. Increase in O₂ intake with rise in temperature
48. Which of the following respiratory pigment is without iron? (CBSE)
a. Chlorocruorin b. Echinochrome c. Pinna globin d. Haemoerythrin
49. One of the following is not a respiratory pigment (CBSE)
a. Hemoglobin b. Chlorocruorin c. Haemocyanin d. Haemozoin
50. A diver when goes very deep, he loses his strength to work and feel drowsy because
<ul style="list-style-type: none"> a. Compressed air is used b. More CO₂ diffuses in muscles c. More N₂ is diffusing in blood d. Nervous system does not work properly
51. A child was killed through asphyxiation, postmortem confirmed it because when a piece of lung was put in water it (CBSE)
a. Settled down b.. Kept floating c. Had blood spots d. None of these
52. If thorax is injured and pleura damaged, the air enters the pleural cavity and the lungs are collapsed. This condition is known as
a. Hyponea b. Orthopnoea c. Dyspnoea d. Pneumothorax
53. O₂ therapy has significant value in all the following types of hypoxia except :
<ul style="list-style-type: none"> a. Atmospheric hypoxia b. Hypoxia due to pulmonary edema

c. Histotoxic hypoxia due to cyanide poisoning d. Hypoventilation hypoxia
54. 'Caisson's disease' occurs in
a. Person living on high altitude b. Person who smokes heavily c. A diver who has been beneath the sea for a long period d. Person whose alveoli are acutely inflamed
55. Severe Acute Respiratory Syndrome (SARS)
a. Is caused by a variant of Pneumococcal pneumonia b. Is caused by a variant of the common cold virus (Corona Virus) c. Is an acute form of asthma d. Affects the non- vegetarian much faster than the vegetarians.
56. Compound soluble in water which does not impede oxygen transportations?
a. SO_2 b. SO_3 c. CO d. NO
57. Cyanide poisoning will lead to
a. Hypoxic hypoxia b. Histotoxic hypoxia c. Stagnant hypoxia d. Anemic hypoxia
58. Under normal conditions, the volume of O₂ delivered to the tissues by every 100ml of oxygenated blood is
a. 50ml b. 5ml c. 0.5ml d. 4ml
59. CO₂ content in arterial and venous blood respectively is:
a. 48 ml% and 52 ml% b. 52 ml% and 48 ml% c. 67 ml% and 52 ml% d. 52 ml% and 67 ml%
60. One of the following cannot enhance the unloading of oxygen from hemoglobin at the level of tissues
a. Increase of CO ₂ b. Increase of pH c. Decrease of pH d. Increase of temperature
61. Bohr Effect is related with
a. Reduced oxygen level in hemoglobin b. Reduced carbon dioxide level in blood c. Reduced carbon level in lymph d. Oxidized phosphorus level in blood
62. The percentage saturation of hemoglobin near the tissue cells at rest will be
a. 97% b. 50% c. 35% to 40% d. 75%
63. Partial pressure of oxygen in inspired and expired air is respectively
a. 158 mm of Hg and 116 mm of Hg b. 116 mm of Hg 158 mm of Hg c. 46 mm of Hg and 40 mm of Hg d. 40 mm of Hg and 40 mm of Hg
64. Body tissue demand of O₂ at rest is:
a. 0.18 ml% b. 1-1.5 ml% c. 2-3 ml% d. 5 ml%
65. Shift to right of oxygen dissociation curve is seen in all except in
a. Increased concentration of 2, 3 DPG b. Hemophilia c. Fever d. Decreased Ph
66. Respiratory rate increases twice/thrice with every 10°C rise in temperature. This is called

a. Haldane effect c. Chloride shift	b. Hamburger phenomenon d. Vant Hoff's law
67. During transport of CO₂, blood does not become acidic due to	
a. Neutralization of H ₂ CO ₃ by Na ₂ CO ₃ c. Blood buffers	b. Absorption by leucocytes d. Non-accumulation
68. If the spinal cord is severed where it joins the brain stem, what would happen to breathing?	
a. Inspiration occurs while expiration stops b. Expiration occurs while inspiration stops c. The length of inspiration increases abruptly d. Both inspiration and expiration cease	
69. Which one of the following is true during inspiration?	
a. External inter costal muscles contract and radial muscles of the diaphragm also contract b. External inter costal muscles relax and radial muscles of diaphragm also relax c. External inter costal muscles contract and radial muscles of the diaphragm relax d. External inter costal muscles relax and radial muscles of the diaphragm contracts	
70. Which one of the following structures is responsible for raising of throat especially in frog?	
a. Hyoglossus muscles c. Petrohyal muscles	b. Sternohyoid muscles d. Both 1 & 2
71. What will happen if pleural fluid is absent from pleural space?	
a. Nothing will happen b. Pleural membranes will stick to each other c. Lungs will slip over pleura during breathing d. Pleural membranes press against each other to form mediastinal septum	
72. A swimmer breathing through a pipe has a respiration rate of 10/min a tidal volume of 550 ml and an effective anatomic dead space of 250 ml. What is his alveolar ventilation?	
a. 2500 ml/min b. 3000 ml/min c. 3500 ml/min d. 4000 ml/min	
73. Identify the correct representation of aerobic respiration reaction	
a. $C_6H_{12}O_6 + 6H_2O + 6CO_2 \rightarrow O_2 + 6H_2O + 686K. Cal Energy$ b. $C_6 H_{12} O_6 + 6H_2 O + 6O_2 \rightarrow 6CO_2 + 12H_2 O + 686K. Cal Energy$ c. $C_6H_{12} O_6 + 6H_2 O + 6O_2 \rightarrow 6O_2 + 6H_2 O + 686K. Cal Energy$ d. $C_6 H_{12} O_6 + 6H_2 O + 6O_2 \rightarrow 6CO_2 + 12H_2 O + 986K. Cal Energy$	
74. One of the following has three thin, twisted bony plates called Turbinals:	
a. Olfactory part c. Vestibular part	b. Respiratory part d. none of these
75. Internally the trachea are lined by	
a. Pseudo-stratified ciliated epithelium b. Columnar stratified ciliated epithelium c. Cuboidal stratified ciliated epithelium d. Keratinised stratified ciliated epithelium	
76. "Phrenic" muscles are the chief muscles of one of the following	

a. Inter-coastal muscles	b. Diaphragm muscles		
c. Thoracic muscles	d. Larynx muscles		
77. The exchange of gases is not based on one of the following factors. Identify.			
a. Partial pressure/ concentration gradient of gases			
b. Solubility of the gases			
c. Thickness of the respiratory membrane			
d. Thickness of the pleural membrane			
78. The respiratory centre in the brain is stimulated by ..			
a. CO ₂ concentration in the venous blood			
b. CO ₂ concentration in the arterial blood			
c. O ₂ concentration in the venous blood			
d. O ₂ concentration in the arterial blood			
79. When a man inhales air containing normal Oxygen as well as Carbon monoxide (CO), he suffers from suffocation because			
a. CO reacts with O ₂ reducing its percentage in air			
b. Haemoglobin combines with CO instead of O ₂ and forms carboxyhaemoglobin			
c. CO affects diaphragm and intercoastal muscles			
d. CO affects the nerves of the lungs			
80. Chemosensitive area of respiratory center medulla is affected by			
a. Less CO ₂ and H ⁺ ions			
b. Less O ₂ and H ⁺ ions			
c. Excess CO ₂ and H ⁺ ions			
d. Excess O ₂ and H ⁺ ions			
LEVEL – 3 (NEET BASED – HARD QUESTIONS)			
81. Oxygen binding to haemoglobin in blood is			
a. Directly proportional to the concentration of CO ₂ in the medium			
b. Inversely proportional to the concentration of CO ₂ in the medium			
c. Directly proportional to the concentration of CO in the medium			
d. Independent of the concentration of CO in the medium			
82. Which one of the following is an environment related disorder with the correct main cause:			
a. Black lung disease (Pneumoconiosis) found mainly in workers in stone quarries and crushers			
b. Blue baby disease (methaemoglobin-aemia) due to heavy use of nitrogenous fertilizers in the area			
c. Non-Hodgkin's lymphoma found mainly in workers involved in manufacture of neem based pesticides			
d. Skin cancer mainly in people exposed to the endangered situations.			
83. The volume of “anatomically dead space” air is			
a. 230 mL	b. 210 mL	c. 190 mL	d. 150 mL
84. People living at sea level have around 5 million RBC per cubic millimeter of their blood whereas those living at an altitude of 5400 meters have around 8 million. This is because at high altitude:			
a. People get pollution free air to breathe and more oxygen is available			
b. Atmospheric O ₂ level is less and hence more RBCs are needed to absorb the required amount of O ₂ to survive			

<ul style="list-style-type: none"> c. There is more UV radiation which enhances RBC production d. People eat more nutritive food, therefore more RBCs are formed
85. The haemoglobin of a human foetus
<ul style="list-style-type: none"> a. Has higher affinity for oxygen than that of an adult b. Has a lower affinity for oxygen than that of an adult c. Has affinity for oxygen same as that of an adult d. Has two protein sub-units instead of four
86. A large proportion of oxygen is left unused in the human blood even after its uptake by the body tissue. This Oxygen
<ul style="list-style-type: none"> a. Raises the pCO₂ of blood 75mm Hg b. Is enough to keep oxyhemoglobin c. Helps in releasing more O₂ to the epithelial tissues d. Acts as a reserve during muscular exercises
87. Lungs donot collapse between breathes and some air always remains in the lungs which can never be expelled because
<ul style="list-style-type: none"> a. There is a negative pressure in the lungs b. There is a negative intra-pleural pressure pulling at the lung walls c. There is a positive intra-pleural pressure d. Pressure in the lungs is higher than the atmospheric pressure
88. When you hold your breathe, which of the following gas changes in blood would first lead to the urge to breathe?
<ul style="list-style-type: none"> a. Falling O₂ concentration b. Rising CO₂ concentration c. Falling CO₂ concentration d. Raising CO₂ and Falling O₂ concentration
89. Which of the following is common in alveoli of lungs and villi of intestine in human beings?
<ul style="list-style-type: none"> a. Provide a large surface area b. Have ciliated epithelium c. Are suited for diffusion of gases d. Have rich supply of blood vessels and lymph ducts
90. The alveoli of the lungs donot contain air because
<ul style="list-style-type: none"> a. We normally do not ventilate our lungs at a high enough rate. b. The lungs have too many alveoli to ventilate. c. There is "dead space" in the trachea and bronchi. d. The trachea and bronchi are too small in volume.
91. Ciliated epithelium in trachea of mammals helps in
<ul style="list-style-type: none"> a. Sucking inspired air in. b. Perceiving sense of smell. c. Pushing expired air out. d. Pushing mucus out.
92. The graph shows four dissociation curves for four respiratory pigments. Chose right order of representation:



	Adult hemoglobin	Hemoglobin with high CO ₂	Foetal hemoglobin	Adult myoglobin
A	1	2	3	4
B	2	1	4	3
C	3	2	1	4
D	3	4	2	1

93. A person can hold his breath longer if he gradually exhales than if he keeps his lungs fully expanded. This phenomenon is due to the fact that:

- Concentration of CO₂ in the blood decreases, lessening the excitatory input to the carotid bodies.
- He is then using less O₂ as his thoracic muscles are not working as hard as possible.
- Stretch receptors in his lungs are then not firing as much thus lessening the excitatory input to the expiratory centers.
- He is preventing the pressure in his lung from increasing too much

94. What would happen if human blood becomes acidic (Low pH)?

- Oxygen-carrying capacity of haemoglobin decreases.
- Oxygen-carrying capacity of haemoglobin increases.
- RBC count increases.
- RBC count decreases.

95. Although much CO₂ is carried in blood, yet blood doesnot become acidic, because

- It is absorbed by the leucocytes
- Blood buffers play an important role in CO₂ transport.
- It combines with water to form H₂CO₃ which is neutralized by NaCO₃
- It is continuously diffused through tissues and is not allowed to accumulate.

96. A biochemist mixed 10 drops of acid to 100 ml of water, and the pH dropped from 7.4 to 5. She, then mixed 10 drops of same acid to 100 ml of blood. The pH of blood dropped from 7.4 to 7.2. What is the reason for this difference?

- Blood is thicker than water.
- Blood is already very acidic, so the acid has less effect.
- Blood is saturated with oxygen; there is little room for acid.
- Blood contains buffers that reduce pH change.

97. Patients with chronic lung disease and difficulty breathing often adapt to the high concentration of CO₂ in their blood. The breathing centers stop responding

to CO₂ level. If such a patient has difficulty in breathing, medical personnel are reluctant to give the patient pure oxygen. Based on what you know about control of breathing why do you think this is the case?

- The patient's body would use the oxygen to make even more CO₂
- The oxygen would increase concentration of bicarbonate, altering pH.
- Increased oxygen in the blood might slow or stop breathing.
- The body is not used to the oxygen, and the patient would overdose

98. Match the disorders given in column-I with symptoms under column-II. Choose the answer which gives the correct combination of alphabets with numbers

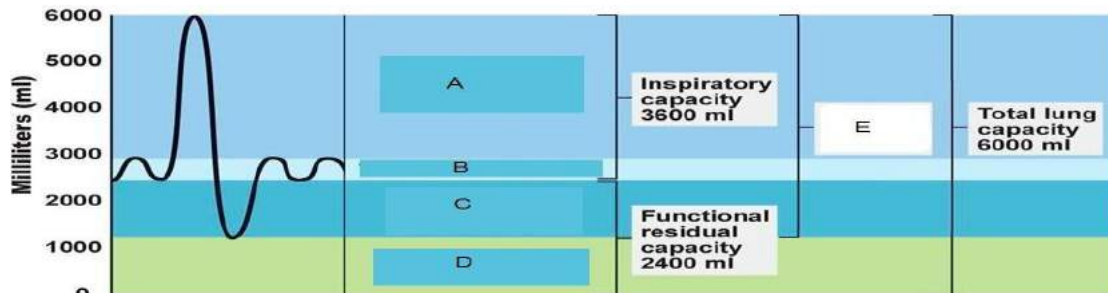
Column-I		Column-II	
A.	Asthma	I.	Inflammation of nasal tract
B.	Bronchitis	II.	Spasm of bronchial muscles
C.	Rhinitis	III.	Fully blown out alveoli
D.	Emphysema	IV.	Inflammation of bronchi
		V.	Cough with blood strained sputum

- A-IV, B-II, C-V, D-I
- A-V, B-III, C-II, D-I
- A-III, B-I, C-V, D-IV
- A-II, B-IV; C-I, D-III

99. A person receives a serious cut on the back of the neck that is deep enough to severely damage the brain stem in the lower medulla. The respiratory effect of this type of wound would likely be:

- Catastrophic and it might result in a complete cessation of breathing.
- To reduce respiration to an irregular rhythm.
- To shift the oxygen-binding curve of haemoglobin to the left.
- To stimulate the production of additional diphosphoglyceric acid

100. Study the spirograph and identify the correctly matched volumes from the codes given:



TV IRV ERV RV VITAL CAPACITY

- A C B D E
- A B C D E
- B A C D E
- C B A D E

14. Assertion & Reasoning Questions

<p>In each of the following question a statement of Assertion (A): is given followed by a corresponding statement of Reason (R): just below it. Of the statements, mark the correct answer as</p> <p>A. If both assertion and reason are true and reason is the correct explanation of assertion B. If both assertion and reason are true but reason is not the correct explanation of assertion C. If assertion is true but reason is false D. If both assertion and reason are false</p>	
1	<p>Assertion (A): Oxidation of nutrients releases bond energy Reason (R): Oxidation of nutrients is done by using molecular oxygen</p>
2	<p>Assertion (A): Aerobic respiration involves the exchange of respiratory gases twice Reason (R): Exchange occurs from lung to heart and then heart to lung</p>
3	<p>Assertion (A): Voice of women and children is high pitched whereas that of men is low pitched Reason (R): Vocal cards of men are longer than of woman and children</p>
4	<p>Assertion (A): Alveoli of lung of man are lined by lecithin phospholipid. Reason (R): Lecithin lowers the surface tension and prevents collapsing of alveolar walls.</p>
5	<p>Assertion (A): Each alveolus acts as a miniature lung. Reason (R): Alveoli provide about 100 sq. m. surface area of respiration, which is about 50 times than that of skin.</p>
6	<p>Assertion (A): Pneumotaxic centre control rate of respiration Reason (R): Primarily it controls switch off point of inspiration</p>
7	<p>Assertion (A): Gaseous exchange continue in the lungs without interruption even during expiration Reason (R): During expiration, volume of thorax increases and air is expelled out</p>
8	<p>Assertion (A): It is beneficial to respire through mouth than through the nasal openings Reason (R): Air gets filtered when passed through the mouth</p>
9	<p>Assertion (A): CO₂ is carried in the plasma mainly as HCO₃⁻ ions. Reason (R) : Zinc containing enzyme carbonic anhydrase of RBC catalyses the formation of HCO₃ ions that enter plasma</p>
10	<p>Assertion (A): More of oxygen is released from oxyhaemoglobin in a more active tissue than in a less active one Reason (R): This is because partial pressure of carbondioxide is very low in an active tissue than in active one</p>
11	<p>Assertion (A): Oxyhaemoglobin carries 1 to 4 molecules of oxygen in the blood Reason (R): The capacity of oxyhaemoglobin depends on the degree of (Fe²⁺) saturation with oxygen</p>
12	<p>Assertion (A): Asthmatic patients use bronchodilator drugs as well as inhalers for symptomatic relief Reason (R): Asthma is characterized by the spasm of smooth muscles in the wall of bronchiole due to allergen</p>
13	<p>Assertion (A): Vital capacity is higher in athletes than non-athletes</p>

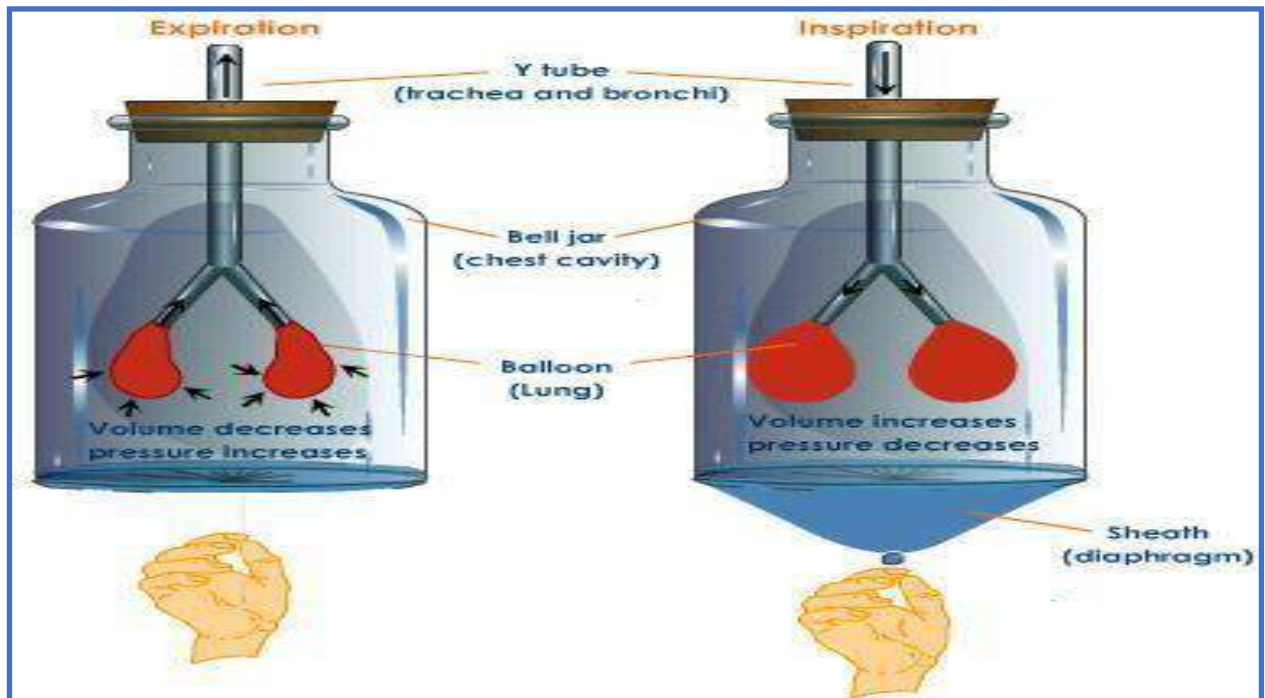
	Reason (R): Vital capacity is about 3.5 to 4.5litres in a normal adult person
14	Assertion (A): Gaseous exchanges continue in the lungs without interruption ever during expiration Reason (R): Residual volume of air can ever be driven out by respiration
15	Assertion: Aerobic respiration involves the exchange of respiratory gases twice. Reason: Exchange occurs from lung to heart and then heart to lung.
16	Assertion: Severe Acute respiratory Syndrome (SARS) originated in China. Reason: China is the most populated country in the world.
17	Assertion: Most fish when out of the water die of suffocation. Reason: Atmospheric air contains far less oxygen content than the dissolved oxygen in water.
18	Assertion (A) : Aerobic animals are not truly aerobic Reason (R): They produce lactic acid anaerobically
19	Assertion (A): Gaseous exchange continue in the lungs without interruption even during expiration Reason (R): During expiration, volume of thorax increases and air is expelled out
20	Assertion (A): Phrenic muscles of diaphragm are called principal expiratory muscles. Reason (R): Contraction of these muscles decrease thoracic cavity to expel main part of foul air.

15. Assignment Questions to answer

UNIT – 1B BREATHING AND EXCHANGE OF GASES		
VSAQ**	1	Define Vital capacity.
**	2	What happens to the respiratory process in a man going up the hill?
***	3	What is Tidal Volume? Find out the tidal volume in a healthy human being, in an hour?
***	4	Define Oxy-haemoglobin Dissociation Curve? Can you suggest any reason for its sigmoid pattern?
**	5	What are Conchae?
***	6	What is meant by chloride shift?
***	7	Mention any two Occupational respiratory disorders and their causes in human beings.
*	8	Name the muscles that help in normal breathing.
SAQ***	1	What are the major transport mechanisms for CO₂? Explain.
*	2	How is respiratory movements regulated in man?
**	3	Describe disorders of respiratory system.
***LAQ	2	Write an essay on the transport of Oxygen And carbon dioxide by blood.

16. Hands on Experiences for you – Try It!!!

1. Prepare Lungs model:



2. Observe & Understand the picture below:

Lung Cancer Risk Factors

In addition to smoking, risk factors include occupational or environmental exposure to secondhand smoke, radon, asbestos (particularly among smokers), certain metals (chromium, cadmium, arsenic), some organic chemicals, radiation, air pollution, and a history of tuberculosis.

- More than 150,000 Americans die every year from lung cancer — it's the most common cause of cancer death in the U.S.
- More Americans die from lung cancer than breast cancer

- The risk of getting lung cancer grows significantly with multiple causes. For example, a cigarette smoker exposed to asbestos increases his/her risk of lung cancer by 50 to 84 times.

RISK FACTOR COMBINATIONS INCREASE ODDS OF LUNG CANCER



3. Understanding Asthma:

Materials:

- Regular straws
- Coffee-stirring straws
- Wadded up paper or foil to make balls (optional)

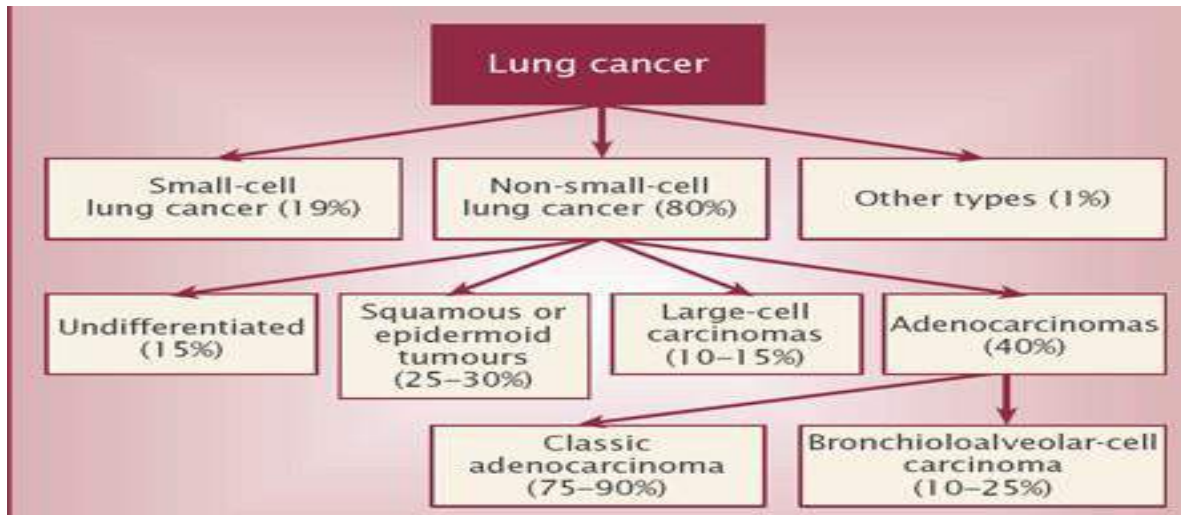
Teacher Background/Directions:

- Read descriptions on the anatomy of the respiratory system. Recall the characteristics of trachea, lung, bronchi/bronchioles, and alveoli.
- Take note of the problems or disorders of the respiratory system.
- Then, tell them they are going to see what it feels like to have asthma (or a close proximity to what it feels like). ***“If students actually have asthma, they should not participate in this activity.”***
- Have students breathe regularly for two minutes. Next have them breathe out of a straw (plugging their nose). Have them write their observations. Finally, have them breathe out of the tiny coffee-stirring straw. Have them write their observations.
- Next have students complete activities normally, then with the regular straw and then with the coffee-stirring straw (make sure the activities are not too vigorous). Have students record their observations.
- Optional: have students try to blow a paper or aluminum foil ball across the table. Have them repeat this with the regular straw and then with the coffee-stirring straw.

Discussion Questions/Follow-up:

- How did the straw impact your ability to breathe?
- Based on how far the ball moved, what can you say about the output (and input) of air during an asthma attack?
- During an asthma attack, what do you think happens to the airways in your respiratory system? How is this like the straw activity?
- Predict how an inhaler for asthma helps someone having an 'asthma attack'

4. KNOW ABOUT TYPES OF CANCER:



5. IMMUNE YOURSELF FROM COVID-19 THROUGH YOGA

A Common Yoga Protocol (CYP) was developed by a team of leading Yoga Experts / Yoga Gurus that is being widely performed on International Day of Yoga (IDY) i.e. 21st June of every year. This protocol available on WHO m-app can be used by the general population to stay fit along with other hygiene and social distancing measures in this current scenario.

CommonYoga Protocol: Forty-Five-minute module: The Common Yoga Protocol of IDY that was developed by a team of leading Yoga experts / Yoga Masters include safe practices to improve physical, mental, emotional and spiritual health of the population. Regular practice on empty stomach is recommended to improve immune resilience. Twenty and ten minute modules are recommended for children, adults, Youths and the elderly population to be repeated twice a day (morning and evening).

Apart from CYP; Jalaneti, Sutraneti and Bhastrika Kriyas are recommended once or twice in a week and Yoga nidra for 20-30 minutes twice or thrice a week.

Yogic Diet

This includes wholesome nutritious freshly cooked traditional home cooked food with plenty of fresh vegetables and fruits (with restrictions as per your disease condition) with added traditional spices in moderate quantities, consumed at regular timings.

Abstinence from substance abuse including tobacco, alcohol and other addictive drugs.


Yogasanas preferred:

Neck Bending	Three minutes
--------------	---------------

Shoulder movement	
Trunk Movement	
Tadāsana (The Palm tree posture)	One minute
ArdhaChakrāsana (The Half wheel posture)	
Sasakāsana (The Hare posture)	One minute
Bhujangāsana (The Cobra posture)	One minute
PawanaMuktāsana (The Wind releasing posture)	One minute
(AnulomaViloma /Nadiswhodhana Pranayama)	One minute
The Alternate nostril breathing (2 rounds)	
The Meditation	10 minutes

6. MYTHS & FACTS ABOUT COVID-19 (Pictures Courtesy WHO)


Can shoes spread the COVID-19 virus?



11 June 2020

The likelihood of COVID-19 being spread on shoes and infecting individuals is very low.

As a precautionary measure, particularly in homes where infants and small children crawl or play on floors, consider leaving your shoes at the entrance of your home. This will help prevent contact with dirt or any waste that could be carried on the soles of shoes.

#Coronavirus
#COVID19


The most common symptoms of COVID-19 are dry cough, tiredness and fever. Some people may develop more severe forms of the disease, such as pneumonia. The best way to confirm if you have the virus producing COVID-19 disease is with a laboratory test. You cannot confirm it with this breathing exercise, which can even be dangerous.

FACT:

Being able to hold your breath for 10 seconds or more without coughing or feeling discomfort DOES NOT mean you are free from the coronavirus disease (COVID-19) or any other lung disease.



World Health Organization

#Coronavirus #COVID19

Thermal scanners are effective in detecting people who have a fever (i.e. have a higher than normal body temperature). They cannot detect people who are infected with COVID-19.

There are many causes of fever. Call your healthcare provider if you need assistance or seek immediate medical care if you have fever and live in an area with malaria or dengue.

FACT: Thermal scanners CANNOT detect COVID-19



World Health Organization

#COVID19 #Coronavirus

27 May 2020

The harmful use of alcohol increases your risk of health problems.

FACT: Drinking alcohol does not protect you against COVID-19 and can be dangerous.



World Health Organization

#Coronavirus #COVID19

27 May 2020

Most people who get COVID-19 have mild or moderate symptoms and can recover thanks to supportive care. If you have a cough, fever and difficulty breathing seek medical care early – call your health facility by telephone first. If you have fever and live in an area with malaria or dengue seek medical care immediately.

FACT:
Most people who get COVID-19 recover from it



#Coronavirus #COVID19

27 May 2020

Can people wear masks while exercising?



16 June 2020

People should NOT wear masks when exercising as masks may reduce the ability to breathe comfortably.

Sweat can make the mask become wet more quickly which makes it difficult to breathe and promotes the growth of microorganisms. The important preventive measure during exercise is to maintain physical distance of at least one meter from others.

#Coronavirus #COVID19



Breastfeeding and COVID-19

Breastfeed to protect your infants and children from getting sick and for their healthy growth and development.

Breastfeeding is particularly effective against infectious diseases because it **strengthens the immune system** by transferring antibodies from you.



World Health Organization
REGIONAL OFFICE FOR THE Eastern Mediterranean

#COVID19
#CORONAVIRUS



SUPPORT, RESPECT & SALUTE & COVID-19 WARRIORS

17. Medical and other Careers in Respiratory System Related Fields

Respiratory Therapists (RTs): These people are trained as “physician-extendors” and are a very important part of a healthcare team. As the name implies, respiratory therapists treat patients with problems related to breathing, such as issues of people suffering from lung disease. They are patient care managers who not only determine the need for respiratory care services but actually administer that care directly to patients.

Pulmonologists: These specialists diagnose and treat conditions that affect the respiratory system in men and women, as well as children. Pulmonologists have expertise in the respiratory disorders that are infectious, structural, inflammatory, neoplastic, which means having to do with a tumor and autoimmune

In some instances, pulmonary disorders extend to the cardiovascular system. Certain conditions, such as pulmonary vascular disease, can first affect the respiratory system but go on to affect other organs in the body. A pulmonologist may work in their own office or as part

of a multidisciplinary practice. They can also work in hospital settings, particularly in intensive care units.

Oncologists and Radiation Oncologists: These are specialists in surgical and non-surgical treatment of cancers that occur in the Respiratory tract. Respiratory cancers are cancers of the lung, larynx, trachea, and bronchus. Symptoms vary, depending on the location of the cancer: Lung cancer—a new cough or cough that doesn't go away, coughing up blood, shortness of breath, chest pain, hoarseness etc.

Laryngologists: Laryngologist is a surgeon with a special interest in voice, airway, and swallowing disorders involving the voice box and the throat. A **laryngoscopy** is an exam that gives your doctor a close-up view of your larynx and throat.

Other careers are Registered Dieticians, Nurse practitioners, Physician assistant (PA), , A Therapist or Mental health professional, Yoga therapists, Ayurvedic Practitioners and Naturopathic physicians. (For definitions read at Unit 1A)



18. Answers

1. True or False statements:

Sl. No.	Statement
1	False (When the diaphragm relaxes , it pulls the ribs together and reduces the size of the thoracic cavity and expels air.)
2	False (The bronchi and bronchioles function as air distributors where as the alveoli act as ' exchange part ' of gases.)
3	False (The hollow nasal cavity is separated by a midline partition, the nasal septum , dividing it into a right cavity and left cavity.)
4	True

5	False (The laryngopharynx moves up and down during swallowing to prevent food or liquid from entering the trachea.)
6	True
7	True
8	False (The lungs are situated in the thoracic chamber which is anatomically a “ air - tight ” chamber.)
9	False (The “diffusion membrane” has three layers:1. Squamous epithelium of alveolar wall, 2. The endothelium of the alveolar capillaries and 3. The “ Basement membrane ” in between them.)
10	True
11	False (A special centre in the “ Medulla ” region of the brain is called “Respiratory Rhythm Centre”.)
12	True
13	False (Hemoglobin can act as a buffer at physiological pH, because of its high content of “ Histidine ”.)
14	False (About 25% of CO ₂ combines with free amino group of hemoglobin and forms “ carbamino-hemoglobin ” in a reversible manner.)
15	True
16	False (COPD stands for “ Chronic Obstructive Pulmonary Diseases ”. Emphysema is an example.)
17	False (Receptors associated with “Aortic Arch” and “Carotid Artery” recognize changes in ‘ Carbon dioxide ’ and Hydrogen ion concentrations.)
18	True
19	True
20	False (Release of alveolar air to the exterior is a “ Passive process ”.)

Answers for Completion of sentences/ Filling the blanks:

1	2	3	4	5
Glottis	Larynx	Branchioles	Respiratory Branchioles	Simple Squamous cells
6	7	8	9	10
Alveolar ventilation	Intra pulmonary pressure	Diaphragm	Temperature	Residual Volume
11	12	13	14	15
Iron ion	Bohr Effect	Carbamino hemoglobin	Apnea	Baroreceptors

16	17	18	19	20
Apneustic	Emphysema	Lamina propria	Vestibule	Alveolar ventilation.

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

Que. No	Ans.	Explanation/Notes
• The students should explore unknown options &make notes here.		
LEVEL - 1		
1	C	
2	D	
3	D	
4	C	
5	B	
6	D	
7	D	
8	D	
9	D	
10	B	
11	D	
12	C	
13	D	
14	D	
15	C	
16	B	
17	B	
18	C	
19	B	
20	B	
21	C	
22	A	

23	C	
24	B	
25	B	
26	B	
27	A	
28	A	
29	A	
30	C	
31	B	
32	D	
33	B	
34	C	
35	C	
36	A	
37	C	
38	C	
39	D	
40	A	
LEVEL - 2		
41	A	
42	B	
43	C	
44	B	
45	A	
46	D	
47	C	
48	C	
49	D	

50	C	When a diver descends to greater depths, he has to breathe on compressed air under high pressure, otherwise his lungs will collapse. This increases concentration of N ₂ in alveoli and subsequently in blood. From blood N ₂ diffuses into muscles and body fats. This makes the diver loose his strength and work capacity and he feels drowsy.
51	B	Asphyxiation is the state or process of being deprived of oxygen, which can result in unconsciousness or death. Due to suffocation air is retained in piece of lung. So it will float.
52	D	
53	C	
54	C	
55	B	
56	C	
57	C	
58	B	
59	A	
60	B	
61	A	
62	C	
63	A	
64	D	
65	B	
66	D	
67	C	
68	D	
69	A	
70	C	
71	B	
72	B	
73	B	
74	B	
75	A	

76	B	
77	D	
78	B	
79	B	
80	C	
LEVEL – 3		
81	B	Bohr Effect is the phenomenon whereby the affinity of the respiratory pigment of the blood for oxygen is reduced, and the level of CO ₂ is increased.
82	B	
83	D	
84	B	At high altitudes atmospheric O ₂ level is less and hence, more RBCs are needed to absorb the required amount of O ₂ to survive.
85	A	
86	D	Our tissue is able to utilize only 25% of O ₂ only carried by the arterial blood. The venous blood is still 75% saturated with O ₂ . This O ₂ acts as a reserve during muscular exercises.
87	B	
88	B	
89	A	
90	C	The alveoli do not contain "air" with 20.9% O ₂ because incoming air is mixed with air left in the "dead space" of the trachea and bronchi that has had some of the O ₂ removed by the lungs.
91	D	Ciliated epithelium contains special goblet cells to create mucous. This mucous surrounds particle that should not be in our body, and the cilia move them out. Without these cells and tissue, a lot of harmful bacteria would remain in our lungs, making us really sick.
92	D	Myoglobin has the greatest affinity for oxygen and does not unload the oxygen until very low partial pressures of oxygen (below 20 mmHg). Foetal haemoglobin has a higher affinity for oxygen than adult haemoglobin, thus facilitating the transfer of oxygen from maternal haemoglobin to foetal, haemoglobin at the placenta. When respiration is occurring at fast rate, more oxygen is needed. High levels of respiration are associated with high levels of carbon dioxide, hence the affinity of haemoglobin for oxygen decreases at higher carbon dioxide partial pressures so that oxygen can be released to respiring tissues..
93	C	When the chest is expanded, stretch receptors in the lungs relax and excite the expiratory centre in the medulla which tends to produce expiration. Partial exhalation lessens the intensity of this reflex, allowing breath to be held for a longer time. Exhalation does not

		change the blood CO ₂ concentration unless fresh air (low in CO ₂) is brought into the lungs, allowing more CO ₂ to diffuse out of the blood.
94	A	
95	B	CO ₂ enters RBC and reacts with water to form Carbonic acid. Carbonic acid dissociates to form bicarbonate and hydrogen ions. Some bicarbonate ions are transported in to erythrocytes while some diffuse into the blood plasma. Exit of bicarbonate ions change the ionic balance between the plasma and erythrocytes. To restore this balance chloride ions diffuse from plasma into erythrocytes. Due to this the pH of blood is maintained.
96	D	Same as above
97	C	Since carbon dioxide levels are not being responded to, the signal to inhale and exhale is dependent upon oxygen levels.
98	D	
99	A	Cutting the brain stem below the medulla eliminates neural contact with the respiratory mechanism and could easily result in a complete stoppage of breathing.
100	2	

Answers to Assertion & Reasoning Questions

1	2	3	4	5	6	7	8	9	10
A	B	A	A	A	A	C	D	B	C
11	12	13	14	15	16	17	18	19	20
C	A	B	A	C	B	C	A	C	A

UNIT – II

HUMAN ANATOMY AND PHYSIOLOGY - II



UNIT – II

HUMAN ANATOMY AND PHYSIOLOGY - II

MAJOR LEARNING OBJECTIVE

- Students will be able to identify, understand and apply the knowledge of the 'Human Lymphatic system, Clotting of Blood, Circulatory Pathways', 'Blood Vessels' and 'Cardiac Cycle'
- Students will be able to appreciate the role of Circulatory System acts as an "Integrating System" cum "The Postman" cum "The Police Man"

LEARNING OUTCOMES:

- Be able to know the structure and functions of the human lymphatic system.
- Be able to understand the process of "Clotting of blood"

- Be able to understand the Structure and functioning mechanism of Human cardio vascular system.
- Be able to analyze the different stages of cardiac cycle in human being.
- Be able to appreciate the role of Autonomic nervous system and different hormones in the Regulation of cardiac activity.
- Be able to differentiate the structure of Arteries and veins.
- Be able to define and understand the disorders of Circulatory system.

ADDITIONAL READING MATERIAL

- Sphygmomanometer

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book
2. Defining key words
3. Adding brief notes on concepts of Lymphatic System
4. Adding brief notes on concepts related to Clotting of Blood
5. Draw and Label the diagram of External Structure of Human Heart
6. Draw and Label the diagram of Internal Structure of Human Heart
7. Differentiating Blood Vessels : Arteries and Veins
8. Note making on stages of “Cardiac Cycle”
9. Note making on “ Disorders of Circulatory system”
10. Answer True or False
11. Completion of each sentence or statement/filling the blanks
12. Multiple Choice Questions for Competitive exams
13. Assertion and Reasoning Questions
14. Assignment Questions to answer
15. Hands on Experiences for you – Try It!!!
16. Medical and other careers related to Excretory System
17. Answers to the activities and note making

INSTRUCTIONS TO LECTURER

- Ask the students to take aid of the textbook
- Ask the students to work with a partner
- Explain each part of the worksheet & Come up with some examples to help
- Clarify doubts of the students before starting the work book

INSTRUCTIONS TO STUDENTS

- First read the text book thoroughly and logically.
- Always try to attempt this workbook through analyzing with a friend cooperatively.
- While attempting the multiple choice questions, make notes on the other options too

ADDITIONAL READING MATERIAL

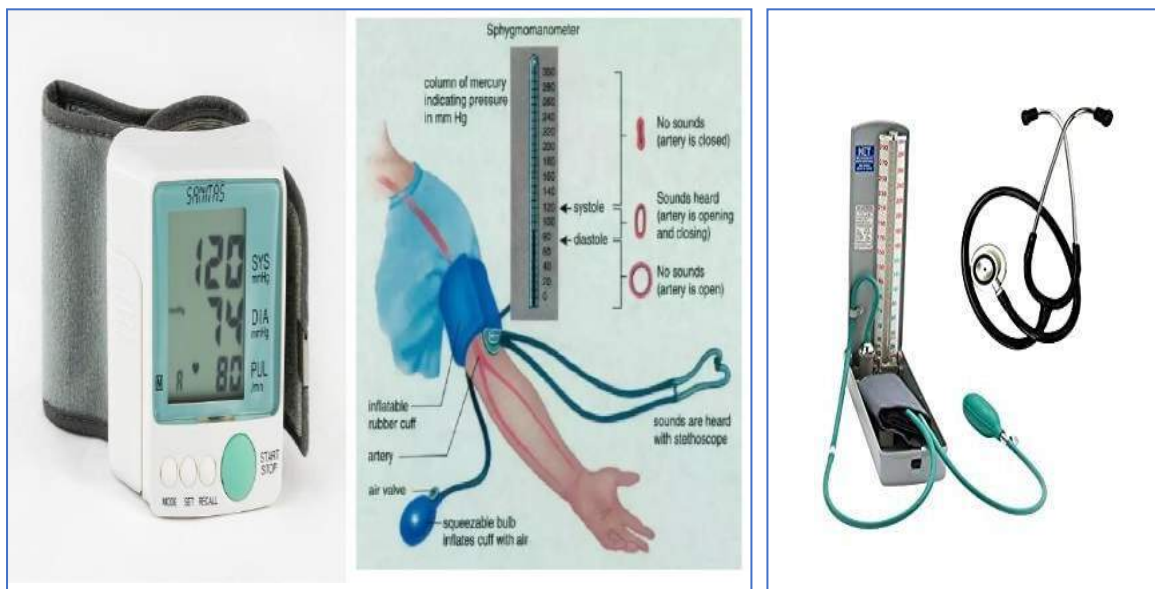
Sphygmomanometer:

A sphygmomanometer is a device that measures blood pressure. The first clinically applicable sphygmomanometer was invented in 1881 by Austrian physician ‘**Karl Samuel Ritter Van Basch**’. Sphygmomanometer is composed of an inflatable rubber cuff, which is wrapped around the arm, a measuring device – indicates the cuff’s pressure, a bulb inflates the cuff and a valve releases pressure. A stethoscope is used to listen to arterial blood flow sounds.

As the heart beats, blood forced through the arteries cause a rise in pressure called systolic pressure, followed by a decrease in pressure as the heart's ventricles prepare for another beat. This low pressure is called the diastolic pressure.

The sphygmomanometer cuff is inflated to well above expected systolic pressure. As the valve is opened, cuff pressure slowly decreases. When the cuff's pressure equals the arterial systolic pressure, blood begins to flow past the cuff, creating blood flow turbulence and audible sounds. Using the stethoscope, these sounds are heard and the cuff's pressure is recorded. The blood flow sounds will continue until the cuff's pressure falls below the arterial diastolic pressure. The pressure when the blood flow sounds stop indicates the diastolic pressure.

Systolic and diastolic pressures are commonly stated as systolic over diastolic. For example 120/80 Over 80 mmHg (120/80) is considered normal blood pressure in human beings. Blood pressure above 140/90 is considered "Hypertension". Blood flow sounds are called korotkoff sounds. Korotkoff sounds (or K-Sounds) are the "tapping" sounds heard with a **stethoscope** as the cuff is gradually deflated.



1. Locate and rewrite the difficult keywords from the text book

1	8	15
2	9	16

3	10	17
4	11	18
5	12	19
6	13	20
7	14	21

2. Defining keywords (search through the text book and write).

1	ECF	
2	SPLEEN	
3	HEMOSTASIS	
4	HEPARIN	
5	PERICARDIAL FLUID	
6	MEDIASTINUM	
7	PACE MAKER	
8	CARDIAC OUT PUT	
9	STROKE VOLUME	
10	MYOCARDIAL INFARCTION	
11	MYOGENIC HEART	
12	EUSTACHIAN VALVE	
13	VALVE OF THEBESIUS	
14	BICUSPID & TRICUSPID VALVES	

3. Adding brief note on concepts of Lymphatic System:

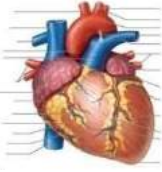
1. Chyliferous Duct	
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2. Left Subclavian Vein	
3. Right Subclavian Vein	
4. Composition of Lymph	
5. Functions of Lymphatic system	

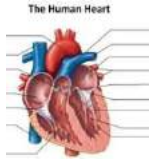
4. Adding brief notes on concepts related to Clotting of Blood

Step – 1	
Step – 2	
Step - 3	
Clot Retraction	
Names of Anticoagulants	

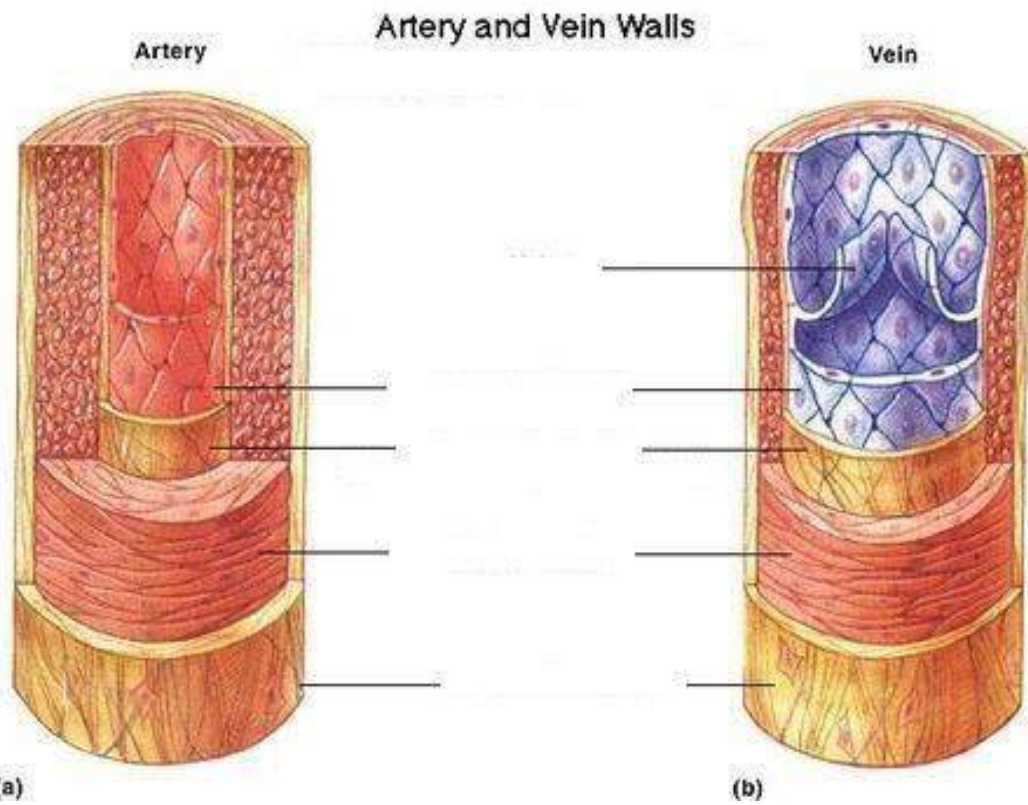
5. Draw and Label the diagram of External Structure of Human Heart



6. Draw and Label the diagram of Internal Structure of Human Heart

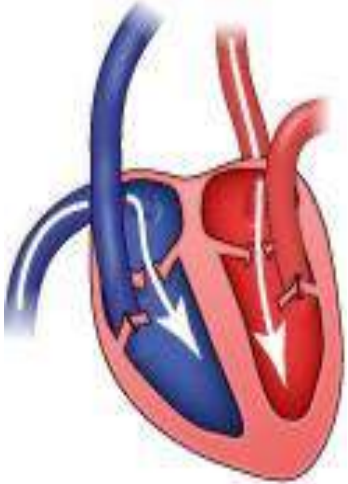
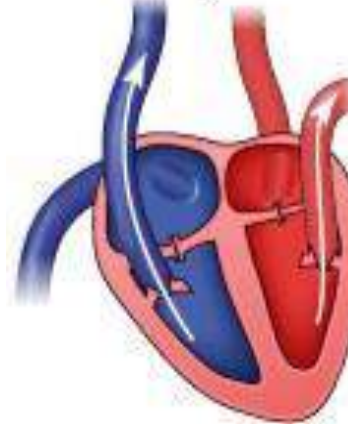
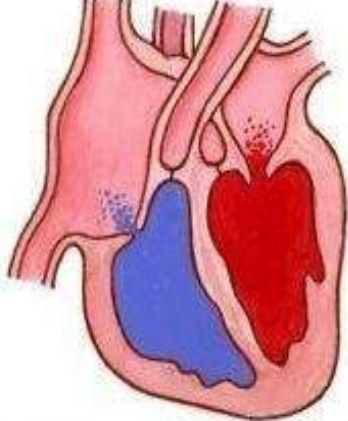


7. Differentiating Blood Vessels : Arteries and Veins



Arteries	Veins

8. Note making on stages of “Cardiac Cycle”:

 <p>Atrial systole</p>	
<p>Ventricular systole</p> 	
 <p>Cardiac diastole</p>	

9. Note making on “ Disorders of Circulatory system”

<ul style="list-style-type: none">• HYPERTENSION	
<ul style="list-style-type: none">• CORONARY ARTERY DISEASE	
<ul style="list-style-type: none">• ANGINA PECTORIS	
<ul style="list-style-type: none">• MYOCARDIAL INFARCTION	
<ul style="list-style-type: none">• CARDIAC ARREST	
<ul style="list-style-type: none">• CARDIAC OUTPUT	

10. Answer True or False

Sl. No.	STATEMENT	TRUE/ FALSE
1.	The circulatory system of man is considered as 'third integrating system' cum 'the postman' cum 'the policeman'.	
2.	The blood pressure is monitored by pressure sensors in the heart.	
3.	Blood and lymph together constitute the 'fluid tissue' in the human body.	
4.	About 85% of ECF is collected into the lymphatic system through lymph capillaries.	
5.	Erythrocytes and lymphocytes are absent in the lymph.	
6.	Prothrombin activator is the final product formed by both intrinsic & extrinsic pathway of blood clotting.	
7.	Heparin is an anticoagulant synthesized by mast cells, basophils and liver	
8.	Amphibians have 3 chambered heart with 2 ventricles and an atrium.	
9.	The heart in human being is covered by a double walled pericardium which consists of the outer serous pericardium and inner fibrous pericardium.	
10.	Atria and ventricles are internally separated by coronary sulcus.	
11.	The right atrium receives deoxygenated blood from various parts of the body, where as left atrium receives oxygenated blood from lungs.	
12.	The right and left atrio ventricular apertures are guarded by bicuspid and tricuspid valves respectively.	
13.	Atrio ventricular node (AVN) present in the right atrium acts as pacemaker.	
14.	Ligamentum arteriosum is the remnant of the ductus arteriosus in the embryonic stage.	
15.	70% of the heart ventricles are filled before the atrial systole.	
16.	LUB sound is the systolic sound produced due to the closing of semilunar valves.	
17.	Thyroxin hormone increases the heart rate and cardiac output in addition to epinephrine and nor epinephrine.	
18.	Lumen of the arteries is wider than the lumen of veins.	
19.	Pulmonary veins are the only veins that carry oxygenated blood.	
20.	Blood pressure is measured in the brachial artery of the arm by using a Spirometer.	

11. Completion of each sentence or statement/filling the blanks

1	_____ provides capillary osmotic pressure to prevent excessive loss of fluids from blood.
2	The extra cellular fluid (ECF) that enters the lymphatic capillaries is called as _____
3	_____ is the haemopoitic organ until the 5 th month of gestation in human
4	_____ % of ECF enter into the lymphatic system.
5	Lymphatic capillaries in the villus of the small intestine that absorbs digested fats are called as _____.
6	Factor involving intrinsic path way of blood clotting is _____
7	The platelet count falls low in the patient suffering with _____ disease.
8	_____ of plant origin are the precursors of anticoagulants such as Warfarin.
9	Coumadin and Jantoven are the brand names of anticoagulants _____.
10	_____ Vitamin is antagonistic to coumarins.
11	Reptiles with 4 chambered heart _____.
12	Heart is originated from germ layer called _____.
13	Inner most layer of heart is made up of _____.
14	The muscular pouch like projection from each atrium is called _____.
15	The opening of the coronary sinus into the right atrium is guarded by the _____.
16	The cord like collagenous processes that connect the papillary muscles to the tricuspid and bicuspid valves are _____
17	_____ acts as relay point in the human heart.
18	The volume of the blood pumped out by each ventricle for each heart beat is called as _____
19	A system of a blood vessel starting in capillaries in one organ and ending in capilleries in another organ is called as _____.
20	_____ is a warning signal of deprivation of blood supply to the heart muscles.

12. Multiple Choice Questions for Competitive exams

LEVEL – 1

<p>1. The circulatory system was first evolved in 1) Cniderians 2) Platyhelminthes 3) Chordates 4) Annelids</p>
<p>2. Largest lymphatic vessel in the lymphatic system is 1) Thoracic duct 2) Left lymphatic duct 3) Cheliferous duct 4) All the above</p>
<p>3. Largest lymphatic organ in human body 1) Liver 2) Spleen 3) Thymus 4) Tonsils</p>
<p>4. Which of the following are absent in the ECF. 1) Glucose 2) Large plasma proteins 3) Inorganic salts 4) Small organic molecules</p>
<p>5. Ions required for blood coagulation 1) Na⁺ 2) Ca⁺⁺ 3) Cl⁻ 4) Hco⁻³</p>
<p>6. Vitamin antagonistic to heparin is 1) Vit-A 2) Vit-D 3) Vit-E 4) Vit-K</p>
<p>7. Find out the odd one regarding open type of blood vascular system. 1) Arthropods 2) Echinoderms 3) Cephalopods 4) Urochordates</p>
<p>8. Closed type of blood vascular system is not found in 1. Cephalopods 2. Urochordates 3. Cephalochordates 4) Annelids</p>
<p>9. Which of the following set of animals show an incomplete double circulation. 1) Fishes & Amphibians 2) Amphibians & Reptiles 3) Reptiles & Aves 4) Aves & Mammals</p>
<p>10. A small pore present on the atrial septum of fetal heart 1) Foramen ovale 2) Fossa ovalis 3) Foramen magnum 4) Foramen of Monro</p>
<p>11. Nonfunctional valve in the heart of adult human is 1) Thebesius valve 2) Eustachian valve 3) Pulmonary valve 4) Aortic valve</p>
<p>12. The left atrio-ventricular aperture is guarded by 1) Thebesius valve 2) Tricuspid valve 3) Mitral valve 4) Eustachian valve</p>
<p>13. Find out the odd one 1) Mediastinum 2) Mesovarium 3) Mesorchium 4) Mesosalpinx</p>
<p>14. Small blood vessel that connects the systemic and pulmonary arches in the embryonic stage. 1) Ductus botali 2) Ligamentum arteriosum 3) Ductus arteriosus 4) Ductus caroticus</p>
<p>15. Valves preventing the backward flow of blood from ventricles to atria. i) Semilunar valves ii) Mitral valve iii) Tricuspid valve iv) Thebesius valve 1) i only 2) ii only 3) i & iv only 4) ii & iii only</p>
<p>16. Blood vessels that carry the oxygenated blood into the left atrium. 1) Pulmonary veins 2) Pulmonary artery 3) Post caval vein 4) Perceval vein</p>
<p>17. The opening of the pulmonary vein into the left atrium is guarded by the valve. 1) Thebesius valve 2) Eustachian valve 3) AV valve 4) No valve</p>
<p>18. What would be the heart rate of a person if the cardiac output is 5 liters, blood volume in the Ventricles at the end of diastole is 100ml and at the end of ventricular systole is 50ml.</p>

1) 50 beats per minute 3) 100 beats per minute	2) 75 beats per minute 4) 125 beats per minute
19. Hepatic portal system in man connects the	
1) Digestive tract with liver 3) Heart with liver	2) Digestive tract with kidney 4) Lungs with liver
20. Innermost layer of blood vessels is made up of	
i. Fibrous connective tissue 1) i only 3) iv only	ii. Smooth muscles 2) ii only 4) iii & iv only
21. Normal systolic blood pressure at rest is	
1) 120 mm Hg 2) 80 mm Hg	3) 140 mm Hg 4) 90 mm Hg
22. Valve lies between right atrium and right ventricle of the mammalian heart.	
1) Valve of thebesius 3) Tricuspid valve	2) Mitral valve 4) Eustachian valve
23. Structures that connect the papillary muscles of heart to the AV valves.	
1) Columnae carnae 3) Trabeculae carnae	2) Chordae tendineae 4) Purkunji fibres
24. The fibrous structures that extend throughout the ventricular musculature.	
1) Columnae carnae 3) Trabeculae carnae	2) Chordae tendineae 4) Purkunji fibres
25. In the ECG atrial systole is represented by	
1) 'P'- wave 2) 'Q'- wave	3) 'T'- wave 4) 'R'- wave
26. Which of the following is used in blood banks to prevent blood clotting.	
1) Sodium citrate 2) Sodium oxalate	3) EDTA 4) All the above
27. Non Chordates with closed type of blood vascular system.	
1) Annelids & Cephalopods 2) Cephalopods & Arthropods 3) Annelids & Cephalochordates	4) Cephalopods & Cephalochordates
28. Pericardial fluid is present between	
1) Serous layer & fibrous layer 3) Myocardium & Endocardium	2) Epicardium & Myocardium 4) Parietal layer & Visceral layer
29. The smallest vessels present in the walls of large blood vessels like aortic arches are called as	
1) Vas deferens 3) Vasa vasorum	2) Vasa efferentia 4) Vasa recta
30. Portal system present in man is	
1) Only hepatic portal system 3) Both hepatic & renal portal systems	2) Only renal portal system 4) both systems are absent
31. Lymph is an ECF that finally drained into	
1) Left subclavian vein 3) Both left and right subclavian veins	2) Right subclavian vein 4) Subclavian artery
32. Which of the following is not a part of lymphatic system	
1) Spleen 2) Thymus	3) Tonsils 4) Pancreas
33. Find out the odd one	
1) Heparin 2) Coumadin	3) Jantoven 4) Naphthoquinone
34. Set of structures of human heart which are functional in embryonic stage but non-functional in adult.	
1) Foramen ovale, Eustachian valve, Ductus arteriosus 2) Foramen valve, Mitral valve, purkinji fibres. 3) Thebesius valve, Eustachian valve, Mitral valve 4) Foramen ovale, Eustachian valve, Mitral valve	

35. The valves of heart that prevent the backward flow of blood from ventricles into atria.
 1) Semilunar valves 2) Tricuspid & Bicuspid valves
 3) Eustachian valve 4) Thebesius valve
36. Ventricular systole lasts for about
 1) 0.1 sec 2) 0.3 sec 3) 0.4 sec 4) 0.8 sec
37. The pulmonary arch arises from
 1) Right anterior angle of right ventricle 2) Right anterior angle of left ventricle
 3) Left anterior angle of right ventricle 4) Left anterior angle of left ventricle
38. In human beings the volume of blood is controlled by hormones such as
 1) Oxytocin & vasopressin 2) Prolactin & Oxytocin
 3) Prolactin & vasopressin 4) vasopressin & Aldosterone
39. Lymph is devoid of
 1) Erythrocytes 2) Leucocytes 3) Lymphocytes 4) Electrolytes
40. The device which is used to measure blood pressure in the branchial artery of the arm
 1) Spirometer 2) Sphygmomanometer 3) Barometer 4) Spectrophotometer

LEVEL – 2

41. Match the following and find the correct answer

I. Fibrinogen	a) Factor – V
II. Prothrombin	b) Factor – VII
III. Proaccelerin	c) Factor – I
IV. Proconvertin	d) Factor – VI
	e) Factor – II

	I	II	III	IV
1	c	e	d	b
2	c	e	a	b
3	c	e	b	A
4	c	e	b	d

42. Match the following and find the correct answer

I. Single circulation	a) Crocodile			
II. Incomplete double circulation	b) Rabbit			
III. Double circulation	c) Frog			
IV. Reptile with double circulation	d) Catla fish			
	I	II	III	IV
1	a	b	c	d
2	b	c	a	b
3	d	c	b	a
4	c	b	d	a

43. Match the following and find the correct answer

I. ventricular systole	a) LUB
II. Cardiac diastole	b) DUP
III. Atrial systole	c) SAN

IV. Aortic arches	d) AVN
V. Atrial septum	e) Ligamentum arteriosum

	I	II	III	IV	V
1	a	b	c	d	e
2	b	a	c	d	e
3	b	e	c	d	a
4	a	b	c	e	d

44. Match the following and find the correct answer

I. Bicuspid valve	a) B/w coronary sinus & Right Atrium
II. Tricuspid valve	b) B/w postcaval vein & Right Atrium
III. Thebesius valve	c) B/w Right Atrium & Right ventricle
IV. Eustachian valve	d) B/w Left Atrium & Left ventricle

	I	II	III	IV
1	d	c	a	b
2	d	c	b	a
3	c	d	b	a
4	c	d	a	b

45. Match the following and find the correct answer

I. SAN	a) Pacemaker
II. AVN	b) Relay point
III. Bundle of His	c) Interventricular septum
IV. Purkinji fibres	d) ventricular musculature

	I	II	III	IV
1	A	B	C	D
2	B	A	C	D
3	A	B	D	C
4	B	A	D	C

46. Match the following factors with their names

I. Factor – III	a) Thromboplastin
II. Factor – IV	b) Stuart prower factor
III. Factor – IX	c) Calcium ions
IV. Factor – X	d)Christmas factor.

	I	II	III	IV
1	A	C	D	B
2	A	C	B	D
3	A	B	C	D
4	A	B	D	C

47. Arrange the following clotting factors in ascending order regarding their number.

- a) Hageman’s factor b) Prothrombin c) Fibrinogen
d) Plasma thromboplastin antecedent e) Plasma thromboplastin component

58. Find the incorrect statements among the following.

I) Fibrin stabilizing factor converts the insoluble fibrin into soluble fibrin filaments.
 II) In open type of blood vascular system arteries and veins are interconnected by means of capillaries.
 III) Blood in arteries flow with more pressure and by jerks.

1) **All excepts I** 2) **All except II** 3) **All except III** 4) **All are correct**

59. Find out the correct statements.

I) AV node is present in the lower left corner of the right atrium II) Pulmonary arch arises from left anterior angle of the right ventricle.
 III) Pulmonary and aortic valves are made up of 3 semilunar flaps each.

1) **All excepts I** 2) **All except II**
 3) **All except III** 4) **All are correct**

60. Find the correct statements regarding pulmonary arch.

I) Arises from right anterior angle of the right ventricle.
 II) Arises from left anterior angle of the right ventricle.
 III) Supplies blood to various parts of the body.
 IV) Only artery that carries deoxygenated blood.

1) **I & II are correct** 2) **II, III & IV are correct**
 3) **I,III & IV are correct** 4) **II & IV are correct**

LEVEL - 3

61. Match the following

A. Erythrocytopenia	1. Fall in platelet count
B. Polycythemia	2. Fall in RBC count
C. Leukocytopenia	3. Fall in WBC count
D. Thrombocytopenia	4. Rise in RBC count

1) **A-3, B-4, C-2, D-1** 2) **A-2, B-4, C-3, D-1**
 3) **A-1, B-2, C-4, D-3** 4) **A-4, B-1, C-2, B-3**

62. If a spleen is removed from an adult person, what is the adverse affect of it?

1) RBC filtration will not occurs 2) Production of WBC decreases
 3) Production of RBC increases 4) Volume of hemoglobin is increases

63. Read the following and select the correct the combination

1) Lub sound - Closure semi lunar valves - Atrial systole
 2) Dup sound - Closure of tricuspid valve - Ventricular systole
 3) Lub sound - Closure of Tri, bicuspid valve - Ventricular systole
 4) Dup sound - Closure of semi lunar valves - Ventricular diastole

64. Match the following with regard to ECG

1. P-wave	A. Depolarization of inter ventricular septum
2. Q-wave	B. Rapid ventricular depolarization
3. T-wave	C. Ventricular repolarization
4. QRS complex	D. Atrial depolarization

1) **1-A, 2-C, 3-B, 4-D** 2) **1-D, 2-A, 3-C, 4-B**
 3) **1-B, 2-C, 3-D, 4-A** 4) **1-A, 2-B, 3-C, 4-D**

65. Match the following

A. Larger P-wave	i. Myocardial infraction
B. Flat T-wave	ii. Heart receives insufficient oxygen
C. Enlarged Q-wave	iii. Hyperkalemia
D. Enlarged R-wave	IV. Enlargement of atrium
	v. Enlargement of ventricles

- 1) A-iv, B-ii, C-i, D-v 2) A-i, B-iv, C-iii, D-ii
 3) A-v, B-i, C-ii, D-iii 4) A-iv, B-i, C-ii, D-iii

66. "Oedema" occurs due to

- 1) Fall in the levels of albumins 2) raise in levels of globulins
 3) plasmolysis 4) destruction of WBC

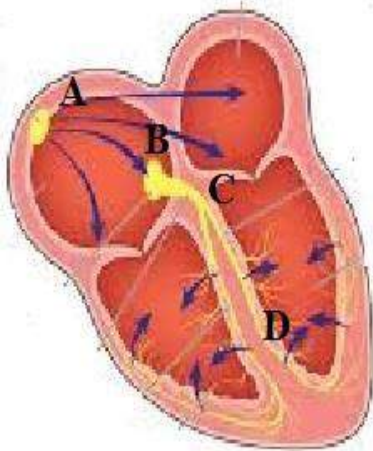
67. Concave shape of RBC of mammals help in

- 1) Increasing volume relative to surface area
 2) Increasing surface area relative to volume
 3) Increasing both surface area and volume equally
 4) To accommodate more RBC in less space

68. Select the correct statement from the following

- 1) The blood group without antigens on the surface of RBCs is considered universal donor.
 2) A person having blood group with all the types of antigens on the surface of RBCs is capable of receiving blood from any other person.
 3) Person with blood group 'O' can donate his blood to persons of any other blood types and can receive blood group of any other type.
 4) Person with blood group AB can donate blood to the person of same blood type as well as A and B.

69. Identify A, B, C & D in an order from the below diagram showing the conducting system of heart.



- 1) SAN, AVN, Bundle of His and Purkinje fibres.
 2) AVN, Bundle of His, Purkinje fibres and SAN.
 3) AVN, SAN, Purkinje fibres and Bundle of His.
 4) SAN, AVN, Purkinje fibres and Bundle of His.

70. Cardiac output is equal to

- 1) Stroke volume \times rate of heart beat
 2) Stroke volume/heart beat
 3) Reserve volume – stroke volume
 4) End diastolic volume – and systolic volume

71. Select the correct statement from the following.

- 1) Atria and ventricles contract simultaneously during heart beat
 2) Atria and ventricles relax simultaneously during heart beat
 3) SAN generates action potentials so that right atrium contracts first; it is followed by left atrium
 4) Ventricular systole causes the opening of semi lunar valves

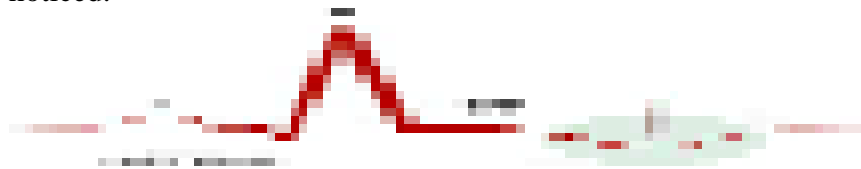
72. Select the correct statement with respect to the lymph

- 1) Lymph is an extra cellular fluid without formed elements
- 2) Lymph is a tissue fluid formed from the blood in the intestinal spaces
- 3) Lymph has large number of lymphocytes and plasma proteins of high molecular weight
- 4) Lymph is involved in the exchange of nutrients and gases only between blood cells and plasma

73. Select the correct statement from the following

- 1) If SA node fails; the AV node generates impulses in abnormal conditions
- 2) The nodal rhythm is insufficient to sustain life
- 3) AV node is capable of producing action potentials at the rate of 120 times per minute normally.
- 4) If there is any damage to the AV node, it can be rectified by SA node.

74. Study the following picture related to ECG and find out the abnormality that you have noticed.



- 1) Myocardial ischemia
- 2) Myocardial infraction
- 3) Rheumatic fever
- 4) Myocardial damage

75. Match the following

- | | |
|---------------------|-------------------|
| A. Sphygmomanometer | 1. Haematocrit |
| B. Wintrobe tube | 2. Cardiac output |
| C. Stethoscope | 3. Blood pressure |
| | 4. Heart beat |

- 1a) A-3, B-1, C-4 2) A-2, B-3, C-4 3) A-1, B-2, C-3 4) A-4, B-3, C-1

76. Pick out the odd one

- 1) Heparin 2) Hirudin 3) Warfarin 4) Erythropoietin

77. True statement from the following regarding PH of blood

- | | |
|--|------------------------------------|
| 1) Higher in veins and lower in arteries | 2) same in both arteries and veins |
| 3) Lower in veins and higher in arteries | 4) same in certain parts of body |

78. Serum differs from the lymph in the absence of

- | | |
|----------------------------|------------------------------------|
| 1) Erythrocytes | 2) Leucocytes and clotting factors |
| 3) Leucocytes and albumins | 4) Erythrocytes and globulins |

79. Reservoir of blood

- 1) Liver 2) Spleen 3) Red bone marrow 4) Lymph nodes

80. The chemical that causes deficiency of vitamin K that leads to prolonged bleeding in cattle is

- 1) dicumarol 2) benzene 3) mercury 4) cyanide

13. Assertion and Reasoning Questions

<p>1) Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'</p> <p>2) Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'</p> <p>3) A is true but 'R' is false</p> <p>4) \Both 'A' and 'R' are false</p>
<p>1. A : In pregnant women accumulation of fluids in legs leads to swollen legs called edema. R : In pregnant woman the enlarged uterus exerts pressure on the abdominal veins.</p>
<p>2. A : In clinical laboratories clotting of blood in test tubes is prevented by the addition of citrates or oxalates of sodium or EDTA . R: Citrates or oxalates of sodium or EDTA binds to calcium ions.</p>
<p>3. A : In fishes heart is described as bronchial heart. R: Fishes have 2 chambered heart with an atrium and a ventricle</p>
<p>4. A : Crocodiles are reptiles which show an incomplete double circulation. R: Crocodiles have 2 atria and an incompletely divided ventricle in the heart.</p>
<p>5. A : SA node is called as Pacemaker. R: SA node is present in the lower left corner of the right atrium.</p>
<p>6. A : AV node is considered as ' relay point ' R: AV node is present in the lower left corner of the right atrium close to the atrio - ventricular septum</p>
<p>7. A : 'LUB' sound is produced during ventricular diastole. R: Ventricular diastole causes the closing of tricuspid and bicuspid valves.</p>
<p>8. A : In normal condition the duration of a cardiac cycle is about 0.8 sec. R: A cardiac cycle includes an atrial systole, a ventricular systole and a cardiac diastole.</p>
<p>9. A : Blood vascular system is considered as ' third integrating system. R: Blood carries various hormones to the body parts from the organs of their secretion and help coordination of the body.</p>
<p>10. A : Arteries are more elastic than the veins R: Arteries are mostly deep seated in the body</p>
<p>11. A: Right ventricle of mammalian heart is thicker than that of left ventricle. R: Right ventricle of mammalian heart needs to pump blood to the extreme body parts with high force.</p>
<p>12. A: Heart of amphibians and reptiles pumps mixed blood to different parts of body. R: Heart of amphibians and reptiles show incomplete double circulation.</p>
<p>13. A: The first Rh+ve child born to the mother of Rh-ve blood group and father of Rh+ve blood group is safe (not affected by HDNB). R: Mother starts preparing antibodies against Rh antigen in her blood just at the time of parturition of the first baby</p>
<p>14. A: Heart of human beings is called myogenic. R: Normal activities of the heart are regulated intrinsically by nodal tissue made up of cardiac muscles.</p>
<p>15. A: The cardiac output of an athlete will be much higher than that of an ordinary man. R: The body has the ability to alter the stroke volume as well as cardiac output in order meet the oxygen requirement to the body.</p>

14. Assignment Questions to answer

VSAQ**	1	Sino-atrial node is called the pace maker of our heart. Why?
**	2	What is the significance of atrio-Ventricular node and Atrio-ventricular bundle in the functioning of the heart?
***	3	Name the valves that guard the left and right atrio-ventricular apertures in man.
***	4	Where is the valve of Thebassius in the heart of man?
**	5	Name the heart sounds? When are they produced?
***	6	Define cardiac cycle. And Cardiac output?
**	7	What is meant by double circulation? What is its significance?
**	8	Why the arteries are more elastic than the veins?
SAQ***	1	Draw a labelled diagram of the L.S, of human heart.
**	2	Describe the events in a Cardiac Cycle, briefly.
**	3	Explain the mechanism of Clotting of Blood.
**	4	Distinguish between Arteries and Veins.

15.Hands on Experiences for you – Try It!!!

1. Detecting Your Pulse

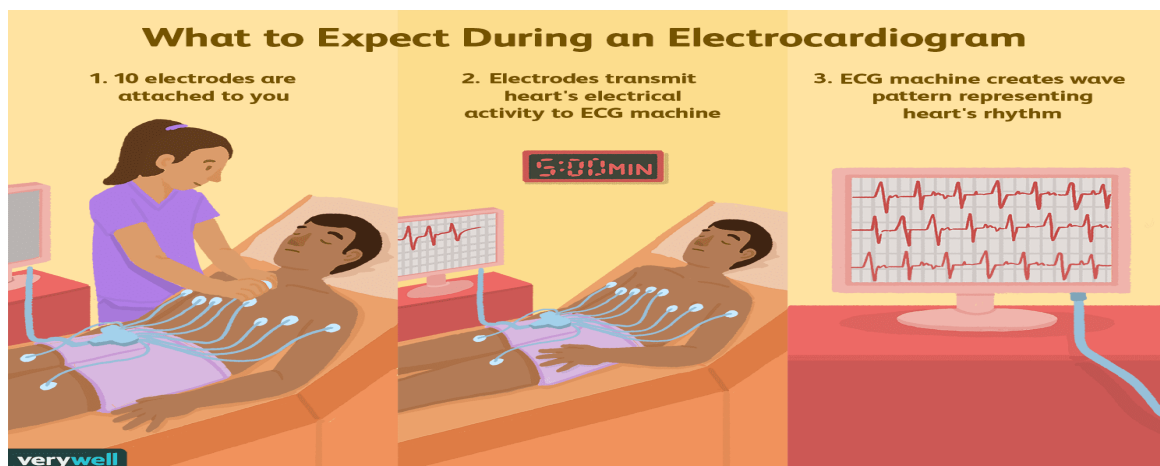
Objective:	To construct a simple apparatus to visually detect the pulse
Materials:	<input type="checkbox"/> toothpicks <input type="checkbox"/> modeling clay
Procedures:	<ul style="list-style-type: none"> • Provide each student with a toothpick and a piece of clay. • Stick the toothpick into a "dime sized" lump of clay. • Have students rest the "counter" on the inside of their wrist just below the base of the thumb. • Have students observe the toothpick as it moves. Let students work in pairs to time the counts in 15 seconds. • Use this information to determine how many beats per minute.
Assessment:	<ul style="list-style-type: none"> • Have students compare and contrast information compiled. • Using this graph, have each student write a journal entry of the information obtained. They should include at least three major points in their summary

2. Make Your Own Stethoscope

Objective:	to use a stethoscope to listen to the heart beat
Materials:	1 cardboard tube from a paper towel roll per every 2 students
Procedures:	<ol style="list-style-type: none"> 1. Have the students pair up and listen for their partner's heartbeat by placing the tube over the partner's heart. 2. Count the number of beats per 30 seconds. Add this number together twice to find out how many times each minute the person's heart beats. 3. Have one partner run in place for one minute, then listen again. Have the students write down what they hear and calculate the new beats per minute. 4. Have the partners switch.
Assessment:	5. Follow-up discussion) The heart beats faster after the exercise in order to pump more blood (oxygen) to the working muscles.

3. Understanding Electrocardiogram:

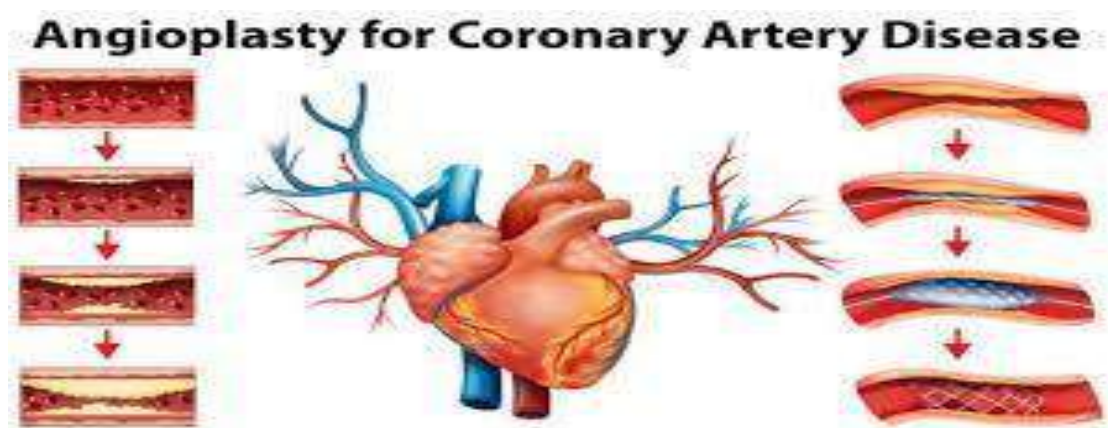
An electrocardiogram is a painless, noninvasive way to help diagnose many common heart problems in people of all ages. Your doctor may use an electrocardiogram to determine or detect: 1. Abnormal heart rhythm (arrhythmias); 2. If blocked or narrowed arteries in your heart (coronary artery disease) are causing chest pain or a heart attack; 3. Whether you have had a previous heart attack; 4. How well certain heart disease treatments, such as a pacemaker, are working. You may need an ECG if you have any of the following signs and symptoms: Chest pain, Dizziness, lightheadedness or confusion, Heart palpitations, Rapid pulse, Shortness of breath, Weakness, fatigue or a decline in ability to exercise.



4. Understanding Angioplasty:

The patient with “coronary artery disease” has narrowed or blocked arteries in heart by a sticky material called “**plaque**”. Angioplasty is a procedure to restore blood flow through the artery.

You have angioplasty in a hospital. The doctor threads a thin tube through a blood vessel in the arm or groin up to the involved site in the artery. The tube has a tiny balloon on the end. When the tube is in place, the doctor inflates the balloon to push the plaque outward against the wall of the artery. This widens the artery and restores blood flow. Doctors may use angioplasty to: 1. Reduce chest pain caused by reduced blood flow to the heart. 2. Minimize damage to heart muscle from a heart attack.



16. Medical and other careers related to Excretory System:

Cardiovascular Technician: A cardiovascular technician plays an important role in diagnosing and treating disorders of the cardiovascular system. Cardiologists rely on cardiovascular technicians to perform tests like echo cardiograms and electrocardiograms to determine specific issues related to diminished performance of the heart. Specialized training enables cardiovascular technicians to perform balloon angioplasties and cardiac catheterizations. An associate or bachelor's degree in cardiovascular technology is required for this job.

Cardiologist: A physician that diagnoses and treats ailments of the cardiovascular system is called a cardiologist. Cardiologists may use catheterizations to view plugged arteries or help patients through the rehabilitation process, following a heart surgery. After assessing a patient, it is common for a cardiologist to refer patients to a cardiovascular surgeon, when surgery is needed. Following medical school, a two to three year residency in cardiology is required to become a cardiologist.

Clinical Cardiac Perfusionist: A clinical cardiac perfusionist plays an important role during a cardiac surgery. During heart bypass or arterial grafting surgery, a clinical cardiac perfusionist uses a special technique to stop the heart so that the surgeon can make the repair. A cardiac perfusionist uses the same technique to help victims of hypothermia and drowning. This health care professional also works in intensive care and the catheterization laboratory, monitoring patients and assisting, as needed. Becoming a clinical cardiac perfusionist requires an undergraduate degree and two years of clinical experience. Additional requirements include passing scores on the Clinical Applications in Perfusion Examination and the Perfusion Basic Science Examination.

Cardiovascular Surgeon: A cardiovascular surgeon performs life-saving operations on patients experiencing issues with their heart. After a patient has been assessed by a cardiologist, patients needing heart surgery are referred to a cardiovascular surgeon. Common surgical interventions include heart defect repair, aneurysm repair, heart valve replacement, heart transplantation and coronary artery bypass surgery. Extensive education and experience is required for this profession. After graduating from high school, 15 years of schooling and experience is necessary to be ready for this career.

Vascular surgeons: They manage veins and arteries in every part of the body except the brain and the heart. For example, vascular surgeons handle blocked carotid arteries in the neck. They treat the problems of the aorta (a large main artery) after it leaves the heart and enters the abdomen, etc.

Allied Careers: There are several types of cardiovascular technicians and technologists who work in the field of cardiology. Some are diagnostic and become experts in running the EKG machine. Other technologists are involved with nuclear cardiology, working the equipment which helps to take computerized images of the heart. Additionally, some technicians work in the cath lab and assist cardiologists with more invasive procedures.

17. Answers to the activities and note making

10. True Or False

SI No	T / F	Correct Answers
1	True	
2	False	Monitored by pressure sensors in the aorta
3	True	
4	False	Only 15% of ECF is collected into lymphatic system
5	False	Erythrocytes are absent but lymphocytes are present
6	True	
7	True	
8	False	3 chambered with 2 atria and a ventricle
9	False	Outer fibrous pericardium and inner serous pericardium
10	False	Externally separated by coronary sulcus & internally separated by atrio ventricular septum
11	True	
12	False	Tricuspid & Bicuspid valves respectively
13	False	Sino – Atrial node (SAN) acts as pacemaker
14	True	
15	True	
16	False	LUB sound is produced by the closing of AV valves
17	True	
18	False	Lumen of arteries is narrow & veins is wide
19	True	
20	False	Measured by using sphygmomanometer

11. Fill in the Blanks

SI No	Answer	SI No	Answer
1	Albumins	11	Crocodiles
2	Lymph	12	Mesoderm
3	Spleen	13	Thin layer of endothelium
4	15%	14	Auricular appendix
5	Lacteals	15	Valve of Thebesius
6	Factor XII (Hageman's factor)	16	Chordae tendineae / heart strings
7	Dengue	17	Atrio ventricular node (AVN)
8	Coumarins	18	Stroke volume
9	Warfarin	19	Portal system
10	Vitamin-k	20	Angina pectoris

12. Answers to Multiple Choice Questions:

Sl No	Answer	The student should be explore unknown option and make notes
Level – 1		
1	4	
2	4	
3	2	
4	2	
5	2	
6	4	
7	3	
8	2	
9	2	
10	1	
11	2	
12	3	
13	1	
14	3	
15	4	
16	1	
17	4	
18	3	
19	1	
20	4	
21	1	
22	3	
23	2	
24	4	
25	1	
26	4	
27	1	
28	4	
29	3	

30	1	
31	3	
32	4	
33	4	
34	1	
35	2	
36	2	
37	3	
38	4	
39	1	
40	2	
Level – 2		
41	2	
42	3	
43	4	
44	1	
45	1	
46	2	
47	2	
48	3	
49	1	
50	2	
51	4	
52	3	
53	2	
54	3	
55	1	
56	2	
57	4	
58	3	
59	4	
60	4	
Level – 3		

61	2	
62	1	
63	3	
64	2	
65	1	
66	1	
67	2	
68	1	
69	1	
70	1	
71	2	
72	2	
73	1	
74	1	
75	1	
76	4	
77	1	
78	2	
79	2	
80	1	

Answers to Assertion & Reason:

SI No	Answer	SI No	Answer	SI No	Answer
1	1	6	2	11	1
2	1	7	4	12	1
3	2	8	2	13	1
4	4	9	1	14	1
5	3	10	2	15	1

UNIT – II

HUMAN ANATOMY AND PHYSIOLOGY - II



UNIT – II B

EXCRETORY PRODUCTS AND THEIR ELIMINATION

MAJOR LEARNING OBJECTIVE

- Students will be able to identify, understand and apply the knowledge of the 'Human excretory system' and 'Physiology of urine formation'.
- Students will be able to know how the excretory system helps in 'Good Riddance' and 'Homeostasis'.

LEARNING OUTCOMES:

- Be able to know the different kinds of excretory products in different animals.
- Be able to know the structure and function of the filtering organ – kidney.
- Be able to know different excretory organs in different organisms.
- Be able to know the different excretory organs in human being.
- Be able to know how the urine is formed in kidneys.
- Be able to know the role of different hormones that help in the regulation of kidney function.
- Be able to know the role of other organs in excretion.

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book
2. Defining key words
3. Name the Organisms against their excretory organs.
4. Name the Type of epithelium or cells in different parts of excretory system
5. Give examples for "Threshold substances"
6. Identifying the parts of the Human Urinary System and L.S. of Kidney
7. Draw and Label the diagram of nephron in detail
8. Comprehension, Labelling and Note Making: Reabsorption and Tubular Secretion
9. Comprehension, Labelling and Note Making: Counter Current Mechanism
10. Comprehend Map of Regulation of Kidney Function: (read text pages 68-69)
11. Note making on "Role of other organs of excretion"
12. Note making on "Functioning of Artificial Kidney: the Dialyser"
13. Answer True or False
14. Completion of each sentence or statement/filling the blanks
15. Multiple Choice Questions for Competitive exams
16. Assignment Questions to answer
17. Hands on Experiences for you – Try It!!!
18. Medical and other careers related to Excretory System
19. Answers to the activities and note making

INSTRUCTIONS TO LECTURER

- Ask the students to take aid of the textbook
- Ask the students to work with a partner
- Explain each part of the worksheet & Come up with some examples to help
- Clarify doubts of the students before starting the work book

INSTRUCTIONS TO STUDENTS

- First read the text book thoroughly and logically.
- Always try to attempt this workbook with a friend cooperatively
- While attempting the activities analyze them.
- While attempting the multiple choice questions, make notes on the other options too

ACTIVITIES:-

1. Locate and rewrite the difficult key words from the text book

1		14		27	
2		15		28	
3		16		29	
4		17		30	
5		18		31	
6		19		32	
7		20		33	
8		21		34	
9		22		35	
10		23		36	
11		24		37	
12		25		38	
13		26		39	

2. Defining key words (search through the text book & write)

1	Ammonotelism	
2	Ureotelism	
3	Uricotelism	
4	Osmoregulation	
5	Retroperitoneal organ	
6	Renal pyramids	
7	Renal papillae	
8	Columns of Bertini	
9	Glomerulus	
10	Malpighian body	
11	Henle's loop	
12	Cortical nephrons	
13	Juxta medullary nephrons	
14	Vasa recta	
15	Ultra filtration	
16	Glomerular filtration Rate (GFR)	
17	Mandatory reabsorption	
18	Counter current	
19	Juxta glomerular cells	
20	Macula densa	

3. Name the organisms against their excretory organs:

Sl No	Excretory Organ	Organism
1	Protonephridia	
2	Flame cells	
3	Renette cells	
4	Solenocytes	
5	Metanephridia	
6	Malpighian tubules	
7	Green glands	
8	Coxal glands	
9	Pericardial glands	

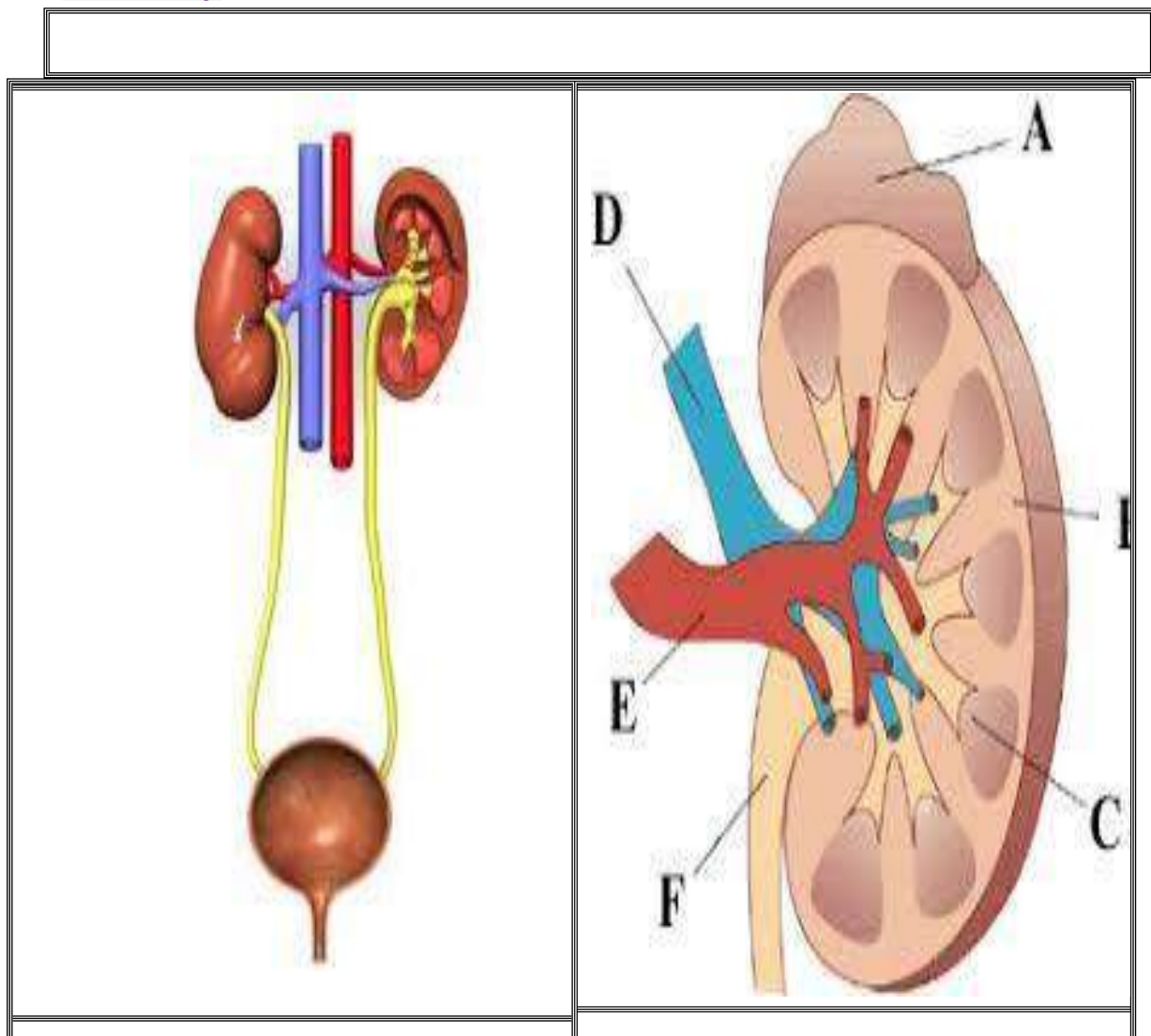
4. Name the type of epithelium or cells in different parts of excretory system

Sl no	Part of Excretory system	Epithelium
1	Bowman's capsule	
2	PCT	
3	DCT	
4	Descending limb of loop of Henle	
5	Thin segment of Ascending limb of loop of Henle	
6	Thick segment of Ascending limb of loop of Henle	
7	Collecting duct	
8	Urinary bladder	
9	Ureters	
10	Urethra	

5. Give examples for “Threshold substances”

1	High threshold substances	
2	Low threshold substances	
3	A threshold substances	

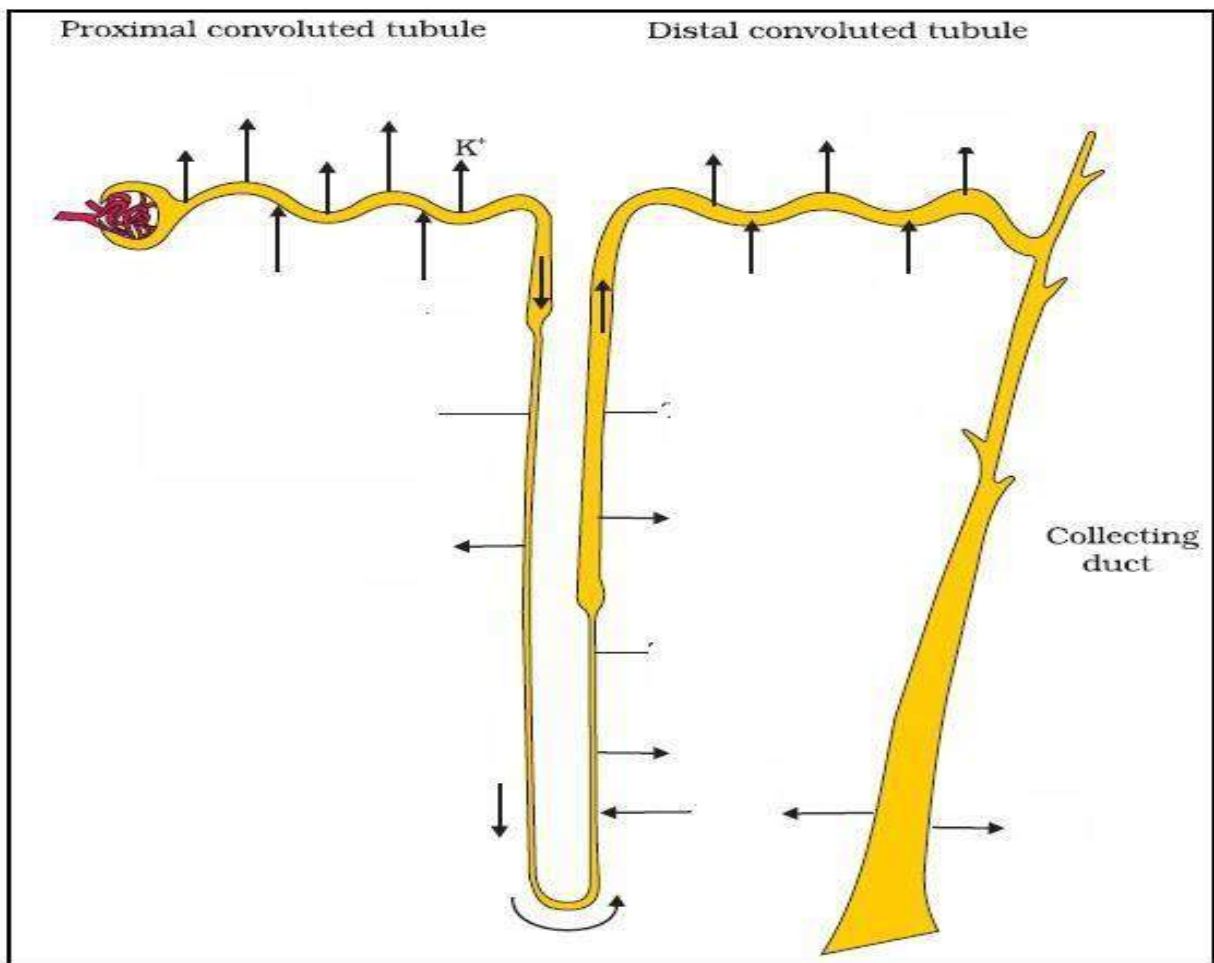
6. Identifying the parts of the Human Urinary System and L.S. of kidney



7. Draw and Label the diagram of Nephron in detail:

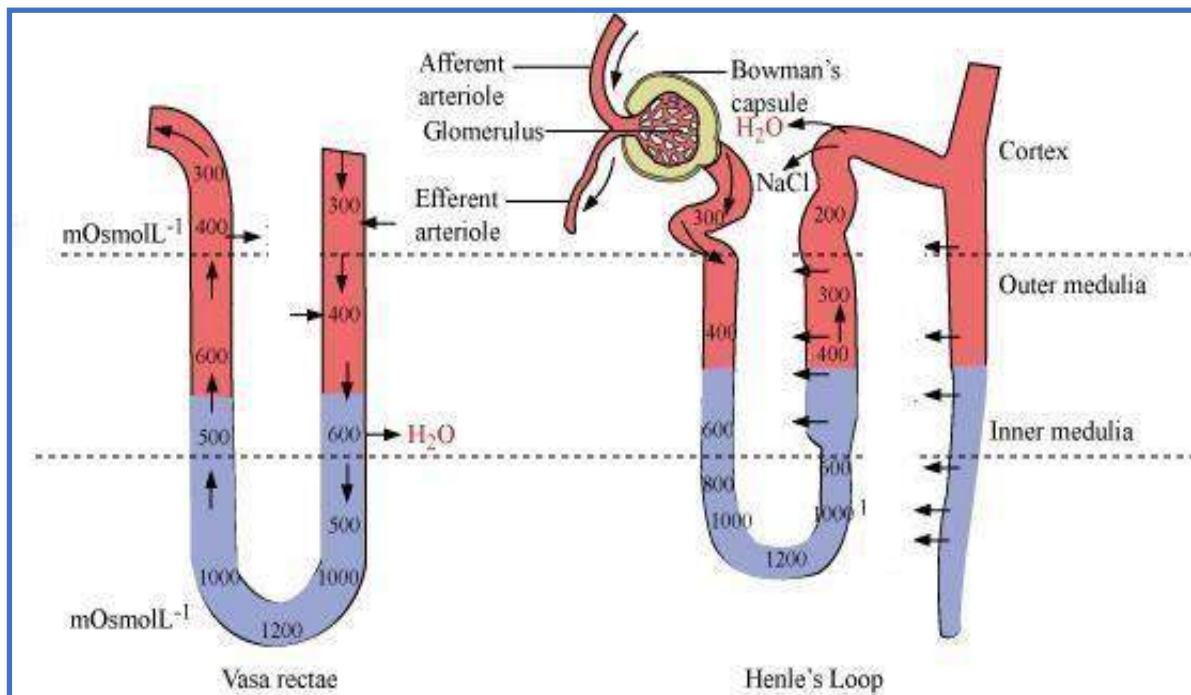


8. Comprehend, Label, and Mention sequences: Reabsorption and Tubular Secretion (pages 64-66)



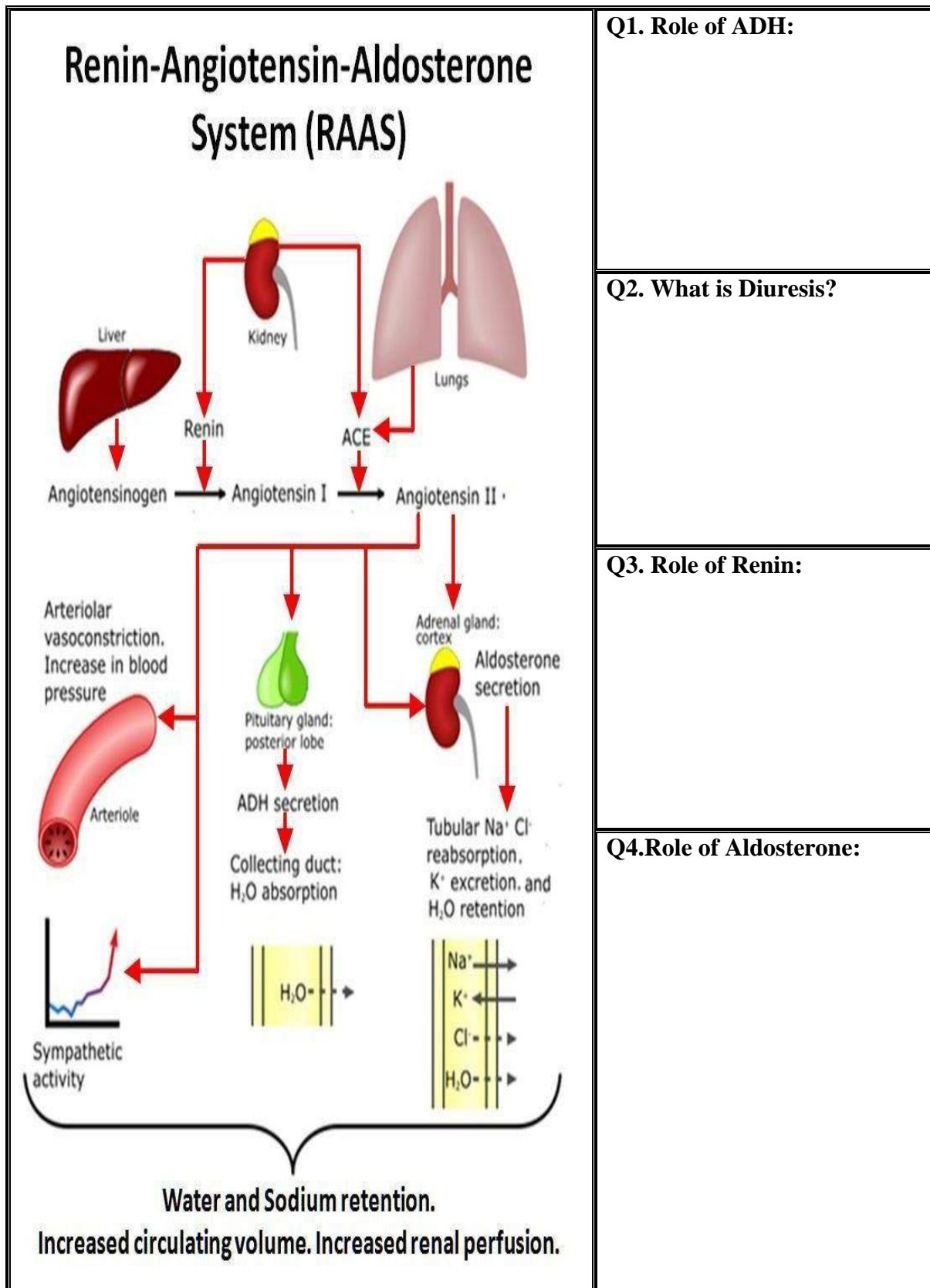
Sequences of events:

9. Comprehension, Labeling and Note Making: Counter Current Mechanism



Notes:

10. Comprehend Map of Regulation of Kidney Function: (read text pages 68-69)



11. Note making on “Role of other organs of excretion”:

Lungs	
Liver	
Skin	

12. Note making on “Functioning of Artificial Kidney: the Dialyser”

1. Hemodialysis:	
2. Role of tubes of cellophane:	
3. Role of Heparin:	
4. Dialysis	
5. Dialysate:	

13. Answer True or False

Sl No	Statement	True / False
1	Dehydration kills a man much faster than lack of food	
2	Aquatic animals excrete allantoin through body surface / gill surface	
3	Ureotelic animals excrete urea which is synthesized in kidney	
4	End product of nitrogen metabolism in insects, reptiles and birds is the uric acid.	
5	All mammals including man uricase enzyme is produced which can convert the uric acid into allantoin.	
6	Cartilaginous fishes exhibit physiological uremia.	
7	In bony fishes most of the ammonia is excreted as ammonium ions through kidneys & minor amounts is eliminated through gills.	
8	Protein metabolism and nucleic acid metabolism are the internal sources of nitrogenous waste in animals.	
9	Protonephridia are primarily concerned with Osmoregulation.	
10	Antennary glands of crustaceans collect nitrogenous waste from the haemolymph.	
11	At hilum region the renal artery & ureter enter the kidney and renal vein leave the kidney.	
12	Ureters, Urinary bladder and Urethra are lined by pseudo stratified epithelium.	
13	Glomerular capillaries are unusual because they have arterioles on both the sides.	
14	In Juxta medullary nephrons the vasa recta is absent or highly reduced.	
15	Glomerular filtration is a passive process.	
16	Urine present at the end of collecting duct is hypotonic to the plasma of blood.	
17	NaCl passes out of the ascending limb of Henle's Loop enters into the blood of the ascending limb of vasa recta.	
18	The two limbs of the loop of Henle constitute a counter current multiplier system.	
19	Atrial natriuretic peptide released from the left atrium of heart acts as vasodilator.	
20	The secretion of sweat glands provide protective oily covering to the skin.	

14. Completion of each sentence or statement/filling the blanks

1.	Enzyme that converts the uric acid into allantoin is _____
2.	Blood vessel that carries high quantity of urea is _____.
3.	The first form of nitrogenous waste formed due to oxidative deamination of proteins is
4.	In ureotelic animals ammonia is converted into urea in_____.
5.	Ornithine cycle occurs in_____.
6.	A nonchordate animal having green glands as excretory structures is ----- --.
7.	Solenocytes are excretory structures in
8.	Structures of annelids that help both in excretion and osmoregulation are
9.	Excretory structures in arachnids are
10.	The average weight of kidney in man is
11.	The inner delicate part of kidney is covered and protected by
12.	A deep notch present on inner surface of each kidney is
13.	_____are the cup like structures formed by the pelvis of kidney.
14.	Whitish tube which emerges from the pelvis of the kidney is lined by .......epithelium.
15.	In female urethra opens near the
16.	Capillary network paralleling the loop of Henle is
17.	Total number of structural and functional units of kidney in man is
18.	Unique cells in the inner visceral wall of Bowman's capsule are called as
19.	The hormone that regulates the reabsorption of water in DCT & CD
20.	On an average..... ml of blood is filtered by the kidney per minute.
21.	_____And_____are the parts of nephron which play a significant role in the formation of concentrated Urine.
22.	The mechanism that helps to maintain a concentration gradient in the medullary interstitium is called as_____.
23.	_____Mechanism acts as counter check on the RAAS
24.	Neuronal mechanism involved in the passing out urine is called as
25.	Blood vessel with high concentration of renin enzyme is
26.	P ^H valve of urine is
27.	Renal failure is typically detected by an elevated level in the blood.
28.	Excretion of excessive sodium ions (Na ⁺) in urine is called as
29.	Presence of glucose and ketone bodies in urine are indicative of
30.	Inflammation of glomeruli of kidneys is called as

15. Multiple Choice Questions for Competitive exams

1.	Ammonia is converted into less toxic urea in the liver along with CO ₂ Via. 1) Krebs cycle 2) Glycolysis 3) Ornithine cycle 4) Cori cycle
2.	In mammals uric acid is produced by 1. Carbohydrate metabolism 2) Lipid metabolism 3.. Protein metabolism 4) Purine metabolism
3.	Which of the following is the retroperitoneal organ 1. Liver 2) Lungs 3) Heart 4) Kidney
4.	Kidneys are situated between 1. Last thoracic & 3 rd lumbar vertebrae 2) Last lumbar and 1 st sacral vertebrae 3) First thoracic & Last lumbar vertebrae 4) Last cervical & 3 rd thoracic vertebrae
5.	Medulla of kidney is divided into multiple cone shaped masses of tissues called 1. Renal papillae 2) Renal pyramids 3) Renal calyces 4) Renal columns.
6.	In kidney of man cortical projections between renal pyramids are called as 1. Renal papillae 2) Renal pelvis 3) Renal calyces 4) Renal columns
7.	Renal pyramids originates at the border between a. Calyces & pelvis 2) Cortex & Medulla 3) Cortex & Pelvis 4) Calyces & Medulla
8.	In the kidney of man blood from the glomerulus is carried away by 1. Afferent arteriole of renal artery 2) Efferent arteriole of renal artery 3) Afferent arteriole of hepatic artery 4) Efferent arteriole of hepatic artery
9.	Characteristic feature of inner wall of Bowman's capsule is the presence of 1. Podocytes 2) Filtration slits 3) Fenestrae 4) 1 & 2
10.	The filtration membrane in kidney that helps in ultrafiltration is formed by 1. Endothelium of capillaries 2) Basement membrane 3) Podocytes of Bowman's capsule 4) All the above
11	Duct that opens on the tip of the renal papillae 1. Initial collecting duct 2) Straight collecting duct 3) Duct of Bellini 4) Column of Bertin
12	The first step in the formation of urine formation is 1. Ultrafiltration 2) Selective reabsorption 3) Augmentation 4) Tubular secretion
13	The amount of filtrate formed by both the kidneys in healthy individual per day is approximately 1) 125 ml 2) 1 to 1.5 L 3) 180 L 4) 1100 to 1200 ml
14	Substances which are efficiently reabsorbed from glomerular filtrate are called as 1. High threshold substances 2. A threshold substances 3. Low threshold substance 4. None of the above
15	Which of the following is never reabsorbed in any part of nephron 1. Glucose 2) Creatine 3) Urea 4) Vitamins
16	Parts of the nephron where selective secretion of H ⁺ ions takes place 1) PCT 2) DCT 3) CD 4) All the above

17	Conditional reabsorption & obligatory reabsorption occur respectively in 1. PCT & Descending limb of loop of Henle 2. DCT & Descending limb of loop of Henle 3. DCT & PCT 4. PCT & DCT
18	The process of passing out urine is called as a. Parturition 2) Micturition 3) Ultra filtration 4) Augmentation
19	Which of the following ions are not at all reabsorbed in PCT 1. Na ⁺ 2) Hco ₃ ⁻ 3) Cl ⁻ 4) H ⁺
20	Low threshold substance among the following 1. Glucose 2) Urea 3) Creatinine 4) Amino acids
21	Part of the nephron which plays a significant role in the maintenance of high osmolarity of the medullar interstitial fluid 1. Bowman's capsule 2) PCT 3) Loop of Henle 4) DCT
22	Pick up the high threshold substance among the following 1. Amino acid 2) Uric acid 3) Urea 4) Creatinine
23	Maintaining the quantity of water and dissolved solutes in balance in the body is called as 1. Osmosis 2) Diffusion 3) Osmoregulation 4) Augmentation
24	The functioning of the kidneys is efficiently monitored and regulated by hormonal feedback control mechanism involving 1. Hypothalamus 2) Juxta glomerular apparatus 3) Heart 4) All the above
25	Diabetes insipidus is caused due to the deficiency of hormones 1. Vasopressin 2) Oxytocin 3) Thyroxin 4) Aldosterone
26	Excessive thirst and excretion of large quantities of dilute urine are the characteristic features of following disorder 1) Diabetes insipidus 2) Exophthalmic goiter 3) Myxedema 4) Glycosuria
27	The hormones that help in the regulation of the amount of water and salts in urine are 1) Vasopressin 2) Aldosterone 3) Angiotensin – II 4) All the above
28	The modified smooth muscle cells of the afferent arteriole near the macula densa are called as 1) Osmoreceptors 2) JG cells 3) Oxyntic cells 4) Parietal cells
29	Enzyme that catalysis the conversion of angiotensinogen into angiotensin – I 1) Angiotensin converting Enzyme 2) Renin 3) Rennin 4) Pepsin
30	The enzyme that converts the angiotensinogen into angiotensin-I is released from 1) JG cells 2) Macula densa 3) Liver 4) Lungs
31	Angiotensinogen is a protein produced by 1) JG cells 2) Kidney 3) Liver 4) Lungs
32	An average amount of urea excreted by a man per day is 1) 10-15 gms 2) 20-25 gms 3) 25-30 gms 4) 35-50 gms
33	Presence of glucose in the urine is called as 1) Uremia 2) Glycosuria 3) Ketosuria 4) Natriuresis
34	Sweat of human contains

	1) NaCl 2) Urea 3) Lactic acid 4) All the above																																				
35	The organ which helps in the elimination of drugs from the body 1) Liver 2) Lung 3) Kidney 4) Skin																																				
36	The structures which help in the elimination of hydrocarbons and carbon dioxide from the body respectively 1) Lungs & Liver 2) Liver & Lungs 3) Sebaceous glands & Lungs 4) Sweat glands & Lungs																																				
37	The process in which the blood of kidney damaged person is filtered is called as 1) Hemodialysis 2) Glycogenolysis 3) Haemolysis 4) Glycolysis																																				
38	Which of the following is used in the dialyser 1) Cellophane membrane 2) Heparin 3) Antiheparin 4) All the above																																				
39	Cellophane membrane is impermeable to 1) Urea 2) Uric acid 3) Plasma proteins 4) Creatinine																																				
40	A Chordate animal having protonephridial type excretory structures 1. Ascidians 2) Lancelets 3) Earthworm 4) Frogs																																				
MATCH THE FOLLOWING AND FIND THE CORRECT ANSWER																																					
41	I. Ammonia a) Birds II. Uric acid b) Cartilaginous fishes III. Urea c) Teleost fishes IV. TMAO d) Molluscs. I II III IV 1) c a d b 2) b a c d 3) c a b d 4) b a d c																																				
42	I. Malpighian tubules a) Annelids II. Antennary glands b) Arachnids III. Coxal glands c) Molluscans IV. Pericardial glands d) Insects. e) Crustaceans I II III IV 1) d e b c 2) d e c b 3) d c b a 4) d e b a																																				
43	I. Bean shaped structure a) Renal pyramid II. Funnel shaped structure b) Loop of Henle III. Cone shaped structure c) Kidney IV. Cup shaped structure d) Calyces V. Hair pin shaped structure e) Pelvis <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th>I</th> <th>II</th> <th>III</th> <th>IV</th> <th>V</th> <th></th> <th>I</th> <th>II</th> <th>III</th> <th>IV</th> <th>V</th> </tr> </thead> <tbody> <tr> <td>1)</td> <td>c</td> <td>d</td> <td>a</td> <td>e</td> <td>b</td> <td>2)</td> <td>c</td> <td>e</td> <td>a</td> <td>d</td> <td>b</td> </tr> <tr> <td>3)</td> <td>c</td> <td>e</td> <td>d</td> <td>a</td> <td>b</td> <td>4)</td> <td>c</td> <td>d</td> <td>e</td> <td>a</td> <td>b</td> </tr> </tbody> </table>		I	II	III	IV	V		I	II	III	IV	V	1)	c	d	a	e	b	2)	c	e	a	d	b	3)	c	e	d	a	b	4)	c	d	e	a	b
	I	II	III	IV	V		I	II	III	IV	V																										
1)	c	d	a	e	b	2)	c	e	a	d	b																										
3)	c	e	d	a	b	4)	c	d	e	a	b																										
44	I. Podocytes a) PCT II. Fenestrations b) DCT III. Cuboidal epithelium with brush border c) Bowman's capsule IV. Cuboidal epithelium without brush border d) Glomerulus.																																				

51	<p>Arrange the following events of RAAS in correct sequence</p> <p>a) Fall in glomerular blood pressure b) Conversion of Angiotensinogen into Angiotensin – I c) Conversion of Angiotensin – I into Angiotensin – II d) Release of Renin from JG cells. e) Secretion of Aldosterone f) Reabsorption of Na⁺ and from water DCT & CD</p> <p>1) a-b-c-d-e-f 2) d-a-b-c-e-f 3) a-d-b-c-e-f 4) d-e-f-a-b-c</p>
52	<p>Arrange the following parts in correct sequence regarding passage of urine</p> <p>a) Ureter b) Calyces c) Urethra d) Pelvis e) Urinary bladder f) Duct of Bellini.</p> <p>1) b-d-a-c-e-f 2) f-b-d-a-e-c 3) b-a-d-c-e-f 4) f-b-d-e-a-c</p>
53	<p>Arrange the following parts of kidney from outer to inner</p> <p>a) Pelvis b) Renal pyramid c) Renal capsule d) Cortex</p> <p>1) c-d-a-b 2) c-d-b-a 3) a-b-c-d 4) a-b-d-c</p>
54	<p>Correct statements regarding the liver of vertebrates.</p> <p>I. helps in the deamination of amino acids II. Urea is produced in the liver by an ornithine cycle III. It changes the decomposed hemoglobin of worn out RBCs into bile pigments</p> <p>1) I & II 2) II & III 3) I & III 4) I,II & III</p>
55	<p>Study the following statements and find the correct answer.</p> <p>I. Ammonia is highly toxic & insoluble in water II. Urea is less toxic than uric acid III. Urea is the least toxic substance & is more soluble in water</p> <p>1) All are correct 2) I & II are correct 3) All are incorrect 4) only II is correct</p>
56	<p>Find out the correct statements regarding human kidney.</p> <p>I. The left kidney is slightly lower than the right kidney II. The right kidney is slightly lower than the left kidney III. Outer surface of the kidney is convex & the inner surface has a deep notch IV. Inner surface of the kidney is convex & the Outer surface has a deep notch</p> <p>1) I & II 2) II & III 3) I,II & III 4) II & IV</p>
57	<p>Incorrect statements regarding urethra of human being.</p> <p>I. It has an internal urethral sphincter made of striated muscles and external urethral sphincter made of smooth muscles. II. It has an internal urethral sphincter made of smooth muscles and external urethral sphincter made of striated muscles. III. It has an internal and an external sphincters made of smooth muscles IV. It has an internal and an external sphincters made of striated muscles</p> <p>1) All except -I 2) All except -II 3) All except -III 4) All except -IV</p>
58	<p>The blood vessel that carries less amount of urea.</p> <p>1) Hepatic vein 2) Renal vein 3) Renal artery 4) Hepatic artery</p>
59	<p>Correct statements among the following</p> <p>I. Malpighian corpuscle, PCT and DCT of a nephron are located in the cortical region of kidney. II. Descending limb of loop of Henle is made up of simple squamous epithelium III. An adult human excretes on an average 1-1.5 liters of urine per day</p> <p>1) I,II & III 2) I & II 3) II & III 4) I & III</p>

60	<p>Find the incorrect statements</p> <p>I. Majority of nephrons are cortical nephrons with very long loop of Henle II. Few nephrons are juxtamedullary nephrons with well-developed vasa recta III. Majority of nephrons are juxtamedullary nephrons with too short loop of Henle IV. Few nephrons are cortical nephrons with well-developed vasa recta</p> <p>1) All except –I 2) All except –II 3) All except –III 4) All except –IV</p>
61	<p>Correct statements among the following</p> <p>I. Afferent renal arteriole forms the 1st set of capillaries called glomerulus II. Efferent renal arteriole forms the 2nd set of capillaries called peritubular capillaries III. peritubular capillaries that surround the loop of Henle is called vasa recta</p> <p>1) I,II & III 2) I & II 3) II & III 4) I & III</p>
62	<p>Study the following statements and find the correct answer</p> <p>I. Primary urine filtered into the lumen of Bowman’s capsule is hypertonic to the cortical fluid II. 70-80% of electrolytes and water are reabsorbed in the PCT III. Urine in the collecting duct is hypertonic to the plasma of blood</p> <p>1) All except –I 2) All except –II 3) All except –III 4) All are correct</p>
63	<p>Correct statements regarding selective reabsorption in PCT</p> <p>I. Na⁺ are actively transported into cortical fluid II. Glucose and amino acids are passively transported III. Water is transported by simple diffusion</p> <p>1) Only I is correct 2) Only II is correct 2) 3) Only III is correct 4) I & III are correct</p>
64	<p>Incorrect statements regarding descending limb of loop of Henle</p> <p>I. It is permeable to electrolytes and impermeable to water II. It is permeable to both electrolytes and water III. It is impermeable to both electrolytes and water IV. It is permeable to water and almost impermeable to electrolytes</p> <p>1) All except –I 2) All except –II 3) All except –III 4) All except –IV</p>
65	<p>Find out the correct answer</p> <p>I. The flow of renal filtrate in two limbs of loop of Henle is in opposite direction II. The flow of blood in the 2 limbs of vasa recta is in opposite direction III. The flow of renal filtrate in descending limb of loop of Henle is opposite to the flow of blood in the ascending limb of vasa recta</p> <p>1) All are incorrect 2) All are correct 3) Only I & II are correct 4) Only III is corr</p>
66	<p>Incorrect statements among the following</p> <p>I. A group of modified epithelial cells of DCT constitute macula densa II. Modified smooth muscle cells of the efferent renal arteriole are called as JG cells III. JG cells secrete an enzyme called Rennin</p> <p>1) I only 2) II only 3) III only 4) All</p>
67	<p>Correct statements regarding elimination of waste from the body</p> <p>I. Waxes are eliminated through sebum II. Small amount of urea is eliminated through sweat</p>

	<p>III. Small amount of nitrogenous wastes are eliminated through saliva 1) I only 2) II only 3) III only 4) All</p>
68	<p>Correct statements regarding disorders of excretory system I. Presence of excessive amounts of urea in the urine is known as glycosuria II. Concentration of uric acid and oxalate crystals in urine cause Renal calculi III. Inflammation of small blood vessels of the kidney is known as glomerulonephritis 1) All except –I 2) All except –II 3) All except –III 4) All are correct</p>
ASSERTION AND REASON QUESTIONS	
<p>1) Both ‘A’ and ‘R’ are true and ‘R’ is the correct explanation of ‘A’ 2) Both ‘A’ and ‘R’ are true and ‘R’ is not the correct explanation of ‘A’ 3) A is true but ‘R’ is false 4) Both ‘A’ and ‘R’ are false</p>	
69	<p>A : Apes & Man cannot produce allantoin R : Uricase enzyme is absent in Apes & Man</p>
70	<p>A : Kidneys are involved in the homeostasis of the body R : Kidneys are retroperitoneal organs</p>
71	<p>A : Ureotelic animals require much less water R : Urea is less toxic than uric acid</p>
72	<p>A : Excretion of ammonia is most common in aquatic animals R : Ammonia is formed by the oxidative deamination of aminoacids in liver</p>
73	<p>A : Sauropsidans excrete uric acid R : Uric acid is less toxic than urea</p>
74	<p>A : Malpighian tubules have a role in conserving water & salts R : Malpighian tubules open into alimentary canal and send wastes into gut</p>
75	<p>A : In man the right kidney is slightly lower than the left kidney R : In man stomach is present on the right side of abdominal cavity below the diaphragm</p>
76	<p>A : Teleost fishes excrete urea R : Urea is the least toxic nitrogenous waste</p>
77	<p>A : Infection of the urinary tract is more common in women than in men R : In female urethra is short & more close to the anal aperture</p>
78	<p>A : Maximum reabsorption of materials takes place in PCT R : PCT is lined by simple squamous epithelium</p>
79	<p>A : The water reabsorption in DCT is described as facultative reabsorption. R : Reabsorption of water in DCT is regulated by ADH</p>
80	<p>Which of the following factors is responsible for the formation of concentrated urine?(NEET-2019) 1) Low level of antidiuretic hormone 2) Maintaining hyper osmolarity towards inner medullary interstitium in the kidneys 3) Secretion of erythropoietin by JG complex 4) Hydrostatic pressure during glomerular filtration</p>

81	<p>Use of an artificial kidney during hemodialysis may result in (NEET-2019)</p> <p>i. Nitrogenous waste build up in the body ii. Non elimination of excess potassium ions iii. Reduced absorption of Ca^{++} ions from gastrointestinal tract iv. Reduced RBC production</p> <p>Which of the following options is the most appropriate?</p> <p>1) I & II are correct 2) II & III are correct 3) III & IV are correct 4) I & IV are correct</p>
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16. Assignment Questions:

VSAQ*	1	What are Renal Pyramids and renal papillae?
***	2	What are the Columns of Bethin? (Note: likely typo for Bowman's capsule)
*	3	Distinguish between Cortical and Juxta medullary nephrons.
**	4	Define Glomerular Filtration.
***	5	Define Glomerular Filtration rate (GFR).
***	6	Distinguish between Juxta glomerular cells and the Macula densa.
***	7	What is Juxta Glomerular Apparatus?
**	8	Distinguish between the enzymes Renin and Rennin.
***	9	What is meant by the term Osmo-regulation?
SAQ***	1	Draw a labelled diagram of the V.S. of Kidney.
*	2	Describe the internal structure of the Kidney of Human being.
**	3	Describe the role of Liver, Lungs and Skin in excretion.
*	4	What is the significance of JuxtaGlomerular apparatus in kidney function?
*	5	Give a brief account of the Counter Current mechanism.
**LAQ	1	Describe the Excretory system of man, giving the structure of a nephron.
***LAQ	2	Explain the Physiology of formation of Urine.

17. Hands on Experiences for you – Try It!!!

1.	KNOW ABOUT YOUR URINE - URINALYSIS
	<p>What Is Urinalysis? Urinalysis is a series of tests on your urine, or pee. Doctors use it to check for signs of common conditions or diseases. Other names for it are urine test, urine analysis, and UA.</p>
	<p>Why is Urinalysis is done? You may have a urinalysis as part of a routine check of your overall health, like during your yearly physical. Urinalysis is one way to find certain illnesses in their earlier stages. They include:</p> <ul style="list-style-type: none"> • Kidney disease • Liver disease • Diabetes <p>Your doctor may want to test your urine if you're getting ready to have surgery or are about to be admitted to the hospital. Urinalysis can be part of a pregnancy checkup, too.</p> <p>If you have symptoms of a kidney or urinary tract problem, you may have the tests to help find out what the problem is.</p> <p>You might also have this test regularly if you have a condition such as a kidney disease that needs to be watched over time.</p>
	<p>How Does a Urinalysis Work? How Do I Prepare for a Urinalysis? What Do the Urinalysis Results Mean?</p>
<p>Find answers to the above questions from a lab technician or Google Collect someone's Urine Analysis report and Analyse yourself</p>	
2.	KNOW ABOUT YOUR URINE – MICRO ALBUMIN TEST
	<p>What Is Albumin? What Is a Microalbumin Urine Test? Who Needs a Microalbumin Urine Test? What Happens During the Test?</p>
	<p>Find answers to the above questions from a lab technician or Google</p>
3.	KNOW ABOUT YOUR URINE – CREATININE TESTS
	<p>What Is a Creatinine Test? Normal Kidney Function and the GFR What Is Creatinine and Creatinine Clearance? Why Creatinine Tests Are Done</p>
	<p>Find answers to the above questions from a lab technician or Google</p>

18. Medical and other careers related to Excretory System

Urologists: Urologists provide medical and surgical management for disorders of the urinary tract in both men and women. They may diagnose and treat urologic disease, cancers, deformities and injuries. After medical school, a urologist must complete at least five years of training, including four years in an approved urology program and one year of surgical training. Urologists perform procedures in their offices as well as endoscopic procedures and major surgeries. They also provide medical management for conditions such as incontinence. Urologists may specialize in urologic oncology, pediatric urology, stone disease, infertility, impotence, female urology and incontinence, and laparoscopy.

Nephrologists: Nephrologists begin their careers in internal medicine. After medical school, an internist must spend three years in an internal medicine residency and take the internal medicine board exam before she studies nephrology for an additional two to three years. Nephrologists provide medical management to patients with kidney disease. They also provide care to kidney transplant patients and people with kidney failure, treating the latter with dialysis. Some nephrologists specialize in kidney failure or high blood pressure; pediatric nephrology is another subspecialty.

Gynecologists: Gynecologists specialize in care for female health problems. Since the female reproductive tract and the urinary tract system are physically co-located, gynecologists often care for women who have urinary problems such as urinary tract infections. They may also perform surgery that involves the bladder and urethra. A gynecologist spends a minimum of four years in residency training and may go on for a fellowship. In addition to gynecology, most doctors in this specialty also practice obstetrics.

Transplant Surgeons: When the kidneys fail, dialysis can help keep patients alive, but a kidney transplant can restore health. Transplant surgeons perform the surgeries that allow renal failure patients to become healthy again. Transplant surgery is a subspecialty of general surgery, which requires a minimum of five years in residency. After completing the general surgical residency, the aspiring transplant surgeon goes on for a two- or three-year fellowship in transplant surgery. Transplant surgeons manage the surgical process of kidney transplantation, including both the removal of the diseased kidney and the insertion of a healthy kidney.

Dialysis Technician: Hemodialysis technicians, also known as dialysis technicians, work together with a doctor or nurse to provide patient care to people with permanent kidney failure (end-stage renal disease).

Lithotripsy Technicians: Lithotripsy is a treatment for kidney stones using shock waves to break up the stones so the patient can excrete them through the urinary tract. If successful, patients can avoid surgery to remove their stones. Lithotripsy technicians

operate the equipment that emits the shock waves and perform other tasks related to caring for patients undergoing the procedure. Lithotripsy technologists typically begin their careers as radiographers or other radiologic technologists. Radiologic technologists use X-rays, MRIs and similar technologies to create images of kidney stones and other health conditions for doctors to use in making a diagnosis or planning treatment. Lithotripsy tables are similar to those used for other diagnoses, and often incorporate an MRI or CT scan as well as the sound-wave circuitry. Lithotripsy technologists use the machine's imaging capabilities to monitor the destruction of the stones and to understand when their work is successfully completed.



Laser lithotripsy is a procedure to break apart kidney stones in the urinary tract. It is done with a ureteroscope passed into the tubes of the urinary tract. Incisions are not needed. The **laser** breaks the kidney stones into smaller pieces that can either be removed by the surgeon or pass out of the body in the urine.



Other careers are Registered Dietitians, Nurse practitioners, Physician assistant (PA), , A Therapist or Mental health professional, Yoga therapists, Ayurvedic Practitioners and Naturopathic physicians. (For definitions read at Unit 1A)

ANSWERS - TRUE/FALSE STATEMENTS

No		Correct Answers
1	True	
2	False	Aquatic animal excrete ammonia
3	False	Urea is synthesized in liver & eliminated through kidney
4	True	
5	False	In man & ape Uricase enzyme is absent
6	True	
7	False	Most of ammonia is excreted as ammonium ions through gills & minor amount through kidney
8	True	
9	True	
10	True	
11	False	Renal artery & nerves enter & the renal vein & the ureter leave
12	False	Lined by transitional epithelium
13	True	
14	False	Vasa recta is well developed
15	True	
16	False	Hypertonic to the plasma of blood
17	False	NaCl enters into the blood of descending limb of vasa recta
18	True	
19	False	ANP is released from right atrium
20	False	Secretion of sebaceous glands

ANSWERS - FILL IN THE BLANKS

Sl. No	Answer	Sl. No	Answer
1	Uricase	16	Vasa recta
2	Hepatic vein	17	2 millions
3	Ammonia	18	Podocytes
4	Liver	19	Vasopressin / ADH
5	Liver	20	1100 – 1200 ml
6	Crustacean	21	Loop of Henle, vasa recta
7	Lancelets	22	Counter current mechanism
8	Metanephridia	23	ANP (Atrial Natriuretic peptide) mechanism
9	Coxal glands	24	Micturition reflex
10	120-170 gms	25	Renal vein
11	Fibrous renal capsule	26	6.0
12	Hilum	27	Serum creatinine
13	Calyces	28	Natriuresis
14	Transitional	29	Diabetes mellitus
15	Vaginal Orifice	30	Glomerulonephritis

ANSWERS -MULTIPLE CHOICE QUESTIONS

Sl No	Answer	The student should be explore unknown option and make notes
1	3	
2	3	
3	4	
4	1	
5	2	
6	4	
7	2	
8	2	
9	4	
10	4	
11	3	
12	1	
13	3	
14	2	
15	1	
16	4	
17	3	
18	2	
19	4	
20	2	
21	3	
22	1	
23	3	
24	4	
25	1	
26	1	
27	4	
28	2	
29	2	
30	1	
31	3	
32	3	
33	2	
34	4	
35	1	
36	3	
37	1	
38	4	
39	3	
40	2	

41	3	
42	1	
43	2	
44	4	
45	3	
46	3	
47	1	
48	4	
49	2	
50	1	
51	3	
52	2	
53	2	
54	4	
55	3	
56	2	
57	2	
58	2	
59	1	
60	2	
61	1	
62	1	
63	1	
64	4	
65	2	
66	3	
67	4	
68	1	
69	1	
70	2	
71	3	
72	2	
73	2	
74	1	
75	3	
76	4	
77	1	
78	3	
79	1	
80	2	
81	3	

UNIT – III

HUMAN ANATOMY AND PHYSIOLOGY - III



UNIT – III A

MUSCULO – SKELETAL SYSTEM

MAJOR LEARNING OBJECTIVE

- *Students will be able to identify the parts ,understand the structure, apply the knowledge of and appreciate the functioning of the “Human Musculo-Skeletal System” and the “Process of Muscle Contraction”*

LEARNING OUTCOMES:

- Be able to understand the ultra structure of the muscle fiber
- Be able to describe the structure and functions of contractile proteins.
- Be able to understand, explain, and appreciate the mechanism of muscle contraction.
- Be able to define and explain Muscle fatigue and the Cori cycle
- Be able to understand the types of muscle fibers
- Be able to understand the structure of the skeletal system in detail
- Be able to explain the structure, location and functions of various types of bones and joints.
- Be able to know about the disorders of the musculo-skeletal system

ADDITIONAL READING MATERIAL

1. **STRUCTURE OF MUSCLE & MUSCLE FIBRE**
2. **RED AND WHITE MUSCLE FIBRES**

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book
2. Defining key words
3. Identification and segregation of words
4. Label the parts of the Skeletal muscle fibre and sarcomere
5. Labeling the diagram of “mechanism of Muscle contraction”
6. Writing a brief note on Cori Cycle
7. Differentiating the types of Red and White Muscle fibres
8. Labelling the diagram of skull
9. Labelling the types of vertebrae and their numbers in Vertebral column
10. Labelling the parts of “Rib cage”
11. Labeling the parts and Writing a brief note on “Synovial Joint”
12. Draw the diagrams of joints
13. Fill in the concept map on Human Skeleton system (Give No. of bones too)
14. Give Characters and Examples of types of joints:
15. Multiple Choice Questions for Competitive exams
16. Assertion & Reasoning Questions
17. Assignment Questions to answer
18. Hands on Experiences for you – Try It!!!
19. Medical and other careers related to Musculo-Skeletal system
20. Answers to the activities and note making

INSTRUCTIONS TO LECTURER

- Explain each part of the worksheet & Come up with some examples to help
- Clarify doubts of the students before starting the work book

INSTRUCTIONS TO STUDENTS

- First read the text book thoroughly and logically.
- Always try to attempt this workbook with a friend cooperatively
- While attempting the activities analyze them carefully

ADDITIONAL READING MATERIAL:

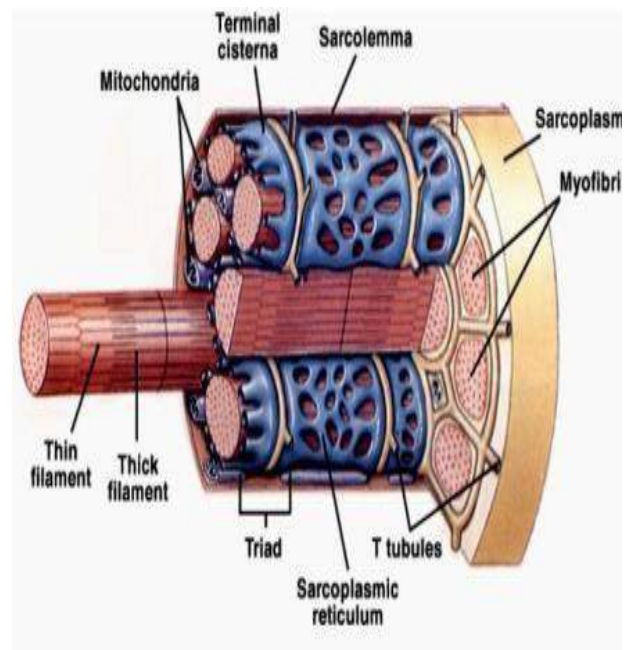
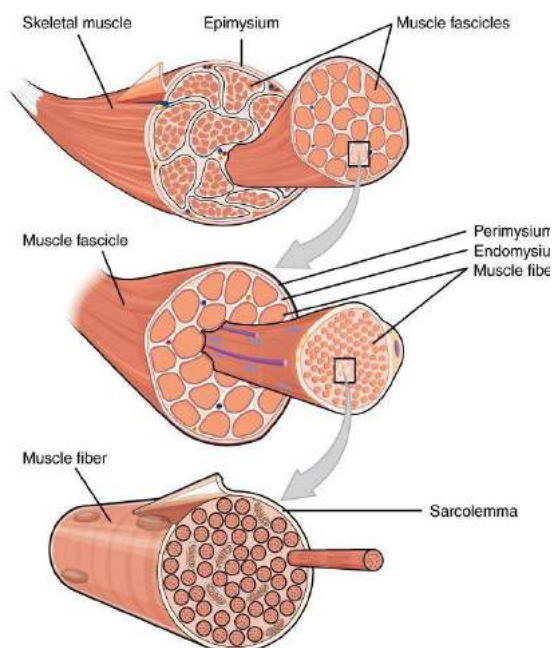
STRUCTURE OF MUSCLE & MUSCLE FIBRE

Skeletal muscles represent a majority of the muscular system. Skeletal muscles are protected with a connective muscle tissue called **epimysium**. The muscle is composed of bundles of tubular muscle cells. These tubular cells are known as muscle fibers or **myocytes**. Bundles of muscle fibers are known as **fasciculi**. One bundle of muscle fibers is protected with a connective tissue known as **perimysium**. Inside the perimysium, there are many muscle fibers. Each fascicle may contain 10 to 100 muscle fibers. Large, strong muscles have a large number of muscle fibers inside each bundle. Smaller muscles contain fewer numbers of muscle fibers in the fascicle.

Muscle tissues and muscle fibers are formed from the [mesodermal](#) layer of the [embryonic germ cells](#) by a process called myogenesis. Each muscle fiber is covered with a fibrous connective tissue called **endomysium**. The diameter of muscle fibers can range from 10 to 80 micrometres and they can be extended up to 30 cm length.

Muscle fiber is composed of numerous rod-like units or cylindrical organelles called **myofibrils**. Each muscle fiber contains hundreds to thousands of myofibrils which are bundles of [myosin and actin proteins](#) run through the length of the muscle fiber. Myofibrils are important in muscle contraction.

Myofibril: A myofibril or a muscle fibril is a basic rod-like unit of a muscle cell. There are hundreds of myofibrils running parallel to each other in a muscle cell. Myofibrils are composed mainly of actin and myosin proteins. Some other types of proteins are also present in myofibrils. These proteins are organized into thick and thin long filaments called myofilaments. Thin myofilaments consist primarily of actin protein while thick filaments consist of myosin protein. These two types of myofilaments run through the length of the myofibril in sections called sarcomeres. Myofibrils comprise of repeating sections of sarcomeres. These sarcomeres appear as alternating dark and light bands under the microscope and are responsible for muscle contractions.



ADDITIONAL READING MATERIAL: RED & WHITE MUSCLE FIBRE

RED MUSCLE FIBRES	WHITE MUSCLE FIBRES
1. These muscle fibres are dark red which is due to the presence of red haemoprotein called myoglobin. Myoglobin binds and stores oxygen as oxymyoglobin in the red fibres. Oxymyoglobin releases oxygen for utilization during muscle contraction.	1. These muscle fibres are lighter in colour as they do not have myoglobin.
2. Mitochondria are more in number.	2. Mitochondria are less in number.
3. Red muscles have less sarcoplasmic reticulum.	3. White muscles have more sarcoplasmic reticulum.
4. They carry out considerable aerobic oxidation without accumulating much lactic acid. Thus red muscle fibres can contract for a longer period without fatigue.	4. They depend mainly on anaerobic oxidation (glycolysis) for energy production and accumulate lactic acid in considerable amounts during strenuous work and soon get fatigued.
5. These muscle fibres have slow rate of contraction for long periods.	5. These muscle fibres have a fast rate of contraction for short periods.
Example: Extensor muscles of the human.	Example: Eye ball muscles



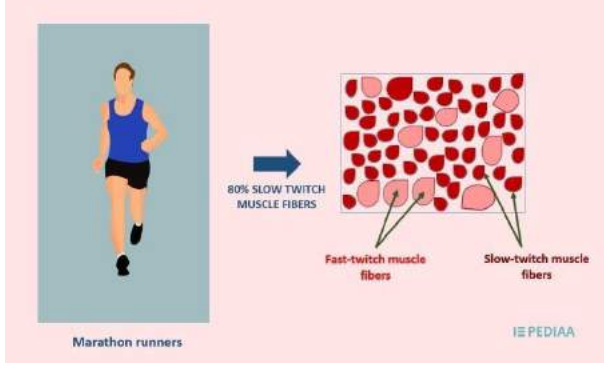
**Red muscle fibers
slow-twitch**

Compose muscles
for static work



**White muscle fibers
fast-twitch**

Compose muscles
For dynamic work

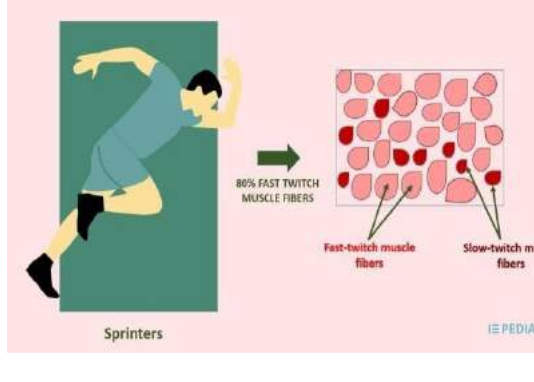


Marathon runners

80% SLOW TWITCH MUSCLE FIBERS

Fast-twitch muscle fibers Slow-twitch muscle fibers

IE PEDIAA



Sprinters

80% FAST TWITCH MUSCLE FIBERS

Fast-twitch muscle fibers Slow-twitch muscle fibers

IE PEDIAA

ACTIVITIES:

1. Locate and rewrite the difficult key words from text book:

1	9	17
2	10	18
3	11	19
4	12	20
5	13	21
6	14	22
7	15	23
8	16	24

2. Defining key words: (Search through the Text and write)

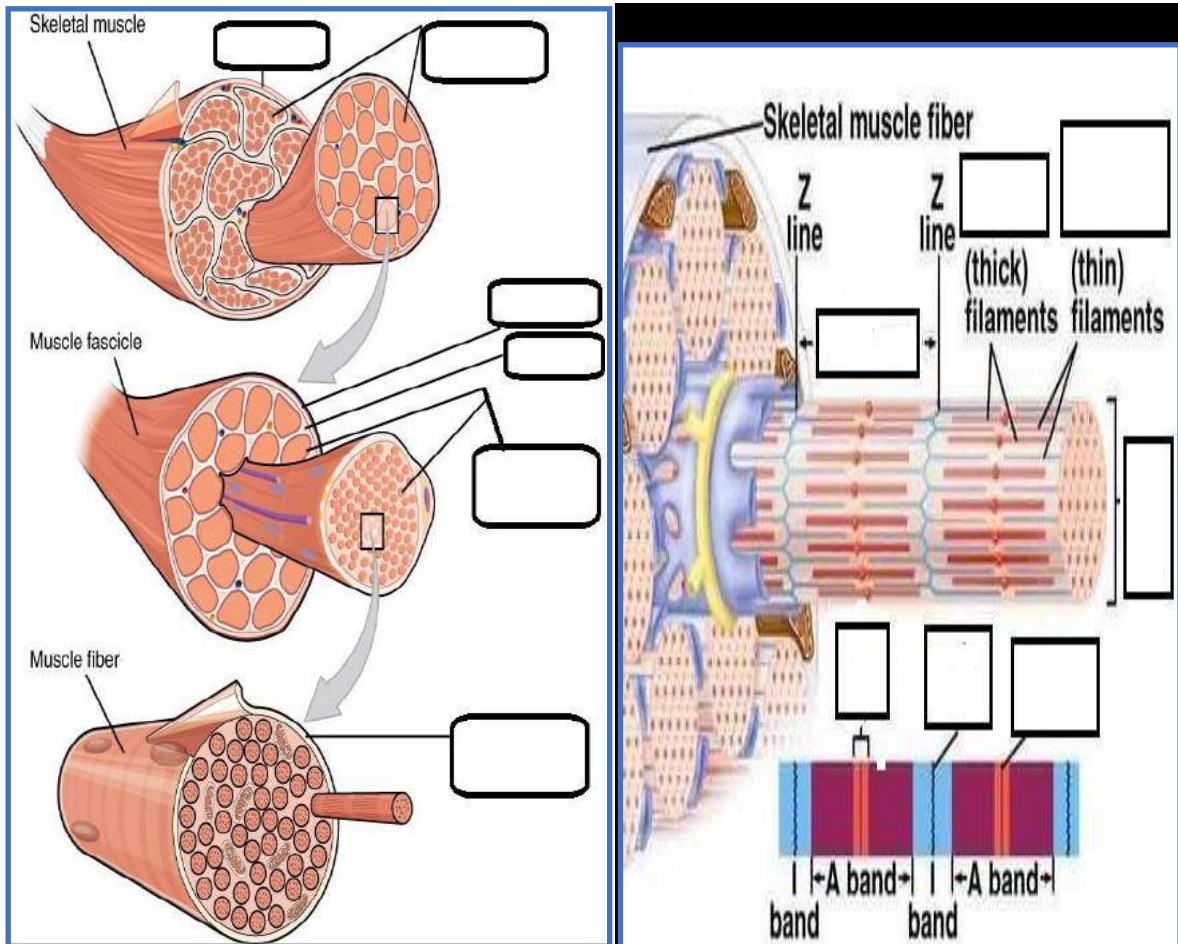
1. SYNCYTIUM	
2. DOBIE'S LINE	
3. HENSEN'S DISC	
4. VERTEBRO-CHONDRAL RIBS	
5. MEROMYOSINS	
6. TRIAD SYSTEM	
7. KEYSTONE BONE	
8. MUSCLE FATIGUE	
9. MYOGLOBIN	
10. DIARTHROSES	

3. Identify and Segregate:

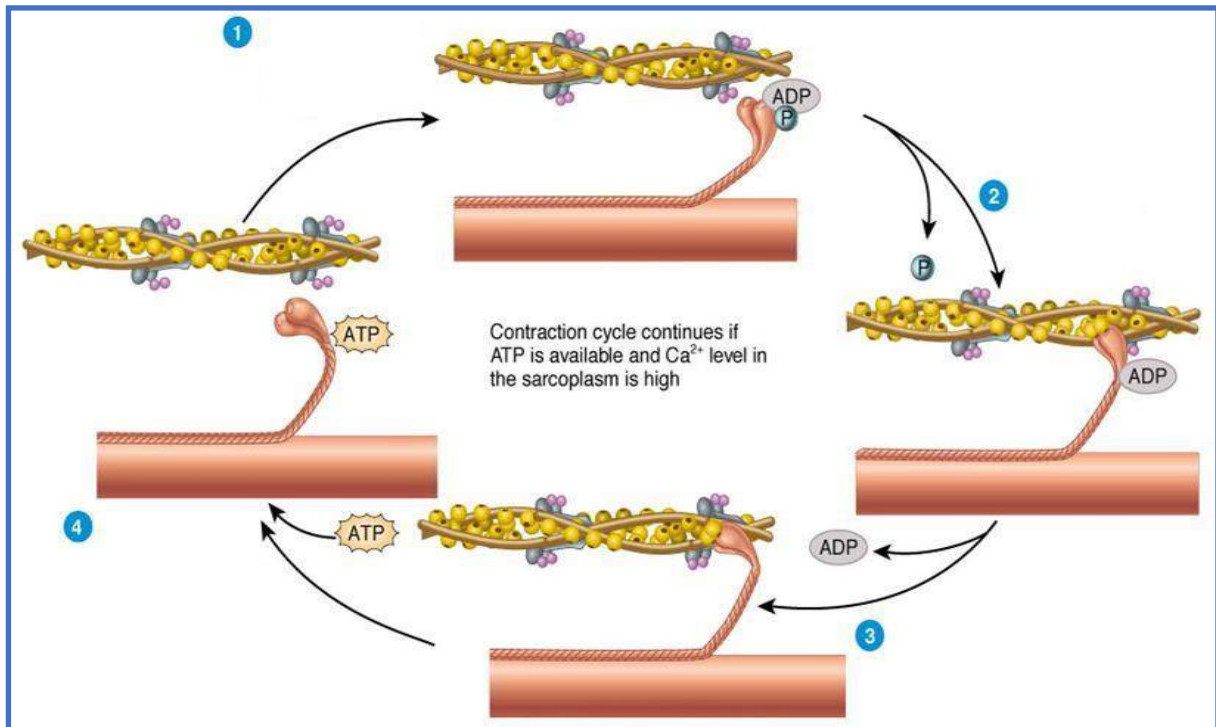
(Of the following words some belong to muscular system and others to skeletal system – Put (M) against terms belonging to muscular part and (S) against terms related to skeletal system. Search through the Text and write)

LAMBDOID SUTURE ()	ACETLCHOLINE ()	PUBIS ()
CROSS ARM ()	BICEPHALIC ()	TROPOMYOSIN ()
DICONDYLIC ()	STERNUM ()	MYASTHENIA GRAVIS ()
VOMERS ()	MYOBLASTS ()	TETANY ()
STAPES ()	ATLAS ()	SARCOMERE ()
T-TUBULES ()	SYNDESMOSES ()	SYMPHISIS ()
SACRUM ()	COCCYX ()	ACROMION PROCESS ()
CORI CYCLE ()	MOTOR END PLATE ()	RED FIBRES ()

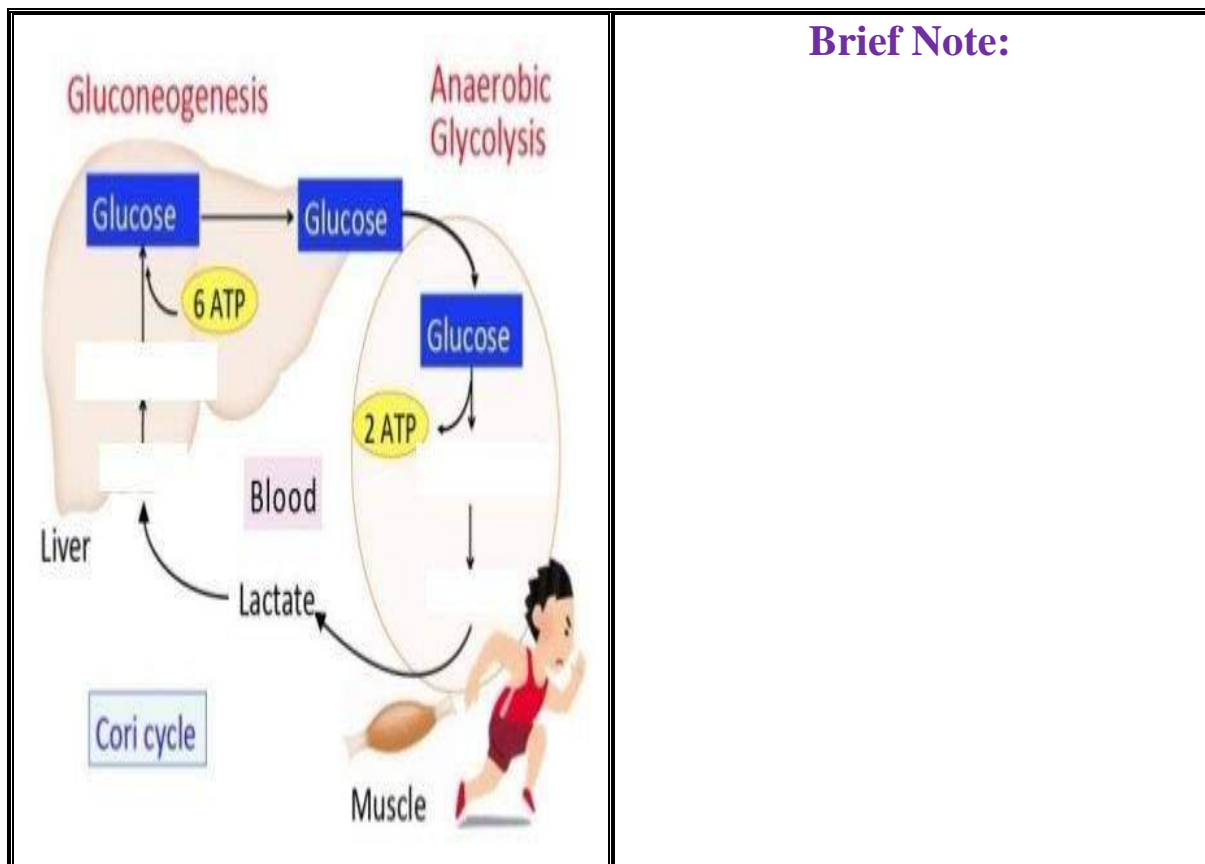
4. Label the parts of the Skeletal muscle fibre and sarcomere



5. Labeling the diagram of “mechanism of Muscle contraction”



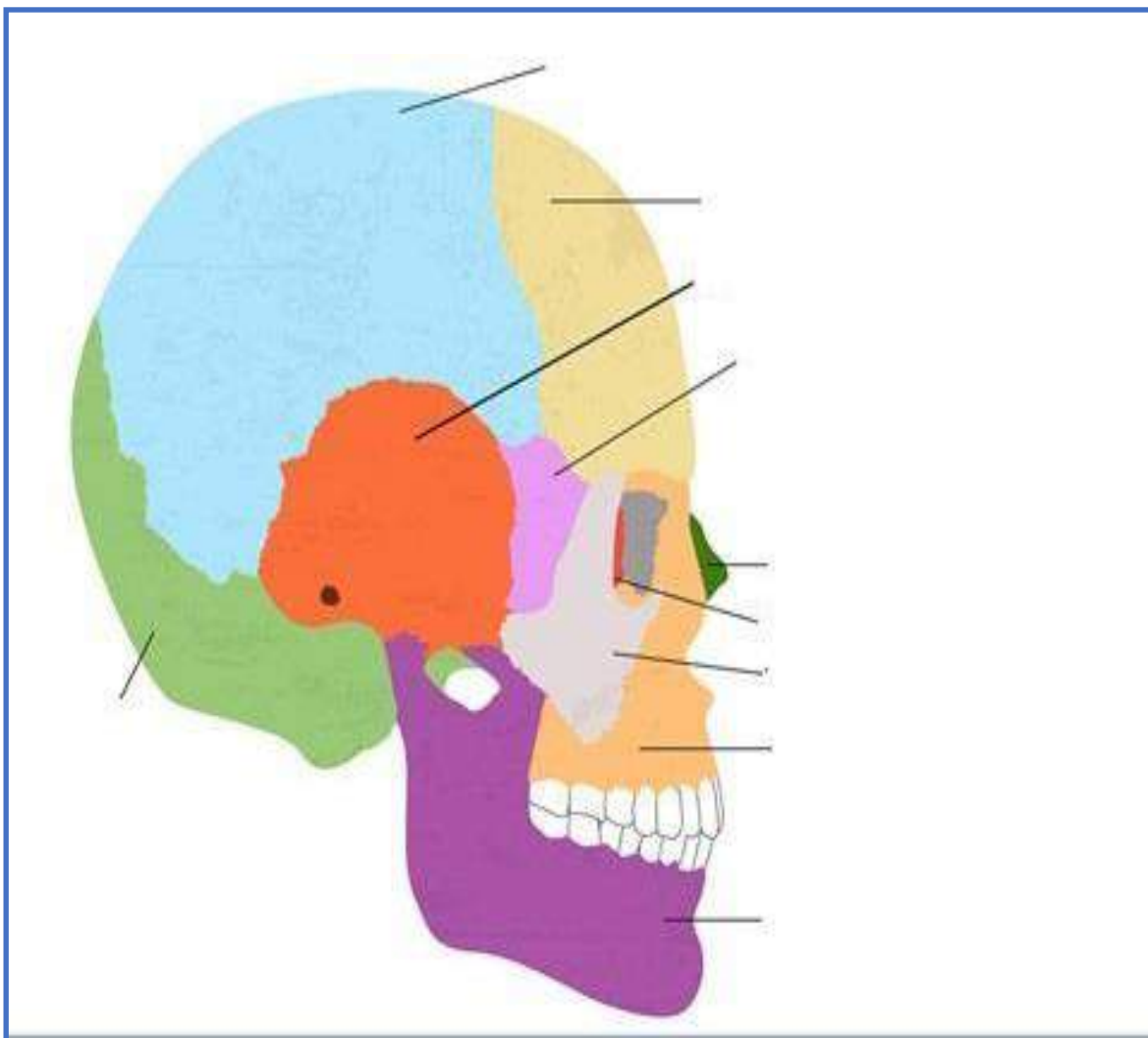
6. Fill in the empty spaces and Write a brief note on Cori Cycle



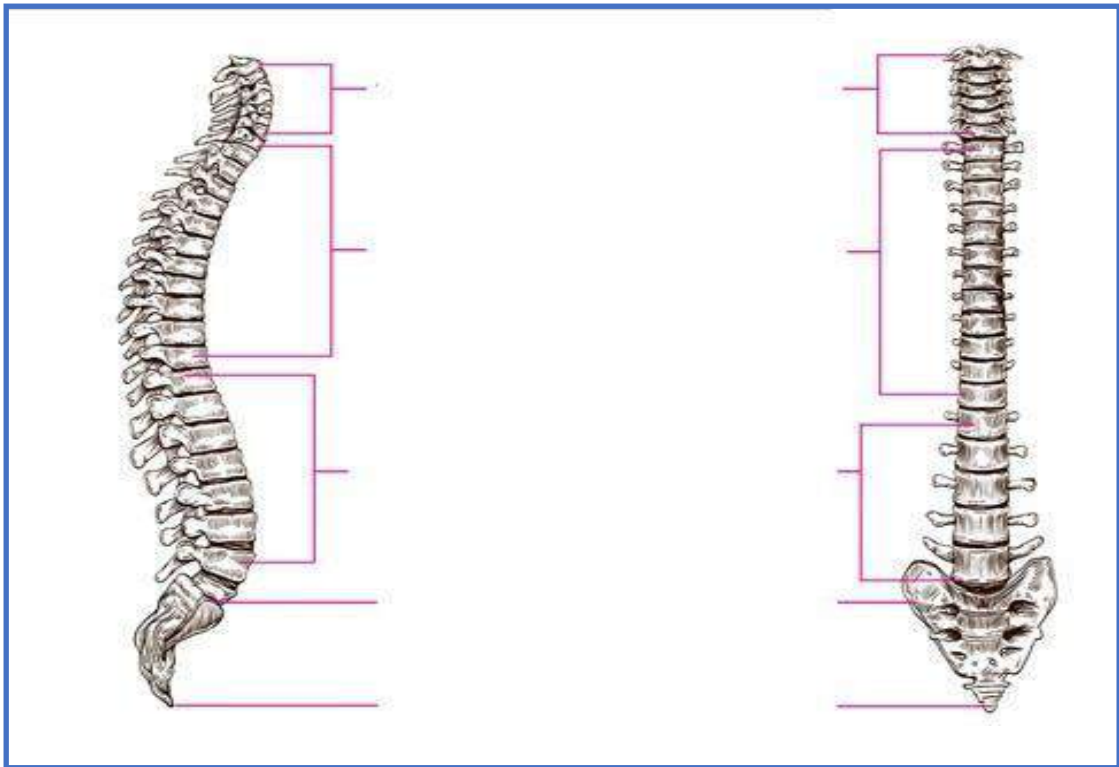
7. Differentiating the types of Red and White Muscle fibres

RED FIBRES	WHITE FIBRES
1	
2	
3	
4	
5	

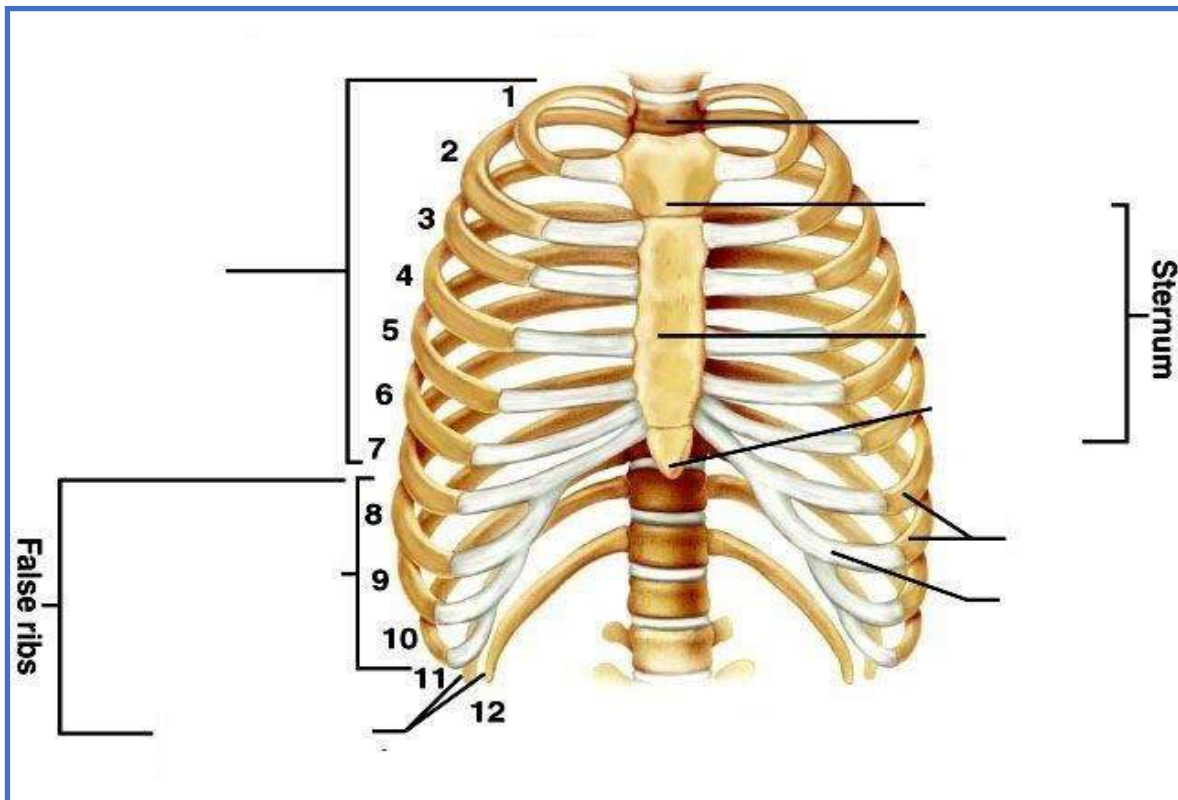
8. Labeling the diagram of skull



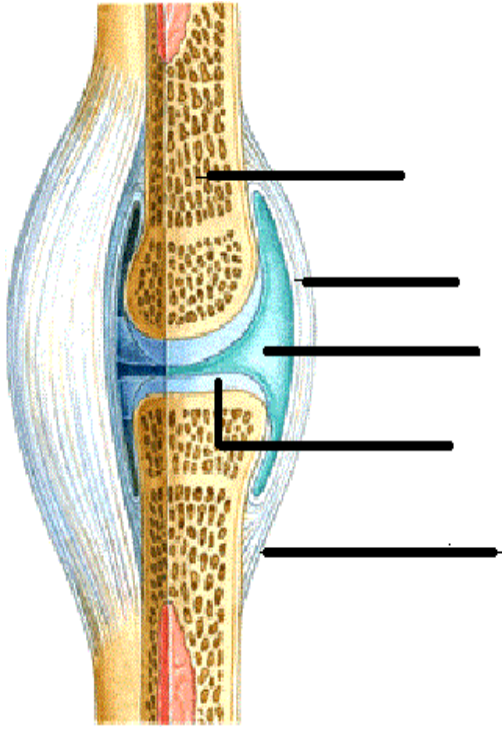
9. Label types of vertebrae and their numbers in Vertebral column



10. Label the parts of “Rib cage”



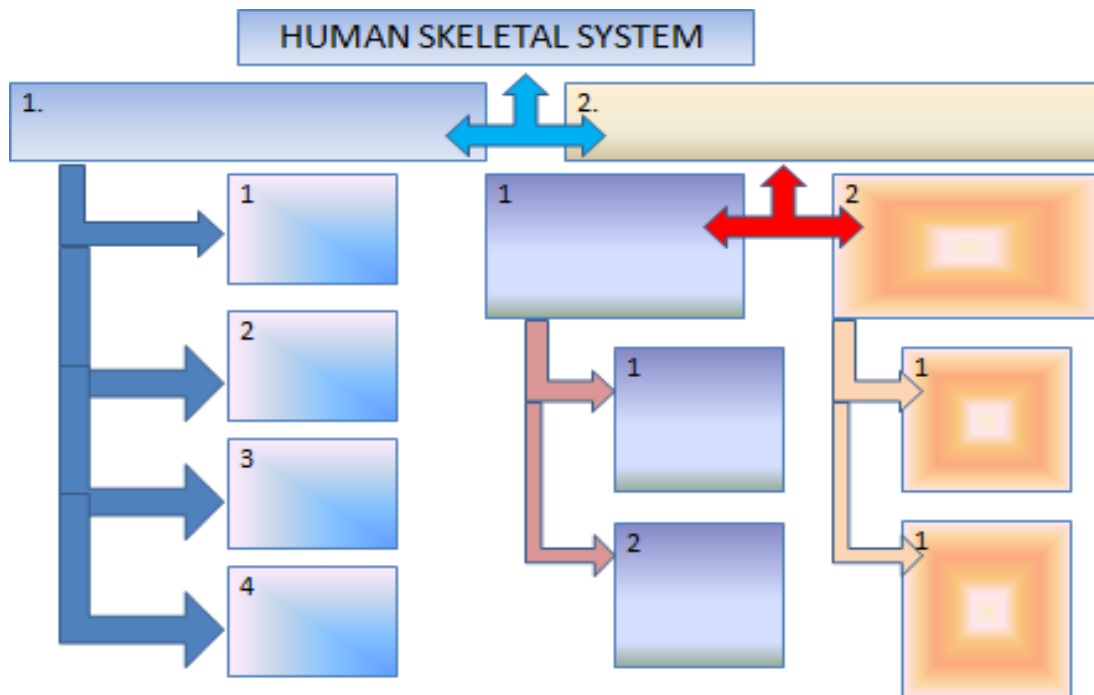
11. Label parts and Write a brief note on “Synovial joint”:

	<p>Brief Note:</p>
---	---------------------------

12. Draw the diagrams of joints

<p>BALL&SOCKET</p>	<p>HINGE JOINTS</p>
<p>PIVOT JOINTS</p>	<p>GLIDING JOINTS</p>

13. Fill in the concept map on Human Skeleton system
(Give No. of bones too)



14. Give Characters and Examples of types of joints:

Fibrous Joints	<ul style="list-style-type: none"> • Characters: • 1. • 2. • 3. • Examples:
Cartilagenous Joints	<ul style="list-style-type: none"> • Characters: • 1. • 2. • 3. • Examples:
Synovial Joints	<ul style="list-style-type: none"> • Characters: • 1. • 2. • 3. • Examples:

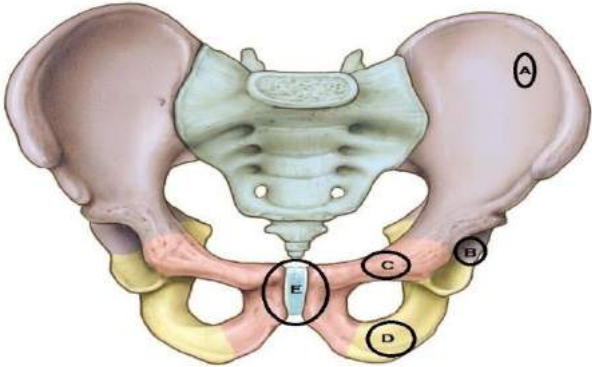
15. Multiple Choice Questions:

1.	The skeletal muscle in our body is made up of a number of bundles called
	a. Fascicles b. Fascia c. Syntitium d. Hensen's Bundle
2.	The skeletal muscle fibres are multinucleate, formed by the fusion of embryonic, mononucleate myoblasts. This condition is called
	a. Syntitium b. Myofibrils c. Nucleation d. None of these
3.	One of the following is the fibrous protein constituent of bone, cartilage, tendon, and other connective tissue.
	a. Collagen b. Fibrin c. Elastin d. Actin
4.	In a sarcomere of a mammal, the numbers of Z-lines, H-zones, M-lines and triad systems respectively are
	a) 2, 1, 2 and 2 b) 2, 1, 1 and 2 c) 2, 1, 1 and 2 d) 1, 2, 2 and 1
5.	In muscle, the region of sarcomere where actin and myosin filaments noticed is
	a. Complete I-band b) Complete A-band c) H-zone d) <i>A-I overlap</i>
6	Troponin-tropomyosin complex shifts away from active site, when
	a) Calcium binds with tropomyosin b) Calcium binds with troponin c) Calcium is stored by S.R d) Oxygen debt is established
7	The middle zone of A-band is provided
	a. With thin filaments only b) With thick filaments only c) With thin and thick filaments d) Neither with thin nor thick filaments
8	Triad system is associated with "A-I junction" and "Z-membrane" in
	a) Mammals b. Vertebrates other than mammals c.. Mammals and vertebrates other than mammals respectively d.. Vertebrates other than mammals and mammals respectively
9	In power stroke, the cross bridge swings towards H-zone
	a) Immediately after the release of ADP b) Immediately after the release of inorganic phosphorus c) After the withdrawal of calcium ions into S.R d) Before the release of calcium ions from S.R
10	In anaerobic degradation, lactic acid formed in muscle is shifted to the following structure to produce glycogen
	a) <i>Liver</i> b) Pancreas c) Brain d) Kidney
11	Shortening of a sarcomere during muscle contraction is due to
	a) Contraction of thin and thick filaments b) Sliding of both thin and thick filaments c) Sliding of thin filaments over thick filaments d) Sliding of thick filaments over thin filaments
12	Cori cycle occurs in between
	a) Liver and kidney b) Kidney and gonad c) Liver and muscle d) Muscle and bone
13	The following acts as an immediate additional source of energy in muscle contraction of mammals
	a) Arginine phosphate b) Creatine phosphate c) Glycogen d) Unsaturated fatty acids

30	Krause's membrane is a bisecting
	a) Dense line of two A-bands c) Dense line of two I-bands
	b) Dense line of one I-band d) Dense line of one H-zone
31	The following muscle is highly inclined to fatigue
	a) Muscle of myocardium c) Muscle of leg
	b) Muscle of urinary bladder d) All the above
32	The following autoimmune disorder is due to imperfection of transmission of nerve impulse
	a) Myasthenia gravis c) Rheumatoid arthritis
	b) Grave's disease d) Addison's disease
33	Duchenne muscular dystrophy (DMD) is a
	a) Degenerative disorder c) Nutritional deficiency disease
	b) Genetic disorder d) Epidemic disease
34	In tetany of muscle
	a) No contractions are seen c) Wild contractions are seen
	b) Slow contractions are seen d) 1 or 2
35	Total number of bones found in human skull is
	a) 22 b) 29 c) 35 d) 72
36	Jaw suspension in mammals is
	a) Amphistylic b) Audodiastylic c) Hyostylic d) Craniostylic
37	The following are forked but false ribs
	a) Vertebrosteral ribs c) Floating ribs
	b) Vertebrochondral ribs d) All the thoracic ribs
38	Biaxial diarthrosis which can be seen in most of the mammals is
	a) Pivot joint b) Cotyloid joint c) Saddle joint d) Condyloid joint
39	The freely movable joint that found in axial skeleton only is
	a) Pivot joint b) Condyloid joint c) Saddle joint d) Planar joint
40	Saddle joint is similar to
	b) Ball and socket joint c) Hinge joint
	b) Pivot joint d) Condyloid joint
LEVEL -2	
41	Immovable joints are
	a) Amphiarthroidial joints c) Synarthroidial joints
	b) Arthrodial joints d) Diarthrodial joints
42	Olecranon process helps in the formation of
	a) Gliding joint b) Hinge joint c) Pivot joint d) Ball and socket joint
43	The bone of upper arm of human is
	a) Compact and flat bone c) Sesamoid and irregular bone
	b) Compact and long bone d) Sesamoid and short bone
44	Acetabulum forms
	a) Ball for hip joint c) Ball for shoulder joint
	b) Socket of hip joint d) Socket of shoulder joint
45	Which of the following bones does not contain paranasal sinus in human being?

	a) Ethmoid bone b) Vomer bone c) Nasal bone d) Sphenoid bone
46	The only movable bone in the skull is
	a) Mandible b) Parietal c) Maxilla d) Vomer
47	The major component of vertebrate bone is
	a) Calcium carbonate b) Calcium phosphate c) Magnesium phosphate d) Magnesium carbonate
48	Synsacrum and sacrum found respectively in
	a) Mammals and birds b) Reptiles and mammals c) Birds and mammals d) Mammals and reptiles
49	In mammals, the zygomatic arch is formed by
	a) Maxilla b) Squamosal c) Jugal d) All the above
50	Sella turcica that lodges pituitary gland is modified
	a) Presphenoid b) Alisphenoid c) Orbitosphenoid d) Basisphenoid
51	Knee joint is
	a) Hinge joint b) Saddle joint c) Condylloid joint d) Ball and socket joint
52	Cartilaginous joints are
	a) Perfect joints b) Slightly movable joints c) Immovable joints d) Synovial joints
53	Which of the following is not a bone of skeleton of forelimb?
	a) Humerus b) Radial c) Ulna d) Tibia
54	Gorilla rib is
	a) Extra abdominal rib b) Abdominal rib c) Extra floating rib d) Extra true rib
55	Which of the following defines “Triad System”
	a. Two T-Tubules and One Terminal Cisternae b. One T-Tubules and Two Terminal Cisternae c. Two T-Tubules and Two Terminal Cisternae d. One T-Tubules and One Terminal Cisternae
56	The following is true with respect to myofilaments of sarcomere
	a) Primary filaments are thicker than secondary filaments b) Secondary filaments are thicker than primary filaments c) Primary and secondary filaments are thin d) Primary and secondary filaments are thick
57	Walk along mechanism in muscle contraction is the
	a) Movement of thin filaments towards H-zone only b) Movement of thin filaments away form H-zone only c) Swinging movements of thin filaments over thick filaments d) Swinging movements of thick filaments over thin filaments
58	The event that does not occur during relaxation of muscle
	a) Cross bridges between actomyosin complex break b) Ca ⁺⁺ ions diffuse into sarcoplasmic reticulum c) Tropomyosin covers active site of thin filament d) Ca ⁺⁺ binds to TpC unit of troponin
59	During the relaxation of muscle, the troponin permits the tropomyosin to cover the active site of thin filament when

	<ul style="list-style-type: none"> a) Calcium binds with troponin b) Creatine phosphate is present in sarcoplasm c) Calcium detaches from troponin d) Creatine phosphate is absent in sarcoplasm
60	The following is the importance of creatine phosphate
	<ul style="list-style-type: none"> a) Stimulating skeletal muscle to a maximum extent b) Formation of thin and thick filaments for sliding movement c) Abundant supply of calcium ions for muscle contraction d) Supply of energy rich phosphorus to convert ADP into ATP
61	Identify the correct statement
	<ul style="list-style-type: none"> a) Syndesmosis is fibrous amphiarthrosis b) Synchondrosis is cartilaginous diarthrosis c) Gomphosis is cartilaginous diarthrosis d) Symphysis is fibrous amphiarthrosis
62	Pick out the correct statement from the following
	<ul style="list-style-type: none"> a) Both the movable and immovable joints have synovial fluid b) Restricted movements are taking place by hip joint c) Angular movement is seen between upper arm and fore arm d) The articular surfaces of a joint are made up of elastic cartilage
63	The movable joint without synovial capsule and synovial fluid is present
	<ul style="list-style-type: none"> a) Pubic symphysis of pelvic girdle of males b) Pubic symphysis of pelvic girdle of females c) Pubic symphysis of pectoral girdle of females d) Pubic symphysis of pectoral girdle of males
64	Which of the following is accurate?
	<ul style="list-style-type: none"> a) Humans have 2 pairs of false floating ribs b) Humans have 1 pair of false floating ribs c) Humans have 3 pairs of false floating ribs d) Humans have 7 pairs of false floating ribs
65	An example of an imperfect joint
	<ul style="list-style-type: none"> a. Ball & socket joint b. Pubic symphysis c. Elbow joint d. None of the above
66	An "All out Sprint" cannot continue for more than 40 seconds because of
	<ul style="list-style-type: none"> a. Run out of oxygen b. Accumulation of creatine c.... Muscle collapse d. all the above
67	In human beings Cranium is formed by
	<ul style="list-style-type: none"> a. Eight bones of which two are paired b. Ten bones in which two are paired c. Twelve bones of which four are paired d. Fourteen bones of which six are paired
68	Sesamoid bone (Ossified tendon) is
	<ul style="list-style-type: none"> a. Patella b. Femur c. Tarsal d. Tibia
69	Innominate is
	<ul style="list-style-type: none"> a. A nerve b. An artery c. A vein d. Part of skeleton and an artery
70	Sella turcica is
	<ul style="list-style-type: none"> a. Depression of a long bone Ridge over a bone

	<p>b. Depression in the skull in the area of pituitary gland c. Ridge in the skull over the area of pituitary gland</p>
71	Joint between Atlas and Odontoid process of Axis is
	a. Pivot Joint b.. Saddle Joint c..Angular joint d.. Hinge Joint
72	Number of vertebrae present on the Cervical, Thoracic, Lumbar, Sacral and Coccyx regions are respectively.....
	a. 12, 7, 5, 1, 1 b. 7, 12, 5, 1, 1 c.. 1, 7, 5, 12, 1 d. 1, 1, 7, 5, 12
73	Which one is a mismatch:
	<p>a. Sternum and Rib - Axial Skeleton b. Clavicle and Glenoid cavity –Pelvic Girdle c. Humerus and Ulna - Appendicular Skeleton d. Malleus and Stapes - Ear Ossicles</p>
74	<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>Identify the labeled parts A, B, C, D, & E serially in the Pelvic Girdle:</p> </div> </div>
	<p>a. Ilium , Acetabulum , Pubis , Ischium , Pubic Symphysis b. Ischium, Acetabulum , Pubis , Ilium, Pubic Symphysis c. Ischium, Pubis , Ilium, Pubic Symphysis, Acetabulum d. Pubis , Ilium, Pubic Symphysis, Acetabulum, Ischium,</p>
75	In hurdle race, what is the major source of energy to leg muscle
	<p>a. Performed ATP b. Oxidative Metabolism c. Pyruvate and lactate d. Glycolysis</p>
76	The unpaired “Facial Bone “ is
	a. Lacrimal b.. Vomer c.. Nasal d.. Palatine
77	Cervical vertebrae are characterized by
	<p>a. Transverse process b.. Nueral Spines c.. Vertebro- Arterial canal d.. odontoid process</p>
78	Human Vertebral formula is
	<p>a. C 4; T 8 ; L 4 ; S 8 ; C 8 b. C 8; T 12 ; L 4 ; S 8 ; C 8 c. C 12; T 8 ; L 6 ; S 8 ; C 8 d. C 7; T 12 ; L 5 ; S 5 ; C 4</p>
79	Involuntary Muscle contraction is called
	<p>a.. Muscle Sprain b.. Muscle fatigue c.. Muscle Spasm d.. Muscle twitch</p>
80	Which one is correctly matched

	<ul style="list-style-type: none"> a. Tibia and Fibula – Both form part of Knee joint b. Cartilage and Cornea – No blood supply but do require O₂ for respiratory needs c. Shoulder joint and elbow joint – Ball and Socket joint d. Premolars and molars - 20 in all and 3 are rooted
LEVEL - 3	
81	The strength of contraction of an entire skeletal muscle is dependent on:
	<ul style="list-style-type: none"> A. Number of muscle fibres that contract simultaneously. B) Frequency of contraction of each muscle fibre C) Number of active cross bridges in each muscle fibre. D) All of the above
82	Correct order of stages of muscle contraction is
	<ul style="list-style-type: none"> a. Stimuli – Neurotransmitter secretion – release of calcium – cross bridges formation – Excitation of Triad system – Sliding of Actin filament b. Stimuli – Neurotransmitter secretion – Excitation of Triad system - Release of calcium – cross bridges formation — Sliding of Actin filament – H band diminishes c. Stimuli — Excitation of Triad system - Release of calcium – cross bridges formation — Sliding of Actin filament – H band diminishes d. Stimuli – Neurotransmitter secretion — cross bridges formation — Excitation of Triad system - Release of calcium - Sliding of Actin filament – H band diminishes
83	<p>Statements :</p> <ul style="list-style-type: none"> 1. A-bands are dark and contain myosin 2. I-Bands are light and contain Actin 3. During contraction, A band contracts 4. Part between two successive Z-lines is Sarcomere. 5. Central part of thin filament , not overlapped by thick filament in H-zone
	<ul style="list-style-type: none"> a. 1,2,3, are Correct; 4 and 5 Incorrect b. 1,3, and 5 Correct; 2 and 4 are Incorrect c. 1,2 and 4 Correct; 3 and 5 are incorrect d. 1 and 2 Correct ; 3,4, and 5 are Incorrect
84	Which of the following would you not expect to find in both a skeletal muscle cell and a cardiac muscle cell?
	<ul style="list-style-type: none"> A) Actin filaments B) Myosin binding sites C) Potassium channels that close slowly after an action potential. D) Large numbers of mitochondria
85	A person is suffering from an age related disorder "X". X is characterised by decreased bone mass and increased chances of fractures. Identify X and its common cause.
	<ul style="list-style-type: none"> A) Tetany, Increased levels of estrogen B) Osteoporosis, Decreased levels of estrogen C) Myasthenia gravis, Decreased levels of estrogen D) Muscular dystrophy, increased levels of Estrogen
86	Study the following about joints and choose the correct answer

	Type	Movement	Example	
	I. Ball and socket	Free movement in more than one plane	Shoulder joint	
	II. Hinge	Two or more than two planes	Elbow joint	
	III. Pivot	Angular	Between C ₁ and C ₂ vertebrae	
	IV. Planar	Restricted movement in different planes	Between carpals	
	a) I and II b) c) II and III		b) I and IV d) II and IV	
87	Match the name of bone given in column-I with their numbers given in column-II. _____			
		Column-I	Column-II	
	B.	Wrist bones	II. 2 pairs	
	C.	False ribs	III. 12	
	A.	Thoracic	I. 8	
	D.	Metatarsal	IV. 3 pairs	
	E.	Skull(cranial & facial)	V. 26	
			VI. 5	
			VII. 22	
		A) A-I; B-VI; C-II; D-V; E-III B) A-III; B-I; C-IV; D-VI; E-VII C) A-I; B-VII; C-III; D-V; E-II D) A-II; B-V; C-VII; D-I; E-IV		
88	Study the following and choose the correct combinations			
	Segment/Capsule	Dorsal	Ventral	Lateral
	I. Occipital	Exoccipital	Supraoccipital	Basioccipitals
	II. Parietal	Parietals	Basisphenoid	Alisphenoids
	III. Frontal	Frontals	Presphenoid	Orbitosphenoids
	IV. Optic	Frontals	Parietals	Basihyals
	a) III and IV b) I and III c) II and IV d) II and III			
89	Read the following and choose the correct combination			
		Type of joint	Type of diarthrosis	Type of motion
	I. Hinge		Monoaxial	Angular
	II. Pivot		Monoaxial	Rotation
	III. Saddle		Biaxial	Angular
	IV. Condylloid		Biaxial	Angular

	a) I and II	b) I, II and III	c) II, III and IV	d) <i>I, II, III and IV</i>											
90	Match the following and choose the correct answer														
	List-I A. Amphiarthrosis and fibrous joint B. Amphiarthrosis and cartilaginous joint C. Synarthrosis and fibrous joints D. Synarthrosis and cartilaginous joint		List-II I. Symphysis II. Syndesmosis III. Gomphosis IV. Sychondrosis												
	a) A-I, B-III, C-IV, D-II		b) <i>A-II, B-I, C-III, D-IV</i>												
	c) A-I, B-II, C-IV, D-III		d) A-I, B-III, C-II, D-IV												
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	c) A-IV, B-III, C-I, D-II		d) A-II, B-IV, C-I, D-III												
93	Read the following and arrange them in a sequence with regard to the stimulation of muscle														
	A. Depolarization of cisternae		B. Depolarization of T-tubule												
	C. Release of Ca ⁺⁺ ions		D. Depolarization of sarcolemma												
	a) D-A-B-C		b) D-C-B-A												
	c) D-B-C-A		d) <i>D-B-A-C</i>												
94	Which of the following match is incorrect?														
	A) 8th, 9th and 10th pairs of ribs - Do not articulate directly with the sternum but join the sixth rib with the help of hyaline cartilage. B) Glenoid cavity - Articulates with the head of the humerus to form the shoulder joint. C) Fibrous joint - Flat skull bones which fuse end-to-end with the help of dense fibrous connective tissues in the form of sutures to form the cranium. D) Increase in Ca⁺⁺ level - Leads to the binding of calcium with a subunit of troponin on actin filaments and thereby remove the masking of active sites for myosin.														

95	<p>Upon preventing acetylcholine from diffusing across a neuromuscular junction, which of the following will not occur?</p> <p>A) No action potential will be produced in the affected muscle fibres. B) The E.R. releases calcium ions (Ca^{2+}) into the cytoplasm. C) Myosin will not bind to actin in the affected muscle fibre. D) The affected muscle fibre will fail to contract.</p>							
96	<p>Muscle contraction is triggered:</p> <p>A) When high levels of oxygen and sugar are released by the sarcolemma. B) When a surplus of ATP is released by a nerve motor unit. C) By release of a neurotransmitter at a synapse that directly causes actin and myosin to slide. D) By the nerve releasing a neurotransmitter, which triggers a flow of calcium that attaches to actin filaments and exposes the myosin binding sites.</p>							
97	<p>A cricket player is chasing a fast ball in the field. Which one of the following groups of bones are directly contributing in this movement?</p> <p>A) Femur, malleus, tibia, metatarsals B) Pelvis, ulna, patella, tarsals C) Sternum, femur, tibia, fibula D) Tarsals, femur, metatarsals, tibia</p>							
98	<p>Children sing a song that goes 'head, shoulders, knees, and toes...' If they sang the names of the bones, it would be (in order)</p> <p>A) Hyoid, sternum, patella, and tarsals. B) Cranial, clavicle, tibia, and carpals. C) Cranial, scapula, patella, and phalanges. D) Clavicle, carpals, phalanges, and tarsals.</p>							
99	<p>Which of the following statements about the molecular arrangement of actin and myosin in myofibrils is incorrect?</p> <table border="1"> <tbody> <tr><td>(i) Each actin (thin filament) is made of 2F (filamentous) actins.</td></tr> <tr><td>(ii) F-actin is the polymer of G (globular) actin.</td></tr> <tr><td>(iii) 2F-actins are twisted into α-helix.</td></tr> <tr><td>(iv) Two strands of tropomyosin (protein) lie in the grooves of F-actin.</td></tr> <tr><td>(v) Troponin molecules (complex proteins) are distributed at regular intervals on the tropomyosin.</td></tr> <tr><td>(vi) Troponin forms the head of the myosin molecule.</td></tr> <tr><td>(vii) The myosin is a polymerised protein.</td></tr> </tbody> </table> <p>A) (i), (iii), (vii) B) (ii), (iv) and (v) C) Only (vi) D) Only (iii)</p>	(i) Each actin (thin filament) is made of 2F (filamentous) actins.	(ii) F-actin is the polymer of G (globular) actin.	(iii) 2F-actins are twisted into α -helix.	(iv) Two strands of tropomyosin (protein) lie in the grooves of F-actin.	(v) Troponin molecules (complex proteins) are distributed at regular intervals on the tropomyosin.	(vi) Troponin forms the head of the myosin molecule.	(vii) The myosin is a polymerised protein.
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(vii) The myosin is a polymerised protein.								
100	<p>Put the following phrases in proper order to describe what occurs at the neuromuscular junction to trigger muscle contraction.</p> <table border="1"> <tbody> <tr><td>(i) Receptor sites on sarcolemma.</td></tr> <tr><td>(ii) Nerve impulse</td></tr> <tr><td>(iii) Release of Ca^{+2} from sarcoplasmic reticulum.</td></tr> <tr><td>(iv) The neurotransmitter acetylcholine is released.</td></tr> <tr><td>(v) Sarcomere shorten.</td></tr> <tr><td>(vi) Synaptic cleft.</td></tr> <tr><td>(vii) Spread of impulses over sarcolemma on T-tubules.</td></tr> </tbody> </table> <p>A) (ii), (iv), (i), (vi), (vii), (iii), (v) B) (ii), (iv), (vi), (i), (vii), (iii), (v) C) (i), (ii), (iii), (iv), (v), (vi), (vii) D) (vii), (vi), (v), (iv), (iii), (ii), (i)</p>	(i) Receptor sites on sarcolemma.	(ii) Nerve impulse	(iii) Release of Ca^{+2} from sarcoplasmic reticulum.	(iv) The neurotransmitter acetylcholine is released.	(v) Sarcomere shorten.	(vi) Synaptic cleft.	(vii) Spread of impulses over sarcolemma on T-tubules.
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16. Assertion & Reasoning Questions

<p>In each of the following question a statement of Assertion (A): is given followed by a corresponding statement of Reason (R): just below it. Of the statements, mark the correct answer as</p> <p>D. If both assertion and reason are true and reason is the correct explanation of assertion</p> <p>E. If both assertion and reason are true but reason is not the correct explanation of assertion</p> <p>F. If assertion is true but reason is false</p> <p>G. If both assertion and reason are false</p>	
1	<p>Assertion (A): Even though the ATP content is very low in a skeletal muscle fibre, it is actively replenished continuously.</p> <p>Reason (R) : In the muscle fibres, the immediate additional source of energy namely Creatine Phosphate is present and it donates an energy rich phosphate group to ADP to form ATP</p>
2	<p>Assertion (A): “Barefoot walking” in human being performed by the operation of second lever system</p> <p>Reason (R) : In normal walking, the resistance (sole) is present between the fulcrums (toes) and effort (muscle of shank)</p>
3	<p>Assertion (A): The increase in the concentration of calcium ions causes the conformational changes in the myosin that permits the binding of myosin to the thin filaments at the active site</p> <p>Reason (R) : ATPase that present in the head of myosin is activated by calcium ions to develop hydrolysed ATP and ultimately results the formation of an active site in myosin filament to attach with thin filaments</p>
4	<p>Assertion (A): Due to rapid activity of a muscle, the oxygen debt occurs in it</p> <p>Reason (R) : Pyruvic acid gets accumulated in a muscle due to lack of oxygen in the medium</p>
5	<p>Assertion (A): Synovial membrane secretes synovial fluid into synovial capsule of joint</p> <p>Reason (R): Lubricants create free movement</p>
6	<p>Assertion(A) : Knee joint is the hinge type of joint.</p> <p>Reason (R) : Femur, patella and fibula are associated with knee joint.</p>
7	<p>Assertion (A): Rheumatoid arthritis is an inflammation of the synovial membrane in the synovial joints.</p> <p>Reason (R): Infectious arthritis mostly occur due to bacterial and viral infections.</p>
8	<p>Assertion (A): Maximum movement is possible at the amphiarthrosis joint.</p> <p>Reason (R): Such joints are also called synovial joints and have almost frictionless movement due to synovial fluid.</p>
9	<p>Assertion (A): Ca^{2+} plays an important role in muscle contraction.</p> <p>Reason (R): Ca^{2+} combines with troponin chain, displacing tropomyocin allowing the myosin head part to combine with actin to form actomyosin complex.</p>
10	<p>Assertion (A): On repeated application of stimuli, involuntary striped muscles undergo fatigue.</p> <p>Reason (R): This is due to the non-availability of ATP molecules.</p>
11	<p>Assertion (A): All muscles follow “All or None” principle..</p>

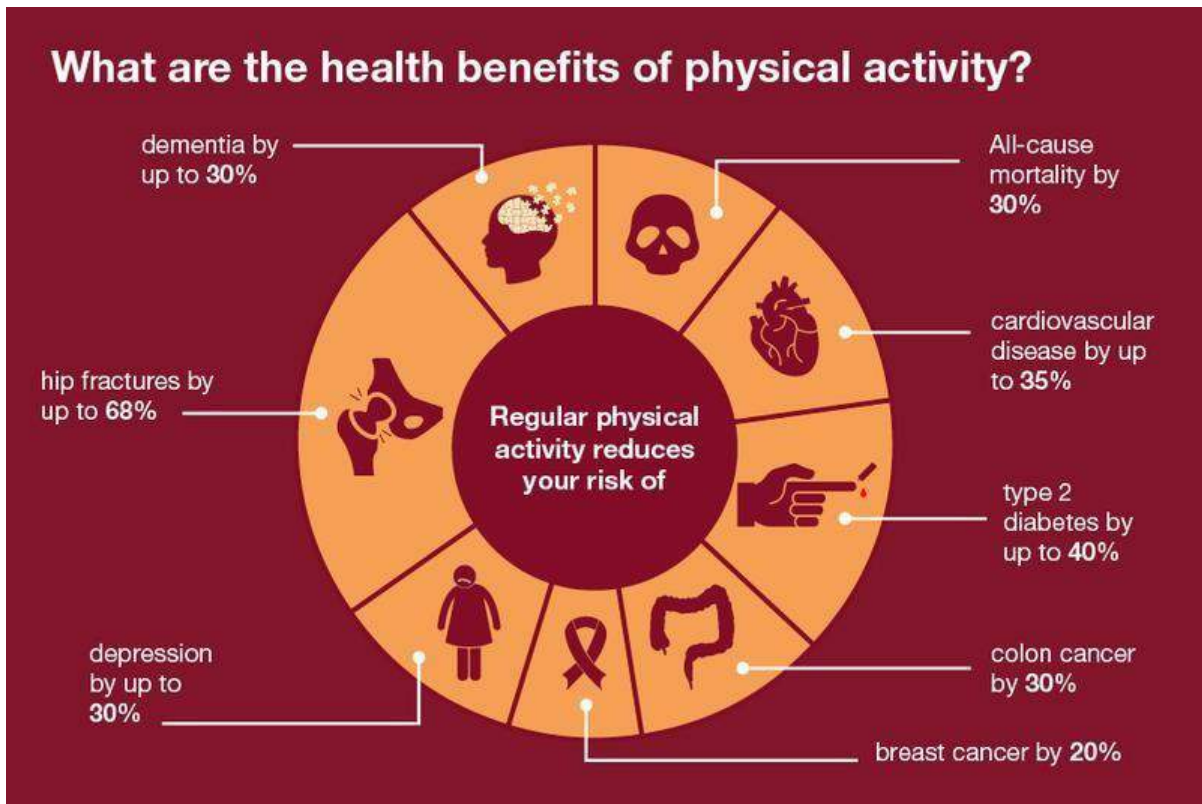
	Reason (R): All muscles contract either fully or do not contract at all depending up on the threshold stimulus availability.
12	Assertion (A): Tibia is stronger and inner whereas fibula is the slender and outer bone of lower leg or shank. Reason (R): Tibia has a sharp crest in the shaft and a projection on the inner side of the ankle called “Lateral Malleolus”.
13	Assertion (A): Skeleton helps in blood cell formation. Reason (R): Blood flows through skeleton.
14	Assertion (A): Skeleton serves as a storage depot. Reason (R): Skeleton stores carbohydrates and proteins.
15	Assertion (A): Ball and socket joints are the most mobile joints. Reason (R): Synovial fluid is present in the Ball and Socket joints.
16	Assertion (A): Arthritis or inflammation of the joints makes the joint painful. Reason (R): Some toxic substances are deposited at the joints.
17	Assertion (A): The contraction and relaxation of muscles are controlled by nerve impulses. Reason (R): The threshold stimulus is the minimum stimulus required for the beginning of the contraction.
18	Assertion (A): Triceps is said to be an extensor muscle for elbow joint. Reason (R): Triceps relaxes during extension of fore arm at the elbow joint.
19	Assertion (A): Biceps and triceps are called Antagonistic muscles. Reason (R): This is due to the fact that they contract and relax together.
20	Assertion (A): Muscl contraction force increases with the rise in strength of stimulus. Reason (R): This is due to increased contraction of individual muscle fibres with increases in stimulus strength.

17. Assignment Questions to answer

UNIT – 3A		MUSCULO-SKELETAL SYSTEM	
	3A.1 The Muscle		
VSAQ***	1	What is Triad System?	
***	2	Write the differences between Actin and Myosin.	
***	3	Distinguish between Red Muscle Fibres and the White Muscle Fibres.	
SAQ**	1	Draw the diagram of a sarcomere of skeletal muscle showing different regions.	
***	2	What is Cori Cycle? Explain the process.	
LAQ*	1	Explain the mechanism of muscle contraction.	
	3A.2 The Skeleton		
VSAQ **	1	Name two Cranial sutures and their location.	
***	2	Name the Key stone bone of the Cranium. Where is it located?	
***	3	Human skull is described as Dicondylic skull. Give the reasons.	
SAQ***	1	Describe the structure of Synovial Joint with the help of a neat and labelled diagram.	

18. Hands on Experiences for you – Try It!!!

A. Write a brief note by observing the below picture:



B. COVID-19: Ultimate Home Workout Ideas To Stay Fit And Active In Times Of Social Distancing

Jumping Rope: This childhood leisure activity of skipping rope is in fact a very effective cardio routine for people of all ages.

All you need is a skipping rope and a little bit of clear space, either in a room with a high ceiling, or the verandah. Beginning your day with 2 - 3 minutes of jumping rope immensely boosts blood circulation and promotes heart muscle activity.

Aerobics: Social distancing can make you feel lonely and gloomy, having to work out all by yourself, that too within the confines of your home. To beat the blues, gather your family members in the evenings, play your favorite songs or any peppy track, and groove to the rhythmic beats in unison.

Aerobics activity comprises simple dance movements that engage all the core muscles of the arms, torso and legs, strengthening them and increasing their flexibility.

Tabata Training: A form of high-intensity interval training, consisting of coordinated movements, lifts and stretches, that vastly builds robustness of muscles in the hips, thighs, glutes and abdominal core.

It is a 4-minute miracle workout that you can easily do at home, with no gym equipment or weights. Simply follow an instructional video on YouTube, or group chat with your gym

buddies as you progress through this grueling workout, to stay on top of your [weight loss](#) goals, even while staying indoors and socially distancing yourself.

Meditation: While engaging the body in regular physical activity is essential for a slim and toned frame, having a clear frame of mind is equally important for enhanced productivity at work and at home.

After a nourishing, wholesome breakfast, find a quiet corner in your own abode, lay a comfortable mat on the floor and sit erect, cross-legged. Close your eyes and meditate for 10 - 15 minutes, clearing your mind of all unnecessary thoughts, to help you alleviate stress, anxiety and nervousness.

Yoga: While good food and physical exercise are vital for preserving lung function particularly in times of the coronavirus disease, the time-tested ancient Indian practice of yoga has umpteen healing benefits not just for respiratory health, but also for overall well-being.

In the morning and in the evening, get together with your family for a [yoga session](#). Perform simple asanas, pranayama techniques and flex exercises, to fortify bones and muscles, as well as regulate normal breathing.

Power Walking: Yes, the simple motion of walking, when performed briskly, with swift arm motions is termed as power walking, which is an amazing workout technique to lose weight, besides conferring many other benefits for health.

Take all safety precautions, keep in mind to socially distance yourself from others in your community and go for a power walk for 10 – 15 minutes every day in the morning, within your backyard or parking area. This activity helps you spend some time outdoors, besides significantly boosting cardiac muscle strength, as well as reducing the risk of hip fractures and joint disorders like arthritis in the later years.



19. Medical and other careers related to Musculo-Skeletal system

Orthopedic surgeon: The healthcare provider who specializes in bone and joint injuries and disorders is called an orthopedic surgeon, or an orthopedist. Orthopedists specialize in the musculoskeletal system. This includes identifying and treating an injury, providing rehabilitation to an affected area or function, and advising on how to reduce more damage.

The orthopedist will have completed medical school, a residency in orthopedic surgery, and possibly some additional specialized training. After becoming licensed to practice medicine, the orthopedic surgeon may become board-certified by passing both oral and written exams given by the American Board of Orthopaedic Surgery.

Many orthopedic surgeons choose to practice general orthopedics. Others specialize in certain areas of the body. This might include foot, hand, shoulder, spine, hip, or knee, or in a specialized area of orthopedic care, such as sports medicine and trauma medicine. Some orthopedists may specialize in several areas and may work with other specialists, such as neurosurgeons or rheumatologists, in caring for patients.

Rheumatologist: A rheumatologist is a healthcare provider who specializes in the treatment of arthritis and other rheumatic diseases that may affect joints, muscles, bones, skin, and other tissues. Most rheumatologists have a background in internal medicine or pediatrics and have additional training in the field of rheumatology. They are specially trained to identify many types of rheumatic diseases in their earliest stages. This includes arthritis, many autoimmune diseases, musculoskeletal pain, disorders of the musculoskeletal system, and osteoporosis. In addition to four years of medical school and three years of specialized training in internal medicine or pediatrics, a rheumatologist has had an additional two or three years of specialized training in the field of rheumatology. A rheumatologist may also be board certified by the American Board of Internal Medicine.

Anesthesiologist: Anesthesiology is the medical specialty gives medicines to control pain and support life functions before, during, and after surgery. The healthcare provider who specializes in anesthesiology is called an anesthesiologist. An anesthesiologist has completed four years of post medical school training in anesthesia. This is in addition to the required four years of medical school. Anesthesiologists usually further specialize in certain surgery specialties, such as neurosurgical anesthesia.

Physiotherapists: They do physiotherapy a treatment to restore, maintain, and make the most of a patient's mobility, function, and well-being. Physiotherapy helps through physical rehabilitation, injury prevention, and health and fitness. Physiotherapists get involved in patient's own recovery. *Physiotherapists who complete advanced studies can be called a doctor. However, I feel using this term should be avoided, as "Doctor" should be reserved for medical professionals.*

Exercise physiologist, Athletic trainer, Orthopedic nurse, Kinesio-therapist, Physical therapist, Sports psychologist, Sports medicine physicians, Sports medicine nurse, Massage Therapists, Yoga and Nature therapists, are some of the highly paid careers.

20. Answers to the activities and note making

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

Que. No	Ans.	Explanation/Notes
LEVEL - 1		
1	A	
2	A	
3	A	
4	B	
5	D	
6	B	
7	B	
8	C	
9	B	
10	A	
11	C	
12	C	
13	B	
14	C	
15	B	
16	B	
17	B	
18	A	
19	B	
20	B	
21	B	
22	C	
23	C	
24	A	

25	A	
26	B	
27	A	
28	B	
29	B	
30	B	
31	C	
32	A	
33	B	
34	C	
35	B	
36	D	
37	B	
38	D	
39	A	
40	A	
41	C	
42	B	
43	B	
44	B	
45	B	
46	A	
47	B	
48	C	
49	D	
50	D	
51	A	
52	B	

53	D	
54	C	
55	B	
56	A	
57	C	
58	D	
59	C	
60	D	
61	A	
62	C	
63	B	
64	A	
65	B	
66	A	
67	A	
68	A	Patella is also called Knee cap.
69	D	Innominate refers to the brachiocephalic artery and veins. It also refers to the three large bones that form “Hip Bone”.
70	C	Sella turcica is a depression in the “Sphenoid bone” , containing the pituitary gland.
71	A	
72	B	
73	B	
74	A	
75	B	Oxidative metabolism is a chemical process in which oxygen is used to make energy from carbohydrates. It is also called as “Aerobic Metabolism” “Aerobic respiration’ or “Cellular respiration”. Within the mitochondrion, the citric acid cycle occurs in the mitochondrial matrix, and oxidative metabolism occurs at the internal folded mitochondrial membranes (cristae).
76	B	
77	C	
78	D	

79	C	
80	B	
LEVEL – 3		
81	D	
82	B	
83	C	
84	C	
85	B	Decreased levels of oestrogen is a common cause of osteoporosis. Osteoporosis is a condition in which the bones become brittle and fragile from loss of tissue, typically as a result of hormonal changes or deficiency of calcium or vitamin D.
86	B	
87	B	
88	D	
89	D	
90	B	
91	B	
92	C	
93	D	
94	A	
95	A	
96	D	
97	D	
98	C	
99	C	
100	B	

Answers to Assertion & Reasoning Questions

1	2	3	4	5	6	7	8	9	10
A	A	C	C	A	C	B	D	A	D
11	12	13	14	15	16	17	18	19	20
D	C	C	C	B	C	B	C	C	C

UNIT – III

HUMAN ANATOMY AND PHYSIOLOGY - III



UNIT – III B

NEURAL CONTROL AND COORDINATION

MAJOR LEARNING OBJECTIVE

- Students will be able to identify and understand the structure, apply the knowledge of and appreciate the functioning of the “**Human Nervous System**” and the “**Process of Neuronal Control and Co-ordination**”.
- Students will be able to appreciate “**the tag line**” - “**Ultimate Biocomputer**”.

LEARNING OUTCOMES:

- Be able to understand the structure and functions of “Human Neural System”.
- Be able to understand, explain, and appreciate the mechanism of Nerve Impulse & Reflex arc
- Be able to understand and appreciate the role of Somatic and Autonomic Nervous systems.
- Be able to compare, understand and integrate the functions of SNS and ANS / SNS and PNS.
- Be able to understand and appreciate the structure and functioning of Sense organs: **Eye & Ear**.
- Be able to know about the disorders of the Human Neural System and the sensory organs

ADDITIONAL READING MATERIAL

1. TYPES OF NEURON
2. TYPES OF SENSE ORGANS
3. DISORDERS OF EYE & DISEASES OF EAR

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book
2. Defining key words
3. Expand the abbreviations
4. Label the types of “The cranial meninges”
5. Label the lobes of the “The Human Brain”
6. Label the parts of the sagittal section of “The Human Brain”
7. Identify the diagram, Label, and add a brief note
8. Labelling the Cranial nerves and their major functions
9. Comprehension on “Spinal Nerves”
10. Understanding the antagonistic roles of Sympathetic and Parasympathetic Neural Systems.
11. Understand and add brief note on Types of “ion channels”
12. Labelling and adding brief note on the stages of “Conduction of Nerve impulse”
13. Labeling the parts of “Synaptic Transmission”
14. Labelling and adding brief note on “Knee jerk reflex”
15. Labelling the parts of the *microscopic structure of retina*
16. Drawing the diagram showing the parts of “Ear”
17. Fill in the blanks
18. Answer “TRUE” or “FALSE”
19. Multiple Choice Questions for Competitive exams
20. Assertion & Reasoning Questions
21. Assignment Questions to answer
22. Hands on Experiences for you – Try It!!!
23. Medical and other careers related to Nervous System
24. Answers to the activities and note making

INSTRUCTIONS TO LECTURER

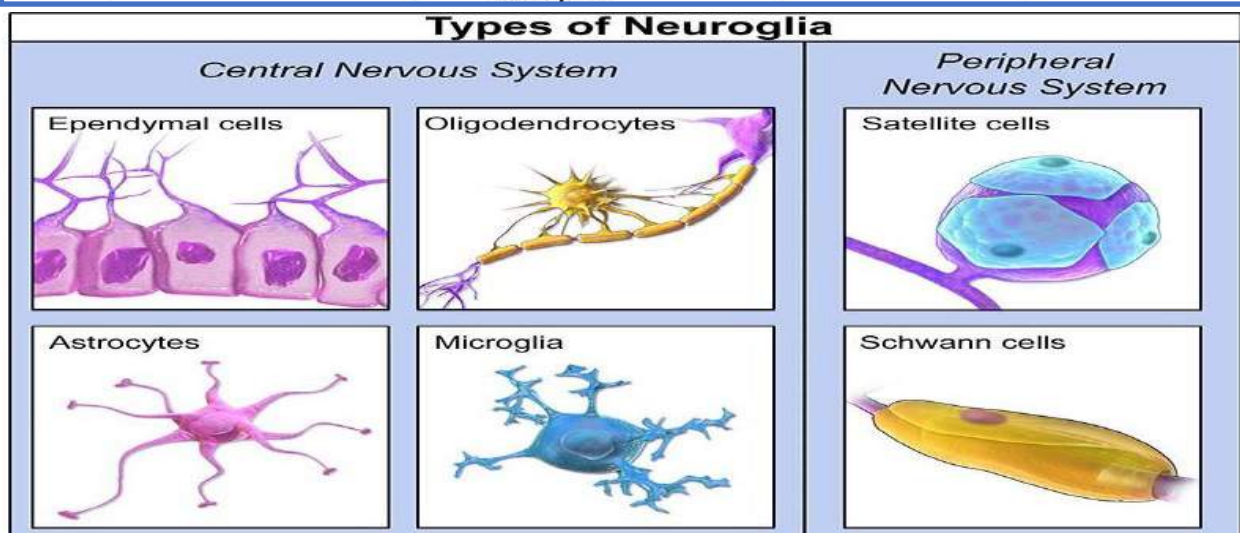
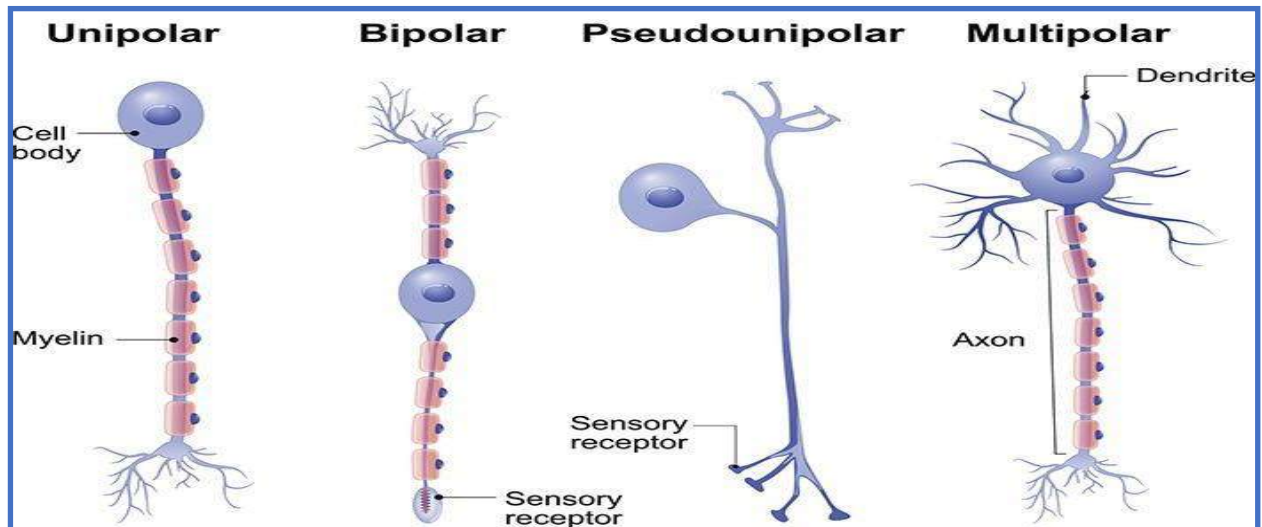
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INSTRUCTIONS TO STUDENTS

AS GIVEN IN PREVIOUS CHAPTER

ADDITIONAL READING MATERIAL

1. TYPES OF NEURON



- A. **Unipolar Nerve cells:** Nerve cells in which only one process, called a neurite, extends from the cell body. The neurite then branches to form dendritic and axonal processes. Most neurons in the central nervous systems of invertebrates, including insects, are unipolar.
- B. **Multipolar Nerve cells:** Nerve cells with many short dendrites and one long axon. Example: Pyramidal cells in the cerebral cortex
- C. **Bipolar nerve cells:** Nerve cells where the long axon extends on either side of the cell body. Example: Neurons in the retina of eye.
- D. **Pseudo-unipolar Nerve cells:** Nerve cells with cell body on a side branch of the main axon. Example: Cells of dorsal root ganglion
- E. **GLIAL CELLS :** Glia, also called glial cells or neuroglia, are non-neuronal cells in the central nervous system (brain and spinal cord) and the peripheral nervous system that do not produce electrical impulses. They maintain homeostasis, form myelin, and provide support and protection for neurons.
 1. **Microglia:** Microglia are the brain's immune cells, serving to protect it against injury and disease. Microglia identify when something has gone wrong and initiate

a response that removes the toxic agent and/or clears away the dead cells. Thus microglia are the brain's protectors and are the scavenger cells.

2. **Astrocytes:** Astrocytes are star-shaped cells that maintain a neuron's working environment. They do this by controlling the levels of neurotransmitter around synapses, controlling the concentrations of important ions like potassium, and providing metabolic support. They also provide nutritional support to neurons.
3. **Oligodendrocytes:** Oligodendrocytes provide support to axons of neurons in the central nervous system, particularly those that travel long distances within the brain. They produce a fatty substance called myelin, which is wrapped around axons as a layer of insulation. Similar in function to insulation layers around power cables, the myelin sheath allows electrical messages to travel faster, and gives white matter its name—the white is the myelin wrapped around axons. Multiple sclerosis is caused by a loss of the myelin sheath around neurons.
4. **Microglia of Central Nervous System**
 - **Ependymal cells:** Ependymal cells line the spinal cord and ventricles of the brain. They are involved in creating cerebrospinal fluid (CSF).
 - **Radial glia:** Radial glial cells are progenitor cells that can generate neurons, astrocytes and oligodendrocytes.
5. **Microglia of Peripheral Nervous System**
 - **Schwann cells:** Similar to oligodendrocytes in the central nervous system, Schwann cells myelinate neurons in the peripheral nervous system.
 - **Satellite cells:** These surround neurons in the sensory, sympathetic and parasympathetic ganglia and help regulate the chemical environment. They may contribute to chronic pain.
 - **Enteric glial cells:** These are found in the nerves in the digestive system.

2. TYPES OF SENSE ORGANS

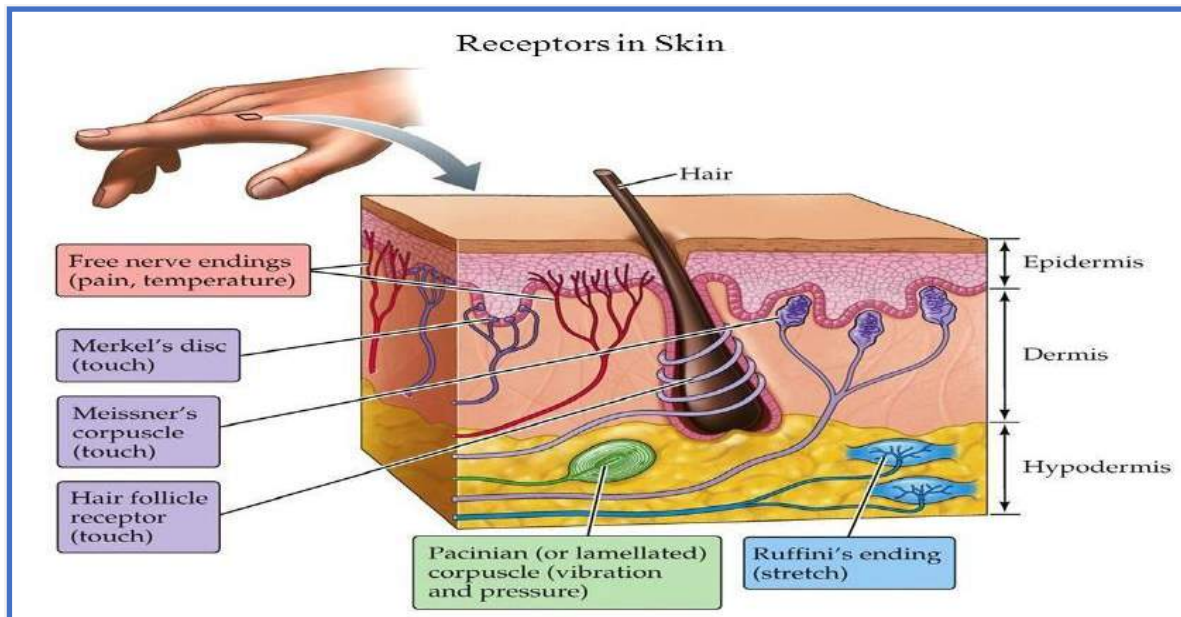
Sense organs also can be specialized organs that help to perceive the world around us. They are also called "Receptors" and are an integral part of our lives and it is the only way that enables us to perceive the environment. Sense organs provide the required data for interpretation through various organs and a network of nerves in response to a particular physical phenomenon. These senses govern our association and our interaction with the environment.

A sense organ may be extremely simple such as those of touch, smell and taste, or they may be highly complex in their structure as well as working like eye and ear, the sense organs of sight and hearing, respectively. Sense organs can be classified based on the following criteria:

a. According to their position:

- **Exteroceptors:** The external sense organs which receive the stimuli from outer environment.
- **Proprioceptors:** Simple receptors present in joints, skeletal muscles, tendons etc., they are not in direct contact with the environment but are affected by the changes in the environment.
- **Visceroceptors or Internal Receptors:** The receptors present in the viscera. They receive stimuli that are originating within the body itself. They are simple and

mostly represented by free nerve endings. Perception is conscious awareness and interpretation of sensation.



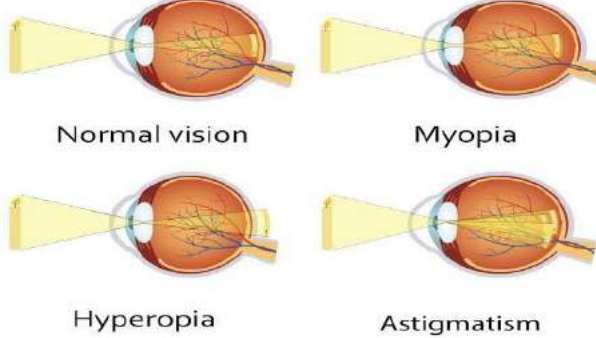
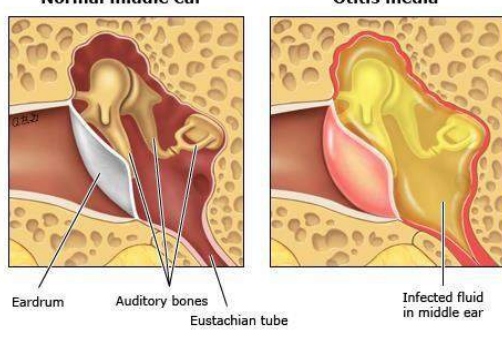
b. According to the form of stimulus they receive:

Name of receptor	Types	Stimulated By	Example
1. Mechanoreceptors (for mechanical stimuli)	a. Tactile receptors	Touch & Pressure (On Skin) See above picture	<ul style="list-style-type: none"> • Meissner's Corpuscles • Merckels Disc • Basket Nerve ending • Pacinian Corpuscles
	b. Phonoreceptors	Sound waves	Organ of Corti in internal ear
	c. Statoreceptors	Angular and Linear movements	Cristae and maculae in internal ear
	d. Analgesicreceptors	Pain	Free nerve endings
	e. Proprioceptors	Position of parts of body	Golgi-Mazzoni organs
	f. Rheoreceptors	Pressure & water currents	Lateral line sense organs in fish,

			(Neuromast cells)
2. Photo receptors		Visual stimuli Light wavelengths	<ul style="list-style-type: none"> • Retina in vertebrate Eyes • Ommatidia of compound eyes in Arthropods
3. Chemoreceptors	a. Gustatory receptors	Taste due to chemicals in solutions	Taste buds on tongue
	b. Olfactory receptors	Smell due to volatile chemicals	Olfactory epithelium in nose
4. Thermoreceptors	a. For Cold	Low Temp (10-20°C)	End bulb of Krause in skin
	b. For Heat	High Temp (25-40°C)	Ruffini's organs in skin

3. DISORDERS OF EYE & DISEASES OF EAR

DISORDERS	
EYE	EAR
<p>1. Myopia or Shortsightedness: In this case, the eye ball is antero-posteriorly elongated so that the image of distant objects is formed in front of the yellow spot. The defect can be removed by using concave glasses</p>	<p>a. Minerie's Disease: Due to increased amount of fluid of internal ear, loss of hearing.</p>
<p>2. Hypermetropia or Longsightedness: The person can see distant objects clearly, but not those which are closer. This is due to the antero-posterior shortening of the eye ball. Hence, the image of the near objects is formed behind the yellow spot. The defect can be removed by using convex glasses</p>	<p>b. Myringitis: Inflammation of tympanic membrane.</p>
<p>3. Presbyopia: A common defect in old age people due to the loss of elasticity of lens and</p>	<p>c. Otitis media: Acute infection in middle ear.</p>

<p>reduced power of accommodation. The disorder can be corrected by convex lenses.</p>	
<p>4. Astigmatism: It is due to the rough curvature of cornea or lens which can be corrected by using cylindrical glasses.</p>	<p>d. Vertigo: A type of dizziness where there is feeling of motion when one is stationary.</p>
<p>5. Cataract: The sight is impaired due to the lens becoming opaque. The defect can be overcome by surgical removal of the defective lens.</p>	<p>e. Cobyrinthine Diseases: Improper functioning of internal ear.</p>
<p>6. Glaucoma: It occurs due to increase in intra-ocular pressure as it may develop due to the blockage of the canal of Schlemm. It exerts pressure on the optic nerve causing its damage. It leads to permanent blindness.</p>	<p>f. Otolgia (Earache): Due to unhygienic habits, cosistant moisture inside the ear, swimmers problem,</p>
	

ACTIVITIES:

1. Locate and rewrite the difficult key words from text book:

1	9	17
2	10	18
3	11	19
4	12	20
5	13	21
6	14	22
7	15	23
8	16	24

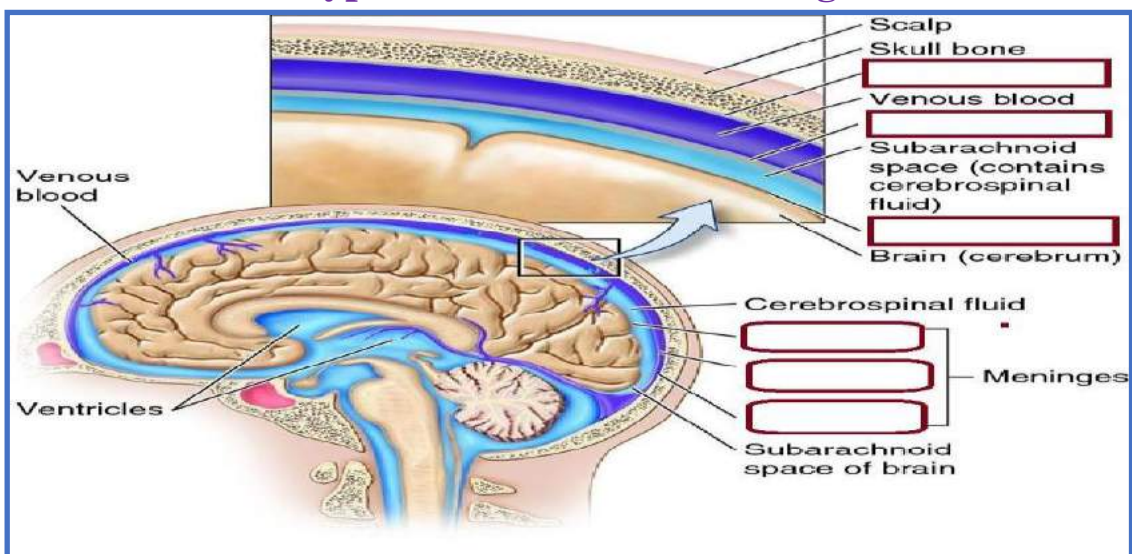
2. Defining key words: (Search through the Text and write)

1. HOMEOSTASIS	
2. ANTERIOR CHOROID PLEXUS	
3. CONUS MEDULLARIS	
4. UNDER SHOOT	
5. LAZY GATES	
6. SPATIAL SUMMATION	
7. CALORECEPTORS	
8. CANAL OF SCHELMN	
9. SCOTOPIC VISION	
10. OTOLITH ORGAN	

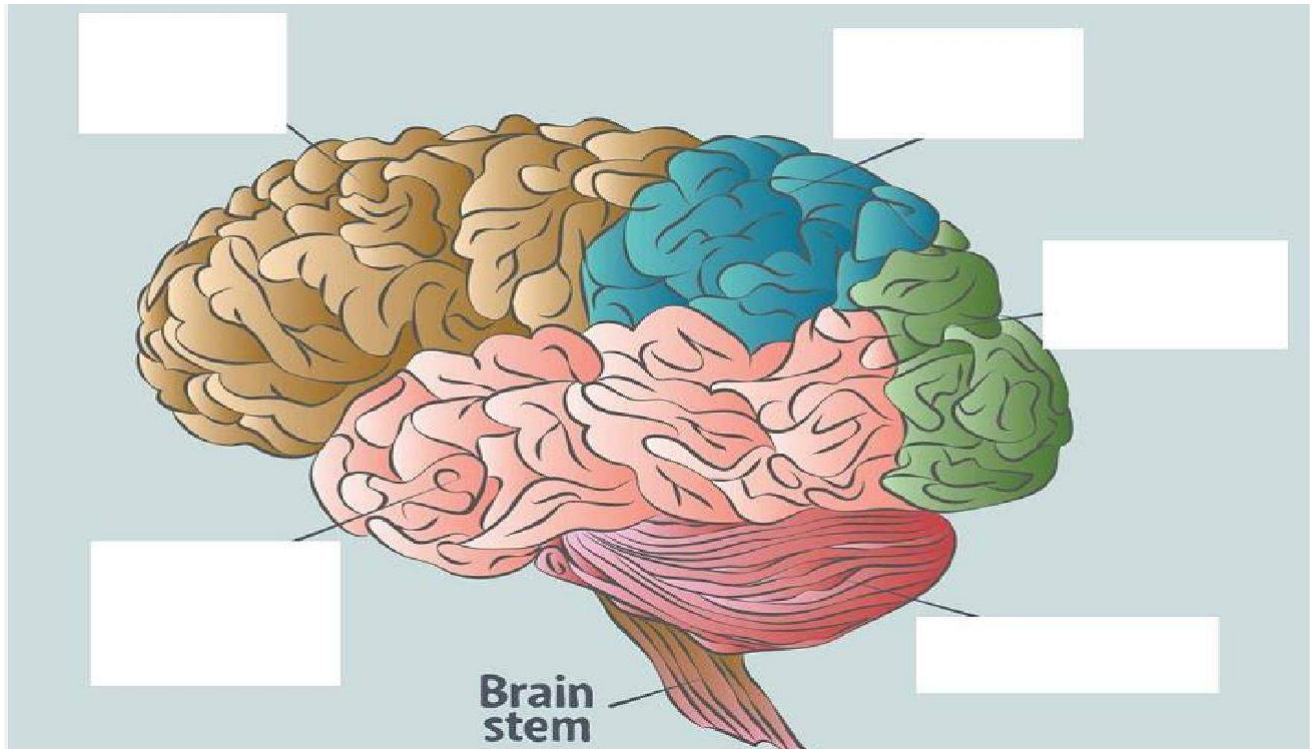
3. Expand the abbreviations: (Search through the Text and write)

Abbreviation	Expansion
CNS	
PNS	
SNS	
ANS	
mV	
GABA	
CVA	
CSF	
ECF	
EPSPs	
IPSPs	

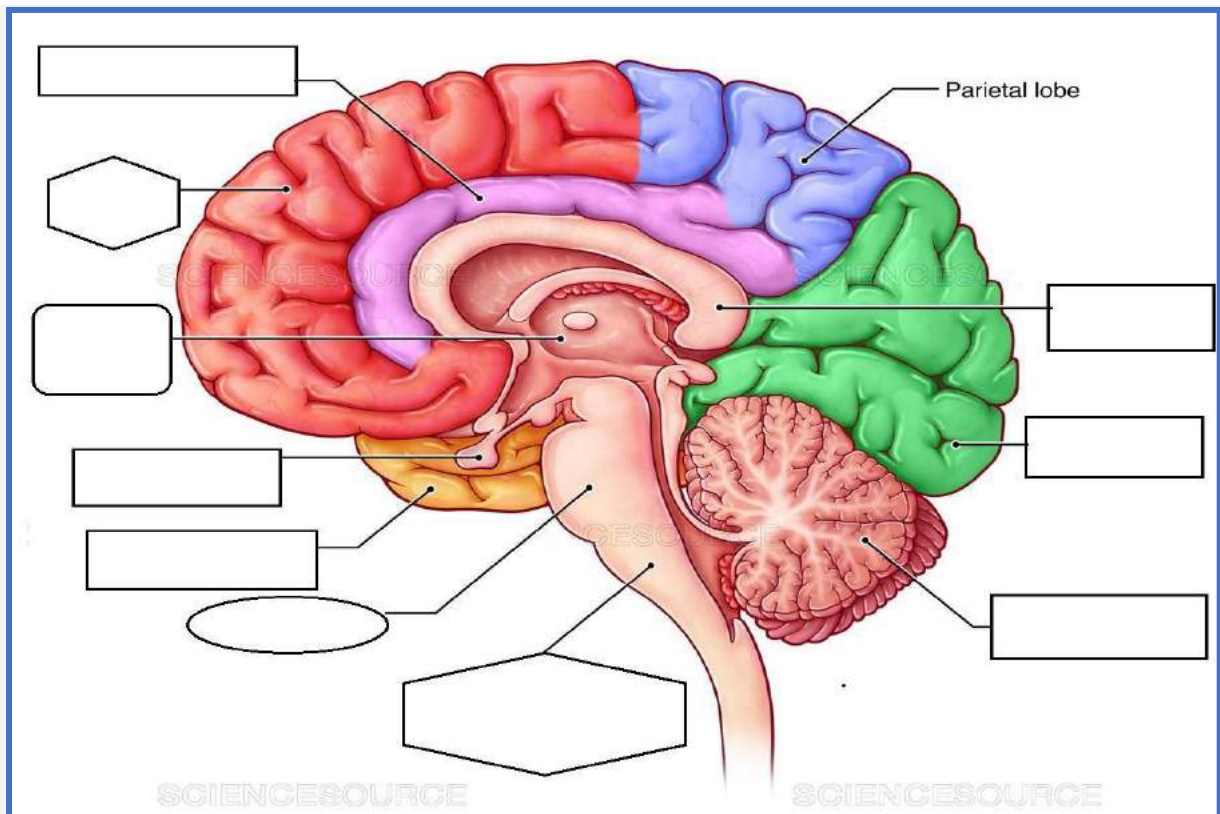
4. Label the types of “The cranial meninges”



5. Label the lobes of the “The Human Brain”

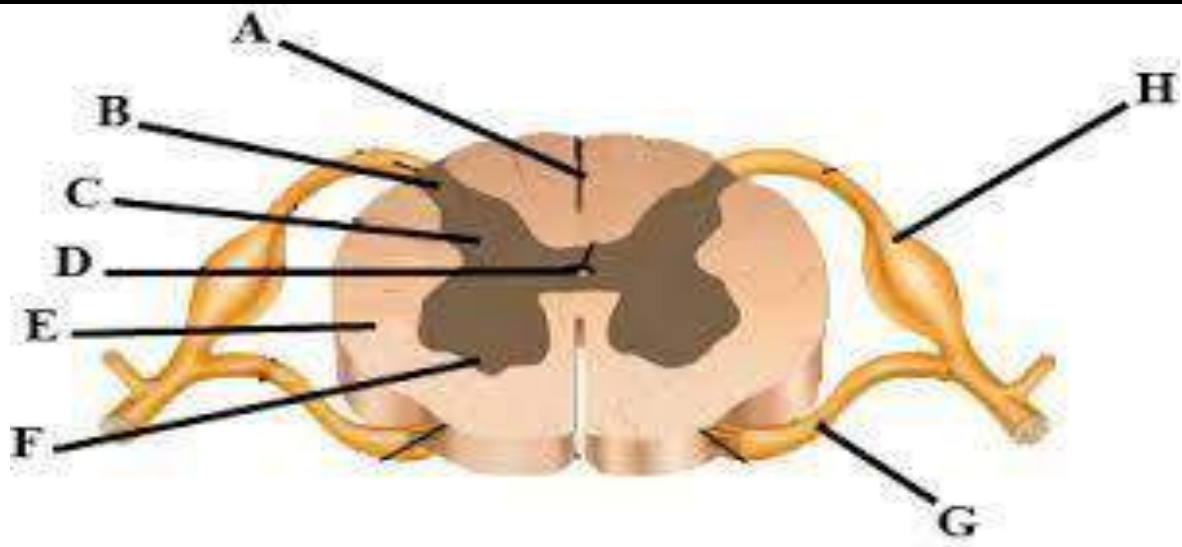


6. Label the parts of the sagittal section of “The Human Brain”



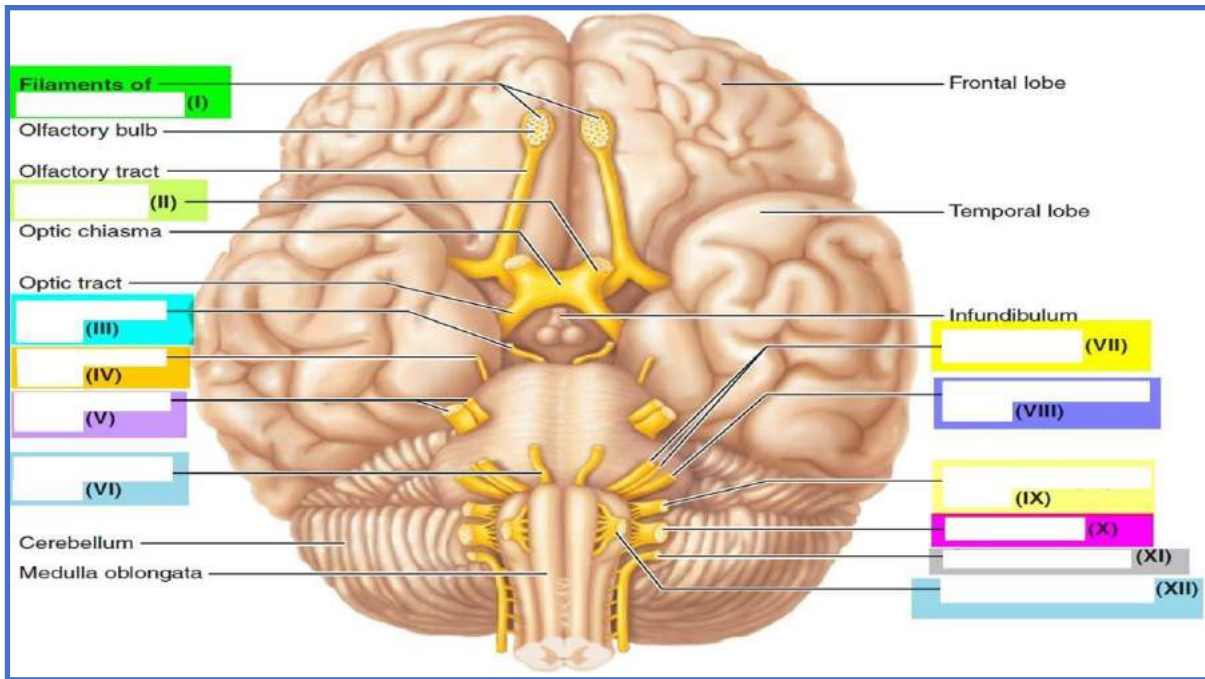
7. Identify the diagram, Label and Add a brief note:

Name the Diagram:



Brief Note:

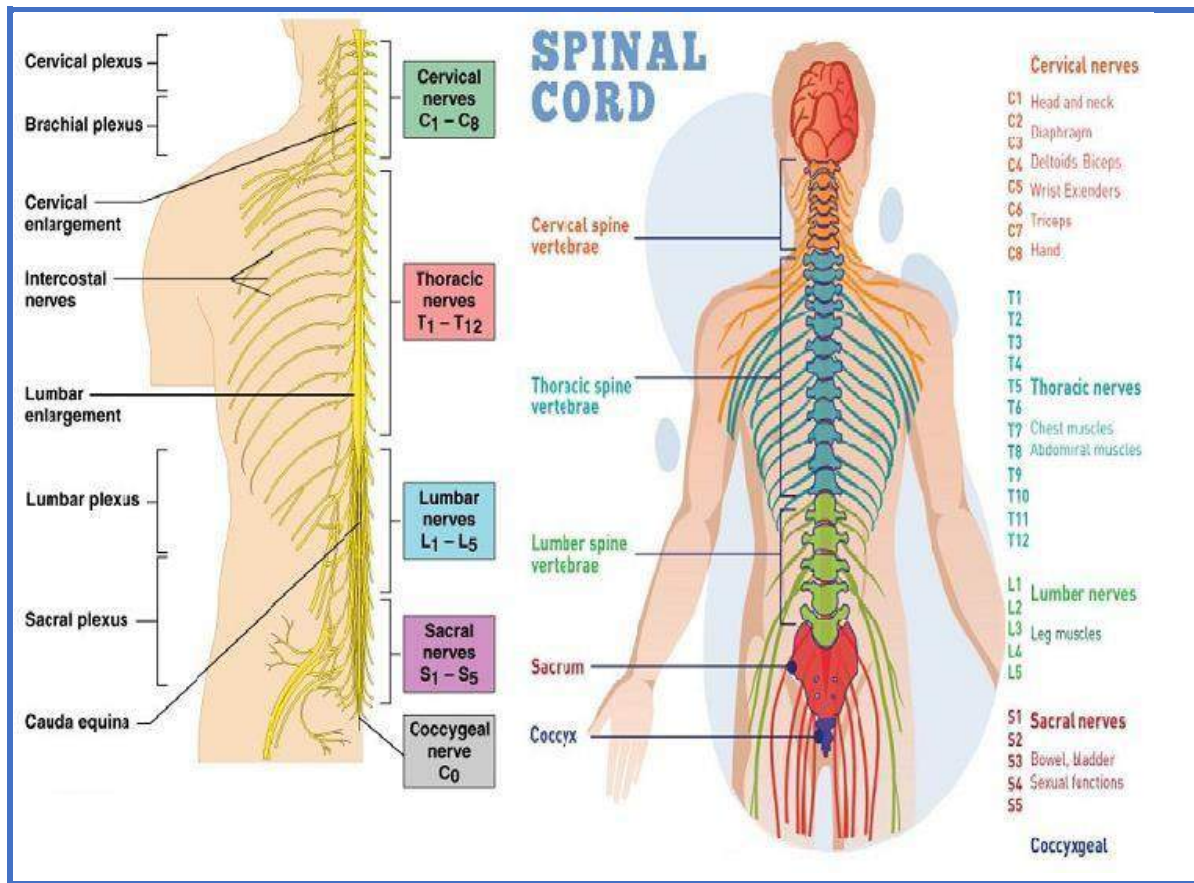
8. Label the Cranial nerves, their orientation and major functions



No	Name of Cranial Nerve	Nature	Origin	Destination	Function
I	Olfactory	Sensory	Olfactory epithelium	Temporal lobe	Sense of smell
II					
III					
IV					
V					
VI					
VII					
VIII					
IX					
X					
XI					
XII					

9. Comprehension on Spinal Nerves:

(Read “The Spinal Nerves” at Page: 101, and answer the questions below.
Diagram is given for understanding the key terms.)

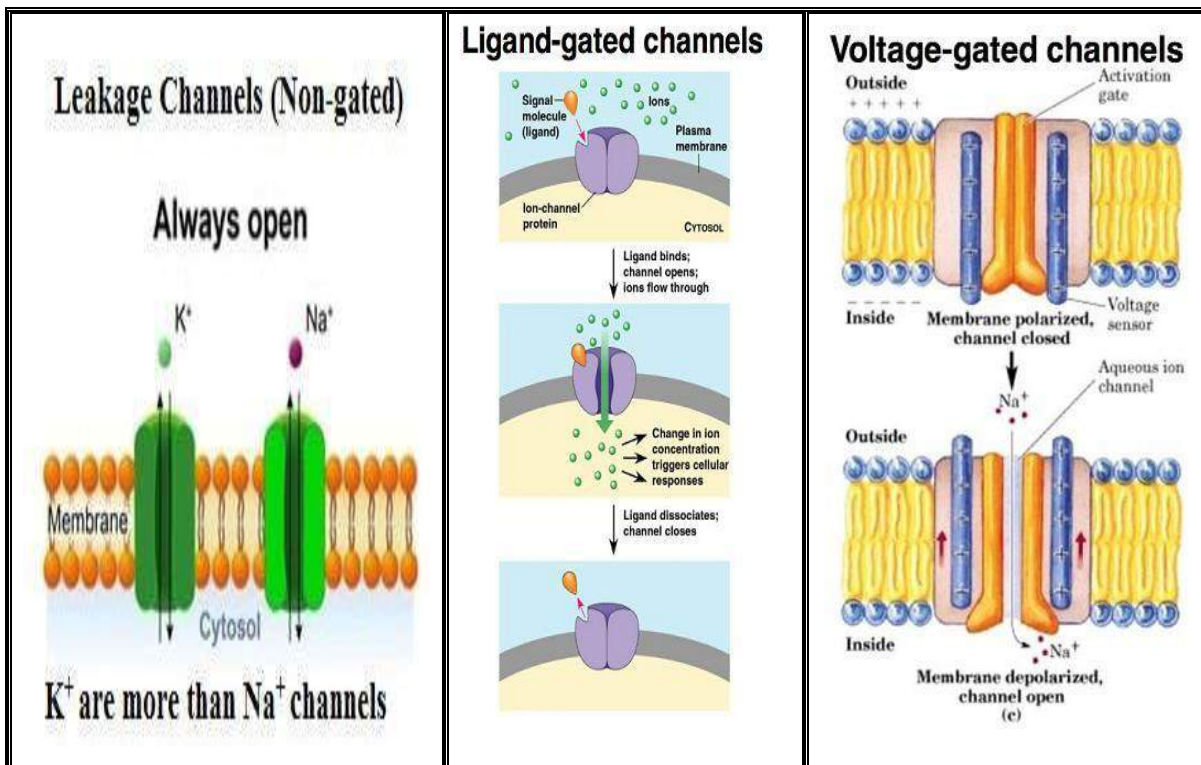


Q1.	What is “Inter vertebral Foramina”?
Ans:	
Q2.	What is “Cauda Equina”?
Ans:	
Q3.	What is “Filum Terminale”?
Ans:	
Q4.	How is “Coccygeal Plexus” formed?
Ans:	
Q5.	How is “Sacral Plexus” formed?

10. Understanding Antagonistic Roles of SNS and PNS: (Fill blank Columns)

ORGAN	SYMPATHETIC (Fight or Flight response)	PARASYMPATHETIC (Rest and Digest Response)
Sweat Glands	Stimulates Perspiration	
Eye (Iris Muscles)	Dilates pupil of eyes	
Arrector Pili	Causes erection of Hairs	
Digestive Tract		Increases Peristalsis
Salivary Glands	Inhibits salivary secretion	
Gastric glands		Stimulates secretion of Gastric juices
Pancreas	Inhibits secretion of pancreatic juice	
Intestinal Glands		Promotes secretion of intestinal juice
Liver	<ul style="list-style-type: none"> ✓ Reduces Bile juice release ✓ Glucose levels 	<ul style="list-style-type: none"> ✓ bile juice release ✓ Glucose levels
Bronchial Muscles	Widens air passages to facilitate breathing	
Heart		Decreases rate and force of heart beat
Arteries	Constricts arteries, raises blood pressure	
Urinary Bladder		Promotes emptying the bladder
Kidney	Increases secretion of Renin	
Lungs	Relaxes bronchi	

11. Understand and add Answer questions on “Types of ion channels”



Answer the following statements:

1. What causes ion channels to open?

Ans:

2. Are ion channels always open?

Ans:

3. Do ion channels require ATP?

Ans:

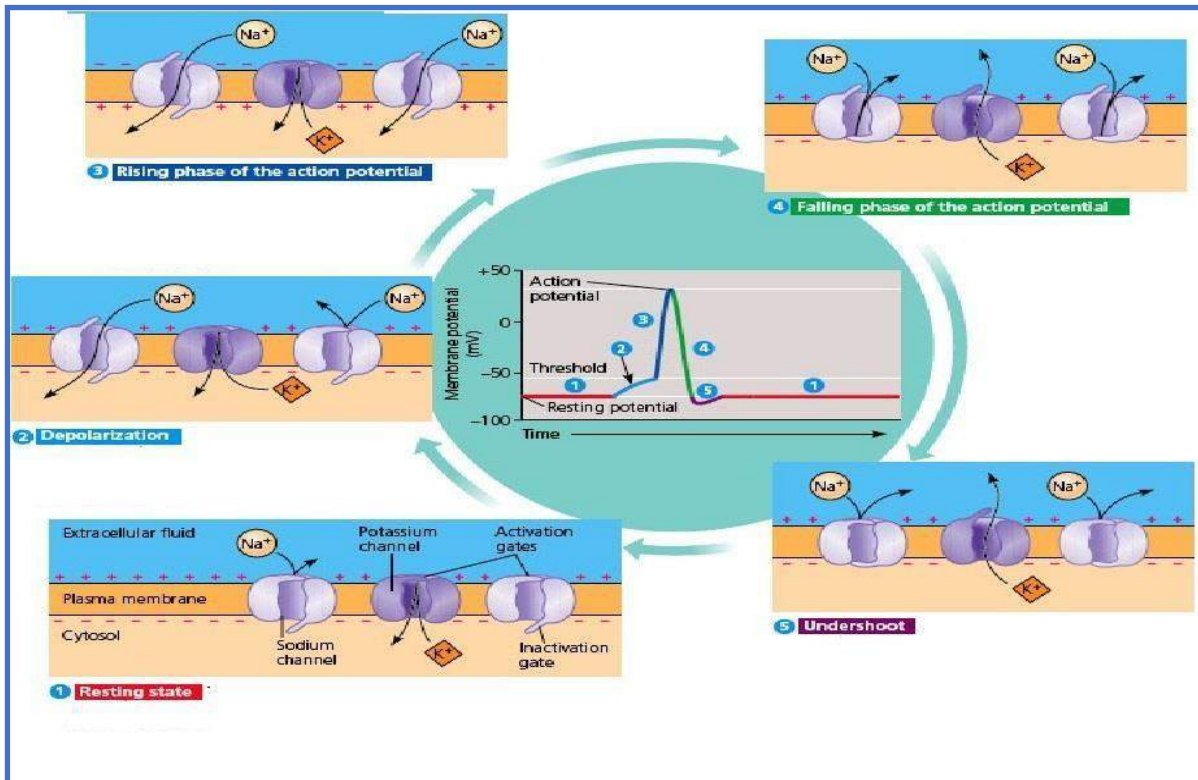
4. Are potassium leak channels always open?

Ans:

5. Why do neurons need ion channels?

Ans:

12. Label and add brief note on stages of “Conduction of Nerve impulse”



Stages	Explanation
1	
2	
3	
4	
5	

13. Label the parts of “Synaptic Transmission” and explain the numbered events:

--

1

2

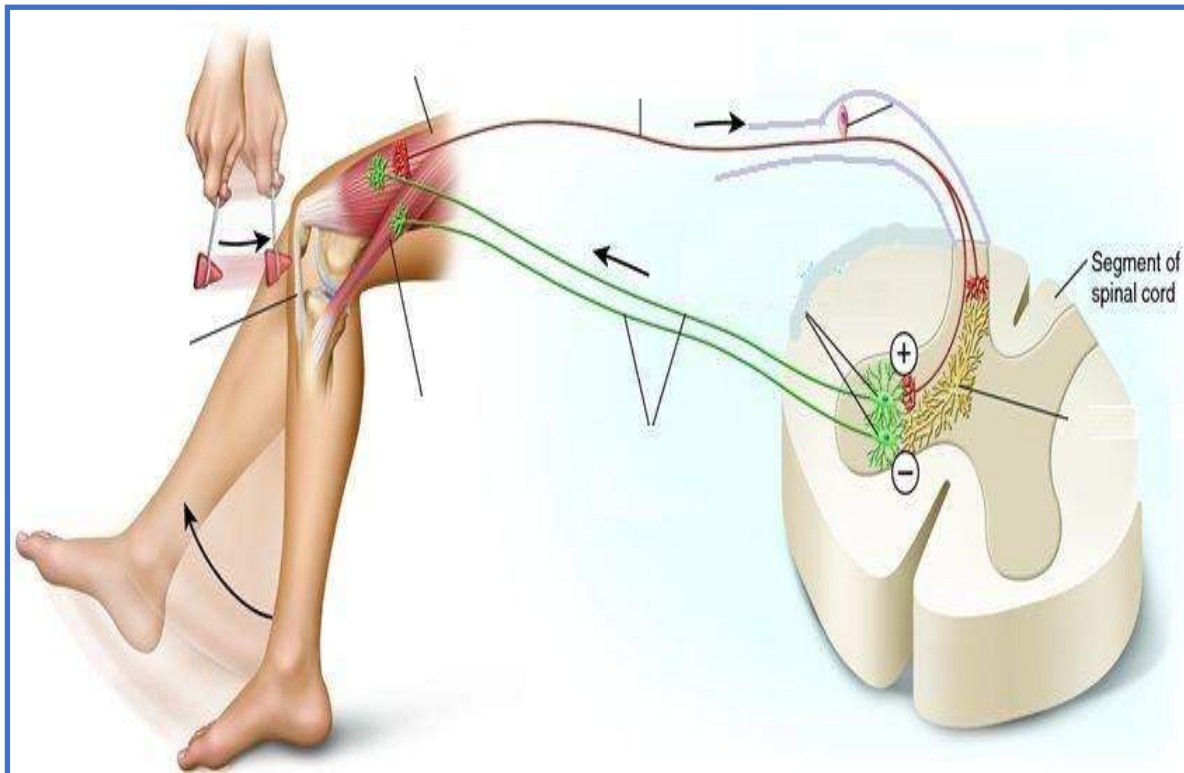
3

4

5

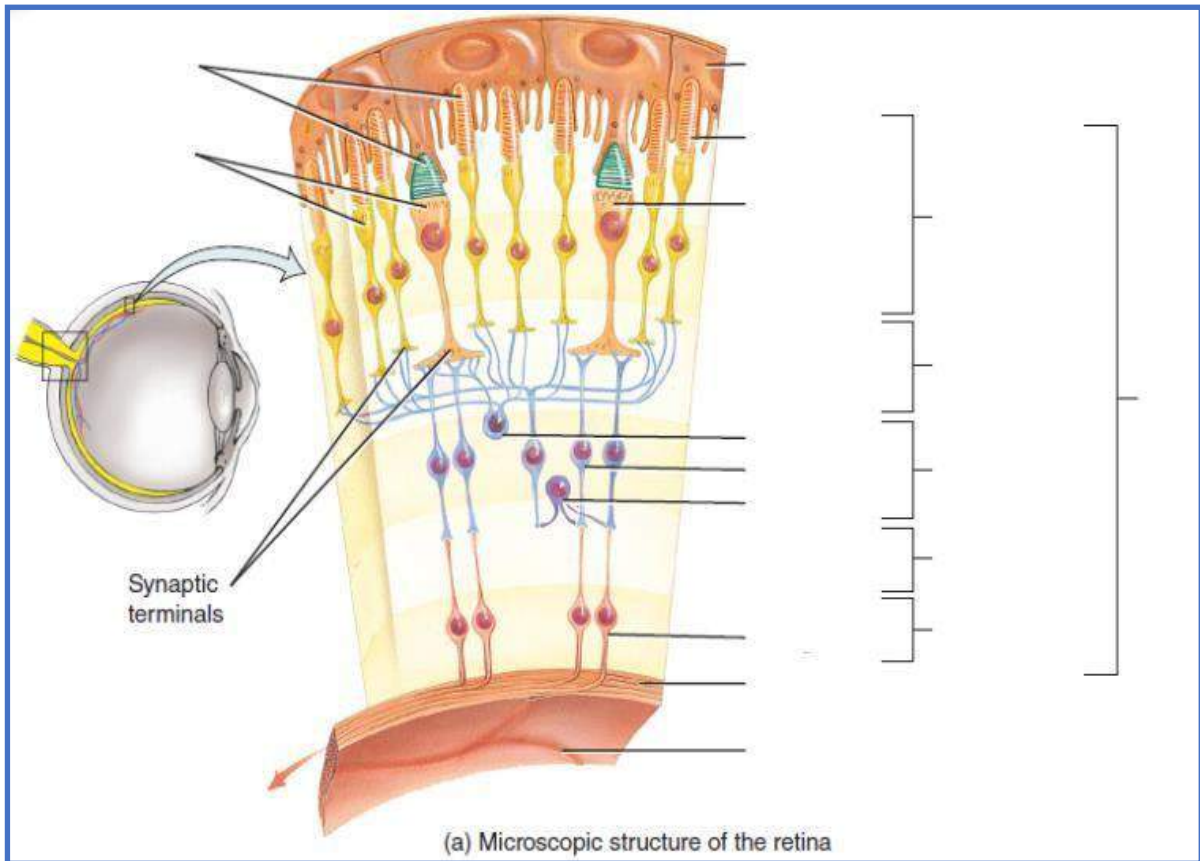
6

14. Label and add brief note on “Knee jerk reflex”



Write a brief note:

15. Label the parts of the microscopic “Structure of retina”:



16. Draw the diagram of “Internal Structure of Ear”



17. Fill in the blanks: (Choose the right words from the list)

Rhodopsin	Touch and Pressure	middle and inner ear	bulbs of krause	hypothalamus.
depolarization	synapse	cochlea	ganglion.	neurofibril node.
Na⁺- K⁺ ATPase pump.	proprioceptors	medulla oblongata.	cerebellum.	meninges.
all-or-none law.	presynaptic neuron	refractory period.	myelin.	neurotransmitter
1	Between which two parts of vertebrate ear oval window is located?			
2	Mechanoreceptors in skin of human beings are called. _____			
3	Name the thermoregulatory centre in human brain_____.			
4	Name the phenomenon in which a muscle fiber contracts completely when it is exposed to a stimulus of threshold strength. _____			
5	Name the junction between the axon of one neuron and the dendrite of another neuron or effector cell. _____			
6	Pacinian corpuscles are receptors for which stimulus? _____			
7	Name the inferior-most portion of the brain stem between the pons and spinal cord__.			
8	Name the neuron carrying the action potential toward a synapse. _____			
9	Name the chemical substance that the terminal end of an axon secetes that either stimulates or inhibits a muscle fiber contraction or an impulse in another neuron_____.			
10	Name the phenomenon in which an electric charge or polarity is lost on the surface of a membrane. _____			
11	Name the time period following stimulation during which a neuron or muscle fiber cannot respond to a stimulus. _____			
12	Name the lipoprotein material that forms a sheathlike covering around some nerve__			
13	What is the name of component of inner ear which is concerned with hearing?_____			
14	Name the group of nerve cell bodies outside the central nervous system. _____			
15	Name the light absorbing pigment in rods of retina of eye. _____.			
16	Name the regular gaps in a myelin sheath around a nerve fiber. _____			
17	Name the active transport mechanism that concentrates sodium ions on the outside of a plasma membrane and potassium ions on the inside of the embrane_____.			
18	Which receptors respond to mechanically induced changes caused by bending, tension etc?_____			
19	Name the portion of the brain that coordinates skeletal muscle movement. _____			
20	Name the group of three membranes that covers the brain and spinal cord. _____			

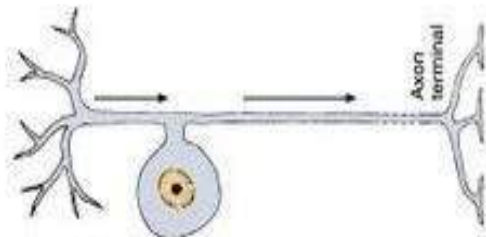
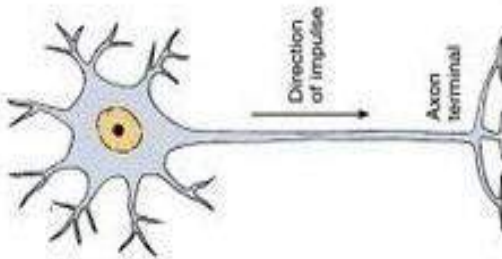

18. Answer “TRUE” or “FALSE”

Sl.No	Statement	True/ False
1.	The supporting cells of the nervous tissue are called Glial Cells.	
2.	The nervous connection between the right and left halves of the cerebrum is called “ Limbic system ”.	
3.	Pia mater is separated from the arachnoid membrane by the “subdural space”.	
4.	Corpus callosum is also called as “Collosal Commissure”.	
5.	Corpora quadrigemina are four rounded optic lobes.	
6.	The dorsal portion of the midbrain consists of a pair of longitudinal bands of nervous tissue called “Crura Cerebri”.	
7.	A branching tree like core of white matter in the cerebellum is called “Arbor vitae”.	
8.	The cerebrum of the brain is called the “gyroscope” of the body.	
9.	The ventricle of the brain, and the sub-arachnoid space are filled with Cerebro-spinal fluid.	
10.	The extension of the conus medullaris as the non-nervous fibrous tissue to the coccyx is called “Filum terminale”.	
11.	Vagus nerve is the tenth spinal nerve.	
12.	The reversal of electrical charge on the axolemma is called “Depolarization”.	
13.	The phenomenon of repolarization typically going more negative than the resting potential to about -90mV, is called Hyperpolarization.	
14.	Falling of voltage below the -70mV level to the resting potential, is called “Undershoot”.	
15.	Ligands are the chemical signals in conduction of nerve impulse.	
16.	Summation of successive inputs from a single presynaptic membrane is called “Temporal Summation”.	
17.	Frigidoreceptors respond when you put your hands in the fridge.	
18.	The middle layer of the eyeball is vascular. It is called Conjunctiva.	
19.	Fovea centralis is a small bulge present in the centre of the Yellow spot.	
20.	The ear drum is also called as “Tympanic membrane”.	
21.	The ear wax secreting sebaceous glands are called as “Ceruminous Glands”.	
22.	The Cochlea is “four tubes in one”.	
23.	Scala media in the ear is filled with “Endolymph”.	
24.	The cochlear epithelium forms a sensory ridge called “Organ of Arbor vitae”.	
25.	The membranous labyrinth in the vestibule of ear consists of two sacs : Saccule and Utricule – together forming “Otolith Organ”.	
26.	The dorsal wall of the cerebrum /cerebral cortex of the brain is called Neopallium.	

	A) Interneuron B) Sensory C) Motor D) Ganglion
13	An involuntary response by the nervous system to a stimulus is a A) Synapse B) Reflex C) Motor response D) Excitation
14	What is common about Serotonin, Acetylcholine, Adrenalin and Nor-adrenalin? a. All are anti-diuretic drugs b. All are pain-relieving drugs c.. All are chemical transmitters or neurohormones d. All are blood pressure lowering drugs
15	The largest number of cell bodies of neurons in our body is found in a. Brain b. Retina c. Spinal Cord d. Tongue
16	One of the following is not the lobe of cerebral hemisphere a. Prietal Lobe b. Occipital Lobe c. Temporal Lobe d. Olfactory Lobe
17	Highly vascular and closely investing protective coat around the brain is called a. Arachnoid b. Pia mater c. Dura mater d. Sub-arachnoid space
18	Due to the presence of Gyri and Sulci, the surface area of cerebral cortex almost a. Doubles b. Becomes three times c. Becomes four times d. Becomes six times
19	The ‘Genu’ and ‘Splenium’ in the brain are associated with a. Cerebellum b. Cerebrum c. Medulla Oblongata d. Vermis
20	A bundle of axons in the PNS is called a A) Tract. B) Nerve C) Nucleus D) Ganglion
21	Which part of the brain is involved in organizing the behavior of an organism related to its survival? A. Amygdala Lobe B. Cerebral cortex C. Corpus callosum D. Hypothalamus
22	Which part of the limbic system converts information from short-term to long-term memory, essential in learning is ? A. Amygdala B. Basal ganglia C. Hippocampus D. Hypothalamus
23	Characteristically large flask shaped “Purkinje Cells” are associated with A. Cerebral Cortex B. Cerebellar Cortex C. Pons D. Hypothalamus
24	Which part is involved in the movement of head to locate and detect the source of sound? A. Superior Colliculi B. Inferior Colliculi C. Pons D. Medulla oblongata
25	The right and left halves of the cerebrum (the cerebral hemispheres) are connected to each other mainly by a bundle of neuron axons called the A) Thalamus. B) Insula. C) Corpus cavernosum. D) Corpus callosum.
26	Signals from the sense organs(such as the ears, eyes, and mouth) are received and analyzed in what part of the brain? A) The cerebellum B) The cerebrum C) The brainstem D) The diencephalon

27	The area of the brain responsible for conscious thought, intellect, memory storage and processing, controlling the movement of skeletal muscles, and sensation is the A) thalamus. B) cerebellum. C) medulla oblongata. D) cerebrum.
28	Emotions, regulation of sleep, wakefulness, sexual arousal, thirst, hunger, body temperature and production of certain hormones are all functions of what structure of the brain? A) Hypothalamus B) Thalamus C) Cerebrum D) Cerebellum
29	This brain area is a routing center for incoming sense signals A) Cerebellum B) Brain stem C) Thalamus D) Spinal cord
30	The hypothalamus does <i>not</i> contain a control center for the homeostatic regulation of A) Body temperature. B) Various emotional states. C) Urination D) Eating.
31	The region of the CNS that contains the vital centers for regulating breathing rate, heart rate, and blood pressure is the A) Thalamus. B) Cerebrum. C) Medulla oblongata. D) Cerebellum.
32	Damage to the cerebellum causes A) Uncontrollable hunger B) Coma. C) Loss of speech D) Loss of balance
33	Involuntary muscles and glands are innervated (stimulated) by neurons of the _____ nervous system A) autonomic B) somatic C) sensory D) central
34	Targets of the autonomic nervous system include all of the following except A) cardiac muscle. B) glands. C) skeletal muscle. D) smooth muscle in hollow organs.
35	The two major divisions of the ANS are A) Peripheral and Central nervous systems B) Voluntary and involuntary muscles C) Sympathetic and parasympathetic D) Neurons and neuroglia
36	Which ANS division is more active when we are relaxed and peaceful? A) Parasympathetic B) Voluntary C) Peripheral D) Central
37	The "fight or flight" response is the term used to describe activation of the _____. A) Parasympathetic division B) Sympathetic division C) Somatic nervous system D) CNS
38	The effects of sympathetic and parasympathetic neurons on the heart can best be described as A) antagonistic. B) identical C) cooperative. D) adrenergic
39	In general, parasympathetic activation will produce effects that are _____ to those produced by activation of sympathetic neurons. A) similar B) antagonistic C) complimentary D) identical
40	When the parasympathetic system is stimulated, what neurotransmitter is released?

	A) Acetylcholine Dopamine	B) Norepinephrine	C) Epinephrine	D)
LEVEL – 2				
41	Activities of cerebellum are A. All involuntary but may involve learning in their early stages B. All voluntary and may involve learning in their early stages C. All voluntary and do not involve learning in their early stages D. All involuntary but do not involve learning in their early stages			
42	Basal ganglion is a collection of subcortical nuclei in the fore brain, at the base of the cortex. A primary function of the basal ganglia is A. Sensory integration B. Short term memory C. Planning stereotyped movements D. Neuroendocrine Control			
43	Which part of the brain is like a defense castle controlling moods and plays an important role in emotional behavior such as aggression and remembering fear? A. Hippocampus B. Amygdala C. Limbic system D. Thalamus			
44	Which of the following are not areas of the cerebrum? A) Sensory signal receiving areas. B) Heart rate and breathing rate control areas C) Logic and language areas D) Motor signal generating areas			
45	Sensations from the skin are converted to perceptions in which part of the cerebrum? A) The primary motor area. B) The primary sensory area C) Wernicke's area D) Broca's area			
46	The spinal cord contains tracts of inter neurons. Some tracts carry _____ signals downward and other tracts carry _____ signals upward. A) Cardiac, Motor B) Sensory, Autonomic C) Sensory, Motor D) Motor, Sensory			
47	The PNS contains these types of neurons (two answers) A) Sensory B) Inter neurons C) Motor neurons D) Neuroglial neurons			
48	Somatic motor neurons have axons that conduct signals from the CNS to _____; and are usually under _____ control. A) Skeletal muscle; involuntary B) Hollow organs; voluntary C) Hollow organs; involuntary D) Skeletal muscle; voluntary			
49	Motor signals in the ANS always pass through _____ (a number) motor neuron(s) before reaching a muscle. Motor signals in the SNS always pass through _____ (a number) motorneuron(s) before reaching a muscle. A) 2, 2 B) 2, 1 C) 1, 3 D) 1, 2			
50	The ganglia of the _____ division are closer to the spine than the ganglia of the _____ division. A) Sympathetic, Parasympathetic B) Parasympathetic, Peripheral C) Sympathetic, Peripheral D) Parasympathetic, Sympathetic			
51	Which of the following releases norepinephrine as a neurotransmitter? A) preganglionic sympathetic neurons B) postganglionic sympathetic neurons C) preganglionic parasympathetic neurons D) postganglionic parasympathetic neurons			

52	<p>All motor neurons release acetylcholine as a neurotransmitter except</p> <p>A) Postganglionic sympathetic neurons B) Somatic motor neurons C) Postganglionic parasympathetic neurons D) Specific cardiac and smooth muscle fibers.</p>
53	<p>When the parasympathetic system is stimulated, what neurotransmitter is released?</p> <p>A) Acetylcholine B) Norepinephrine C) Epinephrine D) Dopamine</p>
54	<p>Which of the following statements is true for preganglionic sympathetic neurons of the ANS?</p> <p>A) They are longer than postganglionic sympathetic neurons. B) They receive signals from interneurons C) They release norepinephrine. D) They synapse with muscles</p>
55	<p>Sensory neurons have the shape shown below on the left. The name of this neuron shape is _____. Most motor neurons and interneurons have the shape shown below on the right. The name of this neuron shape is _____.</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>A) Unipolar neuron & Unipolar neuron B) Multipolar neuron & Unipolar neuron C) Unipolar neuron & Multipolar neuron D) All the above</p>
56	<p>Sensory nerve signals converge in the _____, where they are sorted and relayed to the proper sensory areas of the cerebrum for interpretation.</p> <p>A) Pons B) Thalamus C) Medulla D) All</p>
57	<p>Name ventricles A and B shown below. (Hint: Ventricles names are numbers).</p>  <p>A) 3rd & 4th ventricles B) 2nd & 4th Ventricles C) 1st & 2nd ventricles D) 2nd & 3rd ventricles</p>
58	<p>The dendrites of a neuron contain _____, which allow the neuron to bind to and respond to neurotransmitters</p> <p>A) Myelin B) Receptor proteins C) Na⁺ and K⁺ ions D) None</p>

59	<p>When the neurotransmitter molecules released from the axon terminals of a neuron have diffused across the synapse and have reached the dendrites of the target neuron, the neurotransmitters</p> <p>A) Enter the target neuron by membrane transport proteins (ion channels) B) Diffuse out of the synapse without causing any response in the target neuron C) Bind to receptor proteins D) Stimulate neuron growth</p>
60	<p>When a neurotransmitter binds to a receptor on the target cell, it causes the target cell to have a (n)...</p> <p>A) Repolarization B) Growth phase C) Growth inhibition D) Action potential</p>
61	<p>Arrange these action potential events in their proper sequence:</p> <p>(1) The neuron is stimulated at the dendrites (2) K⁺ gates open (3) The neuron is in a polarized “resting” state (4) Na⁺gates open (5) The cell is fully depolarized (6) The cell is fully repolarized</p> <p>A) 1, 2, 4, 3, 5, 6 B) 3, 1, 4, 5, 2, 6 C) 4, 6, 2, 1, 5, 3 D) 1, 4, 2, 6, 5, 3</p>
62	<p>The movement of K⁺ out of the cell makes the inside of the cell less positive (more negative) and acts to restore the original resting voltage of the neuron -a process called</p> <p>A) Depolarization B) Hyperpolarization C) Repolarization D) Overshoot</p>
63	<p>Both the depolarization and repolarization changes that occur during the action potential are produced by</p> <p>A) Ions moving across the cell membrane B) Small neuroglial cells that act as batteries for the neuron itself C) Negative stimuli D) Enzymes creating new ions</p>
64	<p>The axon has voltage gated ion channels. The term "voltage gated" means that...</p> <p>A) Ion channels open and close because of changes in the neuron’s voltage B) Neuron voltage is controlled by neuroglial cells C) Ion gates will not respond unless the neuron is in the CNS D) Voltage can only be controlled by a reflex</p>
65	<p>In the presence of Ca²⁺ channel blockers, which of the following will be true?</p> <p>A. Neurotransmitter is released but the Na⁺ channel of post-synaptic neuron will not open. B. Neurotransmitter is not released but the Na⁺ channel of post-synaptic neuron will open. C. Neurotransmitter is released but the K⁺ channel of post-synaptic neuron open up. D. Neither Neurotransmitter is released nor the Na⁺ channel of post-synaptic neuron will open up.</p>
66	<p>Mark the incorrect match</p> <p>A. Parkinson’s – Deficiency of Dopamine disease B. Schizophrenia – Excess of Dopamine C. Excess of Alzheimer’s disease – Acetylcholine</p>

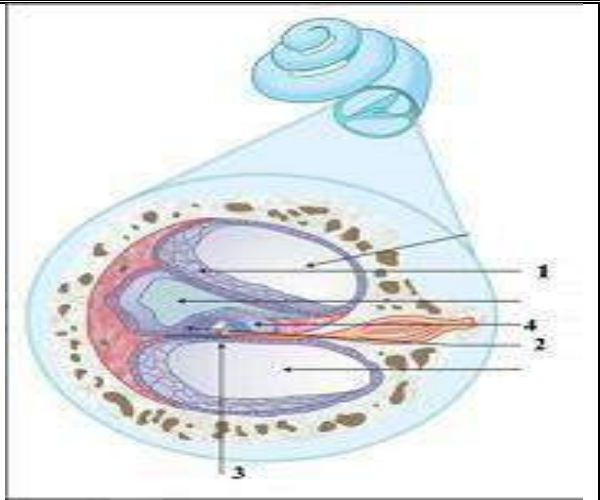
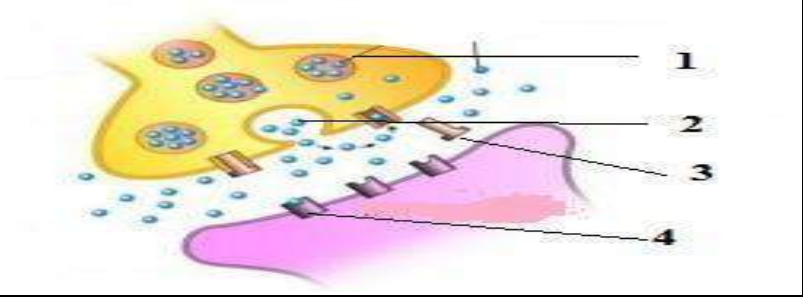
	D. Multiple Sclerosis – degeneration of myelin sheath
67	A molecule cannot be tasted or smelled until it has been A. Converted into protein B. Converted into transmitter C. Grouped into multi molecular complex D. Dissolved in a liquid
68	In right handed individuals , A. Left cerebral hemisphere is poorly developed B. Right hemisphere is the dominant hemisphere C. Left cerebral hemisphere is the dominant hemisphere D. Both cerebral hemispheres are dominant
69	Stimulation of parasympathetic nerves is likely to produce all the following except A. Decreased insulin secretion. B. Increased exocrine pancreatic secretion C. Increased bile synthesis D. Increased gastric secretion
70	The hypothalamus is involved in the regulation of 1. Circadian Rhythm 2. Water balance 3. Respiration and Heatt beat 4. Maintenance of Homeostasis 5. Appetite and satiety. Mark the correct one. A. 1,2,3,4,&5 B. 2 & 4 Only C. 1,2,3,&4 only D. 1,2 and 4 only
71	Which of the following donot occur during the accommodation reflex? A. Contraction in ciliary muscles B. Suspensory ligament become loose C. Decrease in radius of curvature D. Decreasing Refraction
72	A person is unable to speak fluent sentences, although he has no problem in understanding written and spoken words due to damage to the A. Broca's area B. Wernike's area C. Visual area D. Auditory area
73	If we put water in the eye, there will be blurred image due to A. Decrease in refraction as cornea forms plane surface B. Increase in refraction as cornea forms plane surface C. Decrease in refraction as cornea forms Concave surface D. Increase in refraction as cornea forms concave surface
74	During the transmission of impulse from tympanum to internal ear, amplification of sound waves occur. The amplification due to difference in the size of tympanum and fenestra ovalis is about A. 10 times B. 22 times C. 2.2. times D. 40 times
75	In hypermetropia, the image is formed A. Before retina and is corrected by convex lens B. Behind retina and is corrected by convex lens C. Before retina and is corrected by concave lens D. Behind retina and is corrected by concave lens
76	Brachial swelling of the spinal cord extends from A. 4 th Cervical to the 1 st thoracic vertebrae B. 1 st Cervical to the 4 th cervical vertebrae C. 5 st Cervical to the 8 th cervical vertebrae D. 1 st thoracic to the 4 th thoracic vertebrae
77	The trigeminal nerve arises from brain in the region of A. Pons varoli and divides into palatine, chorda tympani and hyomandibular

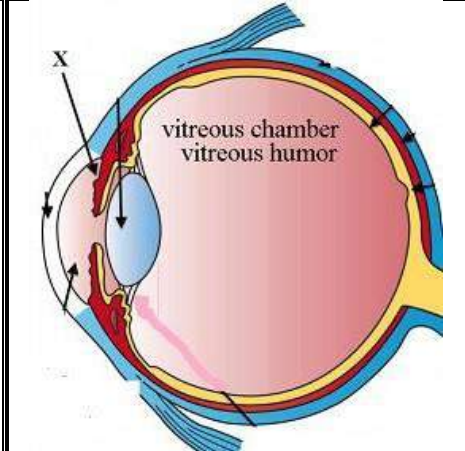
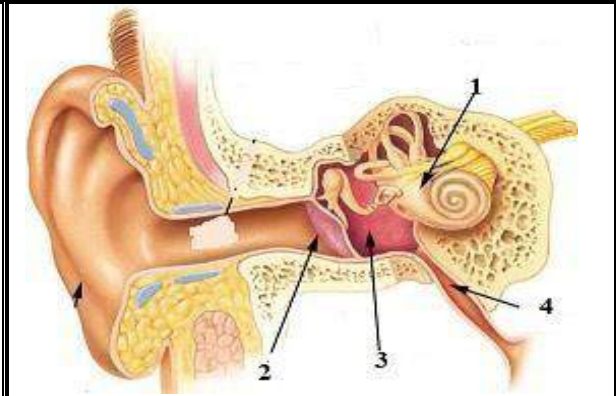
	<p>B. Medulla and divides into palatine, hyomandibular, and chorda tympani. C. Cerebellum and divides into ophthalmic, maxillary and mandibular D. Pons varolii and divides into ophthalmic, maxillary and mandibular</p>								
78	<p>Which one of the following pairs is motor nerve? A. Occulomotor and facial B. Vagus and Trigeminal C.. Optic and Olfactory D. Trochlear and Hypoglossal</p>								
79	<p>Meissner's corpuscles are located in A. Pancreas and secrete trypsinogen B. Adrenal Gland and secrete trypsinogen C. Spleen and destroys the erythrocytes D. Skin and perceives gentle pressure i.e Tangoreceptor function</p>								
80	<p>If receptors are removed from the post-synaptic membrane, then A. Synaptic transmission will be faster B. Chemical synaptic transmission will become slow C. Chemical synaptic transmission will not occur D. Synaptic transmission will be not affected</p>								
LEVEL – 3 & From THE MEDICAL ENTRANCE ARCHIVES)									
81	<p>If the Na⁺ - K⁺ pump stops working, then A. Na⁺ - K⁺ will be in excess in extracellular fluid B. Na⁺ will be in excess in extra cellular fluid C. K⁺ will be in excess in the intracellular fluid D. Na⁺ will be in excess in the intracellular fluid</p>								
82	<p>Unidirectional transmission of a nerve impulse through nerve fiber is due to the fact that A. Nerve fibre is insulated by a medullary sheath (AIIMS 2004) B. Sodium pump starts operating only at the cyton and then continues into nerve fiber C. Neurotransmitters are released by dendrites and not by axon endings D. Neurotransmitters are released by axons endings and not by dendrites.</p>								
83	<p>During the transmission of nerve impulse through a nerve fiber, the potential on the inner side of the plasma membrane has which type of electric charge? (AIPMT 2007) A. First positive, then negative and continue to be negative B. First negative, then positive and continue to be positive C. First positive, then negative and again back to positive D. First negative, then positive and again back to negative</p>								
84	<p>Which of the following statements is correct for node of Ranvier of nerve (AIPMT 2002) A. Neurilemma is discontinuous B. Myelin sheath is discontinuous C.. Both Neurilemma and Myelin sheath are discontinuous D.. Completely covered by myelin sheath.</p>								
85	<p>Column I list the parts of human brain and the Column II lists the functions. Match the columns and identify the correct choice from those given: (KCET 2005)</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center; width: 50%;">COLUMN – I</td> <td style="text-align: center; width: 50%;">COLUMN - II</td> </tr> <tr> <td>A. Cerebrum</td> <td>1. Control the pituitary</td> </tr> <tr> <td>B. Cerebellum</td> <td>2. Controls vision and hearing</td> </tr> <tr> <td>C. Hypothalamus</td> <td>3. Controls the rate of heart beat</td> </tr> </table>	COLUMN – I	COLUMN - II	A. Cerebrum	1. Control the pituitary	B. Cerebellum	2. Controls vision and hearing	C. Hypothalamus	3. Controls the rate of heart beat
COLUMN – I	COLUMN - II								
A. Cerebrum	1. Control the pituitary								
B. Cerebellum	2. Controls vision and hearing								
C. Hypothalamus	3. Controls the rate of heart beat								

	<p>D. Mid brain</p> <p>4. Seat of intelligence 5. Maintains body posture</p> <p>A. A to 5; B to 4; C to 2; D to 1 1</p> <p>C.. A to 5; B to 4; C to 1; D to 2 2</p> <p>B. A to 4; B to 5; C to 2; D to 1</p> <p>D. A to 4; B to 5; C to 1; D to 2</p>															
86	<p>The function of cerebrospinal fluid does not include (HPPMT 2006)</p> <p>A. Protection of brain and spinal cord by containing antibodies.</p> <p>B. Protection of delicate brain and spinal cord from shock</p> <p>C. As a medium for excretion of waste products</p> <p>D. Buoyancy to brain.</p>															
87	<p>Column I list the parts of human brain and the Column II lists the functions. Match the columns and identify the correct choice from those given: (Kerala PMT 2005)</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center; width: 50%;">COLUMN – I</td> <td style="text-align: center; width: 50%;">COLUMN - II</td> </tr> <tr> <td>A. Cervical nerves</td> <td>1. 5 pairs</td> </tr> <tr> <td>B. Thoracic nerves</td> <td>2. 1 pair</td> </tr> <tr> <td>C. Lumbar nerves</td> <td>3. 12 pairs</td> </tr> <tr> <td>D. Coccygeal nerves</td> <td>4. 8 pairs</td> </tr> </table> <p>A. A to 2; B to 4; C to 1; D to 3 B. A to 4; B to 3; C to 1; D to 2</p> <p>C.. A to 4; B to 2; C to 1; D to 3 D. A to 1; B to 4; C to 2; D to 3</p>	COLUMN – I	COLUMN - II	A. Cervical nerves	1. 5 pairs	B. Thoracic nerves	2. 1 pair	C. Lumbar nerves	3. 12 pairs	D. Coccygeal nerves	4. 8 pairs					
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88	<p>Which of the following is not under the control of Vagus nerve? (JIPMER 2005)</p> <p>A. Gastrointestinal movement B. Respiratory Movement</p> <p>B. C. Salivation D. None</p>															
89	<p>Given below is a table comparing the effects of sympathetic and parasympathetic nervous system for four features (1-4). Which one feature is correctly matched? (AIIMS 2006)</p> <table style="width: 100%; border: none;"> <thead> <tr> <th style="text-align: center;">Feature</th> <th style="text-align: center;">Parasympathetic Nervous system</th> <th style="text-align: center;">Sympa nervous</th> </tr> </thead> <tbody> <tr> <td>A. Salivary Glands</td> <td style="text-align: center;">Stimulates secretion</td> <td style="text-align: center;">Inhibits se</td> </tr> <tr> <td>B. Pupil</td> <td style="text-align: center;">Dilates</td> <td style="text-align: center;">Constrict t</td> </tr> <tr> <td>C. Heart rate</td> <td style="text-align: center;">Decreases</td> <td style="text-align: center;">Increases</td> </tr> <tr> <td>D. Intestinal Peristalsis</td> <td style="text-align: center;">Stimulates</td> <td style="text-align: center;">Inhibits</td> </tr> </tbody> </table>	Feature	Parasympathetic Nervous system	Sympa nervous	A. Salivary Glands	Stimulates secretion	Inhibits se	B. Pupil	Dilates	Constrict t	C. Heart rate	Decreases	Increases	D. Intestinal Peristalsis	Stimulates	Inhibits
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90	<p>Which of the following statements is correct? (AIPMT 2006)</p> <p>A. Neither hormones control neural activity, not the nervous control on endocrine activity.</p> <p>B. Endocrine glands regulate the neural activity , but not vice versa</p> <p>C. Neurons regulate the endocrine activity, but not vice versa</p> <p>D. Endocrine glands regulate the neural activity and the nervous system regulate the endocrine activity.</p>															
91	<p>If the dorsal root of the spinal cord is broken down, then its effect is (JIPMER 2006)</p> <p>A. No effect on impulse B. Impulse is transmitted fast</p> <p>C.. impulse is transmitted but slowly D. No impulse is transmitted from receptor</p>															

92	<p>Somesthetic or post-central area is responsible for (UPMT 2006)</p> <p>A. Initiation of motor impulses for voluntary muscles B. Initiation of motor impulses for involuntary muscles C. Perception of pain, touch, and temperature D. Coordination of speech</p>						
93	<p>Adrenalin directly affects on..... (AIPMT 2002)</p> <p>A. S-A Node B. C. Dorsal root of spinal cord stomach B. β - cells of Langerhans D. Epithelial cells of the</p>						
94	<p>Vagus nerve is mainly composed of parasympathetic fibres. The preganglionic fibres forms a network in the walls of the gut. This network is known as ... (UPMT2006)</p> <p>A. Choroid plexus B. Nervous Plexus C. Auerbach's Plexus D. Brachial plexus</p>						
95	<p>During the conduction of nerve impulse, the action potential is the result of the movement of (wardha 2007)</p> <p>A. Na^+ from intracellular fluid to extra cellular fluid B. Na^+ from Extracellular fluid to intracellular fluid C. Na^+ towards the both directions D. None of the above</p>						
96	<p>A man is admitted to a hospital. He is suffering from an abnormally low body temperature, loss of appetite, and extreme thirst. His brain scan would probably show a tumour in (KCET 2009)</p> <p>A. Pons B. Thalamus C. Cerebellum D. Hypothalamus</p>						
97	<p>When a neuron is in resting state, i.e not conducting any impulse, the axonal membrane is (CBSE 2011)</p> <p>A. Comparatively more permeable to Na^+ ions and nearly impermeable to K^+ ions B. Equally permeable to both Na^+ and K^+ ions C. Impermeable to both Na^+ and K^+ ions D. Comparatively more permeable to K^+ ions and nearly impermeable to Na^+ ions</p>						
98	<p>Cornea transplant in humans is almost never rejected. This is because.. (AIPMT 2008)</p> <p>A. It is composed of enucleated cells B.. It is a non-living layer C.. Its cells are least penetrable by bacteria D. It has no blood supply.</p>						
99	<p>Static equilibrium is maintained by (HPMT – 2007)</p> <p>A. Utriculus B. Sacculus C. Both of these D. Semicircular canals</p>						
100	<p>Eustachian tube connects (CPMT 2009)</p> <p>A. Pharynx to middle year B. Middle year to external year C.. Left Ventricle to right ventricle D. Left atrium to right atrium</p>						
101	<p>Select the answer which correctly matches the endocrine gland with the hormone it secretes and its function/deficiency symptom: (NEET 2013)</p> <table border="1"> <thead> <tr> <th>Endocrine Gland</th> <th>Hormone</th> <th>Function/Deficiency symptom</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Endocrine Gland	Hormone	Function/Deficiency symptom			
Endocrine Gland	Hormone	Function/Deficiency symptom					

	A. Posterior pituitary	Growth Hormone (GH)	Over secretion stimulates abnormal growth																					
	B. Thyroid Gland	Thyroxine	Lack of iodine in diet results in Goitre																					
	C. Corpus leuteum	Testosterone	Stimulates spermatogenesis																					
	D. Anterior pituitary	Oxytocin	Stimulates uterus contraction during child birth																					
102	Bowman's Glands are found in (CBSE2006) A. Olfactory epithelium B. External Auditory Canal C. Cortical Nephrons only D. Juxtamedullary nephrons																							
103	In the following abnormalities of eye , which one is a serious condition that leads to blindness? (CBSE 2008) A. MYOPIA B. GLAUCOMA C. PRESBYOPIA D. ASTIGMATISM																							
104	The lens and cornea are not having blood supply. So the nutrients are supplied by (KCET 2003) A. Retina B. Eye lash C. Blind spot D. Aqueous humour																							
105	Which of the following statements is correct? (NEET 2019) A. Cornea is an external, transparent and protective proteinacious covering of the eye-ball. B. Cornea consists of dense connective tissue of elastin and can repair itself. C. Cornea is convex, transparent layer which is highly vascularised. D. Cornea consists of dense matrix of collagen and is the most sensitive portion the eye.																							
106	The transparent lens in the human eye is held in its place by (A) smooth muscles attached to the iris (B) ligaments attached to the iris (C) ligaments attached to the ciliary body (D) smooth muscles attached to the ciliary body																							
107	Match the column-I (various phase of an action potential) with column-II (ionic activity associated) and choose the correct option. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Column-I</th> <th></th> <th>Column-II</th> </tr> </thead> <tbody> <tr> <td>A.</td> <td>Resting stage of a neuron</td> <td>I.</td> <td>Opening and then closing of the</td> </tr> <tr> <td>B.</td> <td>Depolarisation phase in the generation of action potential.</td> <td>II.</td> <td>All voltage gated sodium and potassium channels are closed.</td> </tr> <tr> <td>C.</td> <td>Repolarisation phase in the generation of action potential</td> <td>III.</td> <td>The sodium channels remain opened.</td> </tr> <tr> <td>D.</td> <td>Absolute refractory phase.</td> <td>IV.</td> <td>Opening of potassium gates and the rushing of potassium</td> </tr> </tbody> </table> <p> A) A-II; B-I; C-IV; D-III B) A-I; B-II; C-III; D-IV C) A-III; B-IV; C-I; D-II D) A-IV; B-II; C-III; D-I </p>					Column-I		Column-II	A.	Resting stage of a neuron	I.	Opening and then closing of the	B.	Depolarisation phase in the generation of action potential.	II.	All voltage gated sodium and potassium channels are closed.	C.	Repolarisation phase in the generation of action potential	III.	The sodium channels remain opened.	D.	Absolute refractory phase.	IV.	Opening of potassium gates and the rushing of potassium
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108	<p>"X" is spiral shaped structure (given below) consisting of hair cells that serve as receptors for auditory stimuli. Identify "X" and its label & location (marked as 1, 2, 3 and 4) from the given diagrammatic representation of the sectional view</p> 	<p>A) X- Organ of corti, 2, 3. B) X- Eustachian tube, 1, 2. C) X- Semicircular canal, 3, 4. D) X- Crista ampullaris, 1, 4.</p>				
109	<p>Which of the following statements is correct regarding a myelinated nerve fibre?</p> <table border="1"> <tr> <td>(i) It is always associated with an axon.</td> </tr> <tr> <td>(ii) It allows rapid conduction of nerve impulses.</td> </tr> <tr> <td>(iii) It allows slow conduction of nerve impulses.</td> </tr> <tr> <td>(iv) It has nodes of Ranvier.</td> </tr> </table> <p>A) Only (i) and (ii) B) Only (i), (ii), and (iii) C) Only (i), (ii), and (iv) D) Only (i), (iii), and (iv)</p>		(i) It is always associated with an axon.	(ii) It allows rapid conduction of nerve impulses.	(iii) It allows slow conduction of nerve impulses.	(iv) It has nodes of Ranvier.
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110	<p>The resting membrane potential for neuron A is -70mV, while the resting potential for neuron B is -50mV. The threshold voltage for the production of an action potential is -35mV for both neurons. Which of the following statements is incorrect?</p> <p>A) Neuron A must depolarize by 35mV to reach the threshold voltage. B) Neuron B must hyperpolarize by 15mV to reach the threshold voltage. C) The inside of both neurons is negatively charged with respect to the outside. D) A single EPSP received by neuron A would cause it to depolarize slightly.</p>					
111	<p>In the given figure of synapse few structure are marked as 1, 2, 3, and 4. Study the figure carefully and identify the structure which transmits signal across a chemical synapse.</p> 	<p>A) 1 B) 2 C) 3 D) 4</p>				

112	<p>The given diagram shows different parts of human eye with one part labeled as X. Which the following statement is correct regarding label X?</p> 	<p>A) It is the opening in lens that permit into the inner chambers of the eye.</p> <p>B) It is the coloured portion of vascular</p> <p>C) It is a biconcave structure that change to bring objects into focus.</p> <p>D) It is thick, jelly-like substance in the posterior compartment of the eye.</p>
113	<p>Refer the given figure of ear with few structures marked as 1, 2, 3 & 4. Which labeled structure converts sound waves into mechanical vibrations?</p> 	<p>A) 1</p> <p>B) 2</p> <p>C) 3</p> <p>D) 4</p>
114	<p>Several nervous system diseases result from a loss of support cells or of substances produced by support cells (such as myelin). The primary function of these support cells is to:</p> <p>A) Act as supporting structures within nervous tissue.</p> <p>B) Produce insulating material around axons.</p> <p>C) Assist in the conduction of impulses along neurons.</p> <p>D) All of the above</p>	
115	<p>A particular disease of the nervous system specifically involves the Ca^{2+} ion channels at the chemical synapses of motor neurons where neurotransmitter is stored and released. In other words, this disease affects the</p> <p>A) Axon terminals of the pre-synaptic cell and the release of acetylcholine.</p> <p>B) Axon terminals of the postsynaptic cell and the release of K^{+} ions.</p> <p>C) Electrical synapses.</p> <p>D) Axon terminals of the pre-synaptic cell and the release of K^{+} ions.</p>	
116	<p>Which of the following statements is false about the electrical synapse?</p> <p>(i) At electrical synapses, the membranes of pre and post synaptic neurons are in very close proximity.</p>	

	<p>(ii) Electrical current can flow directly from one neuron into the other across the synapses.</p> <p>(iii) Transmission of an impulse across electrical synapses is very similar to impulse conduction along single axon.</p> <p>(iv) Electrical synapses pass electrical signal between cells with the use of acetylcholine (Ach).</p> <p>(v) Electrical synapses are fast in our system.</p>																								
	A) (i) and (ii) B) Only (ii) C) Only (iv) D) Only (v)																								
117	<p>The following statements about nerve metabolism excitation and conduction are true except:</p> <p>A. Nerve fibre can be excited under anaerobic conditions.</p> <p>B. Nerve conduction proceeds in the absence of oxygen and development of action potential does not depend on metabolism immediately.</p> <p>C. In the absence of oxygen, action potential can be generated and nerve conduction proceeds, but later, it fails as the Na⁺ pump cannot operate.</p> <p>D. At rest, the oxygen consumption in the brain is lesser than what is seen in a nerve.</p>																								
118	<p>Match the given terms in column-I with its definition given in column-II and choose the correct options.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;"></th> <th style="width: 40%;">Column-I</th> <th style="width: 10%;"></th> <th style="width: 40%;">Column-II</th> </tr> </thead> <tbody> <tr> <td>A.</td> <td>Semi-circular canal</td> <td>I.</td> <td>Spiral organ of Corti</td> </tr> <tr> <td>B.</td> <td>Vestibule</td> <td>II.</td> <td>Fluid found in the scala vestibule and scala tympani.</td> </tr> <tr> <td>C.</td> <td>Cochlea</td> <td>III.</td> <td>Evaluates rotational motion</td> </tr> <tr> <td>D.</td> <td>Perilymph</td> <td>IV.</td> <td>Fluid found within the Organ of Corti</td> </tr> <tr> <td>E.</td> <td>Endolymph</td> <td>V.</td> <td>Responds to gravity and movements of the head</td> </tr> </tbody> </table> <p>A) A-III; B-V; C-I; D-II; E-IV B) A-I; B-II; C-III; D-IV; E-V C) A-II; B-III; C-IV; D-V; E-I D) A-IV; B-I; C-V; D-II; E-III</p>		Column-I		Column-II	A.	Semi-circular canal	I.	Spiral organ of Corti	B.	Vestibule	II.	Fluid found in the scala vestibule and scala tympani.	C.	Cochlea	III.	Evaluates rotational motion	D.	Perilymph	IV.	Fluid found within the Organ of Corti	E.	Endolymph	V.	Responds to gravity and movements of the head
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119	<p>Which of the following statements is correct?</p> <p>A. The internal ear receives sound waves and directs them to the ear drum.</p> <p>B. The membranous canals are suspended in the endolymph of the bony canals.</p> <p>C. The ear ossicles increase the efficiency of transmission of sound waves to the inner ear.</p> <p>D. The malleus is attached to the oval window and the stapes is attached to the temporal membrane of the cochlea.</p>																								
120	<p>Route of reflex arc is:</p> <p>A) Receptors, effectors, grey mater and motor fibers</p>																								

	<p>B) Receptors, sensory fibers, grey mater, motor fibers and effectors C) Sensory fibers, grey mater, motor-fibres, receptors and effectors D) Effectors, grey mater, motor, sensory fibres and receptors</p>
121	<p>'Ishihara charts' are used by ophthalmologists to detect: A) Visual acuity B) Night blindness C) Colourblindness D) Microbial infection</p>
122	<p>One group of neurotransmitter receptors is the metabotropic receptors. Which one of the following statements about metabotropic receptors is false? A) Both muscarinic and p-adrenergic receptors are metabotropic receptors. B) Metabotropic receptors are coupled with A proteins. C) Metabotropic receptors can stimulate gene expression. D) Muscarinic receptors bind with acetylcholine.</p>
123	<p>Which of the following statement is incorrect? A) The ear ossicle attached to tympanic membrane is malleus. B) Opsin (of rhodopsin) develops from vitamin A. C) The pressure on ear drum is equalised by Eustachian tube. D) Otolith organ consists of saccule and utricle.</p>

20. Assertion & Reasoning Questions

<p>In each of the following question a statement of Assertion (A): is given followed by a corresponding statement of Reason (R): just below it. Of the statements, mark the correct answer as</p> <p>a. If both assertion and reason are true and reason is the correct explanation of assertion b. If both assertion and reason are true but reason is not the correct explanation of assertion c. If assertion is true but reason is false d. If both assertion and reason are false</p>	
1	<p>Assertion (A): In the nervous system generation of action potential depends upon the influx of sodium ion into axoplasm Reason (R) : Influx of sodium ion during nerve impulse generation is due to efflux of potassium ions.</p>
2	<p>Assertion (A): "Presence of myelin sheath increases the rate of conduction of nerve impulse. Reason (R) : Ionic channels are absent in the area covered by myelin sheath. Therefore, depolarization occurs only at the nodes of ranvier, resulting in salutatory or jumping conduction.</p>
3	<p>Assertion (A): Receptors in the tendon, joints give information regarding the position and movements of different parts of the body. Reason (R) : These are termed as "Noci-receptors".</p>
4	<p>Assertion (A): The sharpest vision is in fovea centralis. Reason (R) : The relationship of receptor to bipolar cells to ganglion cells is 1:1:1 within fovea centralis.</p>
5	<p>Assertion (A): The post ganglionic nerve fiber of parasympathetic nervous system</p>

	<p>has acetylcholine while the sympathetic nervous system has adrenalin as the neurotransmitters.</p> <p>Reason (R): Sympathetic nervous system inhibits the intestinal peristalsis while parasympathetic stimulates peristalsis.</p>
6	<p>Assertion(A) : Brain and spinal cord has a common covering.</p> <p>Reason (R) : Both brain and spinal cord possess meninges.</p>
7	<p>Assertion (A): Cerebrospinal fluid is present throughout the CNS.</p> <p>Reason (R): CSF has no such function.</p>
8	<p>Assertion (A): The brain stem contains centers for controlling activities.</p> <p>Reason (R): Brain stem is very sensitive.</p>
9	<p>Assertion (A): Spinal cord has a column of both white and grey matter.</p> <p>Reason (R): Grey matter forms the central spinal canal.</p>
10	<p>Assertion (A): Motor end plate is a neuromuscular junction.</p> <p>Reason (R): Motor end plate is the junction between motor neuron and muscle fib</p>
11	<p>Assertion (A): Corpuscallosum is between the pia and arachnoid maters.</p> <p>Reason (R): It serves to maintain a constant pressure inside the cranium.</p>
12	<p>Assertion (A): With the evolution of multicellularity, it became imperative to develop nervous system.</p> <p>Reason (R): Special senses such as vision, hearing are produced by sense organs associated with the nervous system.</p>
13	<p>Assertion (A): The auditory ossicles help in hearing.</p> <p>Reason (R): Auditory ossicles maintain the balance of air pressure between two sides of the ear drum.</p>
14	<p>Assertion (A): Image focused on the fovea is seen most accurately.</p> <p>Reason (R): Fovea of retina contains numerous photoreceptor rod cells.</p>
15	<p>Assertion (A): Blind spot on the retina of the eye is devoid of the ability for vision.</p> <p>Reason (R): The photoreceptor cone cells are absent at the blind spot.</p>
16	<p>Assertion (A): The imbalance in the concentration of Na^+, K^+ and proteins generates "Resting potential".</p> <p>Reason (R): To maintain the unequal distribution of Na^+, and K^+, the neurons use electrical energy. (AIIMS 2007)</p>
17	<p>Assertion (A): After hearing a sound, nerve impulse passes from neurons to the brain</p> <p>Reason (R): The neurons which pass nerve impulses from the body organ to the brain is called afferent neuron.</p>
18	<p>Assertion (A): Medulla oblongata causes reflex actions like vomiting, coughing and sneezing.</p> <p>Reason (R): It has many nerve cells which control autonomic reflexes.</p>
19	<p>Assertion (A): A person has lost most of its intelligence, memory and judgement.</p> <p>Reason (R): A person has operated a tumour present in the cerebrum.</p>
20	<p>Assertion (A): A receptor is a specialized group of cells in a sense organ that perceive a particular type of stimulus.</p> <p>Reason (R): Different sense organs have different receptors for detecting the stimuli.</p>
21	<p>Assertion (A): Nerve impulse is a one way conduction.</p> <p>Reason (R): Nerve impulse is transmitted from dendrites to axon terminals.</p>
22	<p>Assertion (A): Units which make up the Nervous system are called the neurons.</p>

	Reason (R): Nerve impulse are carried by dendrites towards the cell body.
23	Assertion (A): Cyton region of Nerve fiber collects information for the brain. Reason (R): Nerve fibers can either have or lack myelin sheath.
24	Assertion(A) : In man , only peripheral nervous system is present . Reason (R): The peripheral nervous system includes nerves coursing between the central nervous system and different parts of the body.
25	Assertion(A) : Anterior lobe of pituitary is attached to hypothalamus by a vein. Reason (R): This attachment is done through a portal vein.

21. Assignment Questions to answer

VSAQ***	1	Name the cranial meninges covering the brain of a man.
***	2	What is Corpus callosum?
**	3	What do you know about Arbor Vitae?
***	4	What is All – or - None principle?
***	5	What is Organ of Corti?
SAQ***	1	Draw a labelled diagram of the T.S. of spinal cord of man.
***	2	Give an account of Synaptic Transmission.
***LAQ	1	Give a brief account of the structure and functions of the brain of man.
*LAQ	2	Explain the transmission of nerve impulse through a nerve fibre with the help of suitable diagrams.

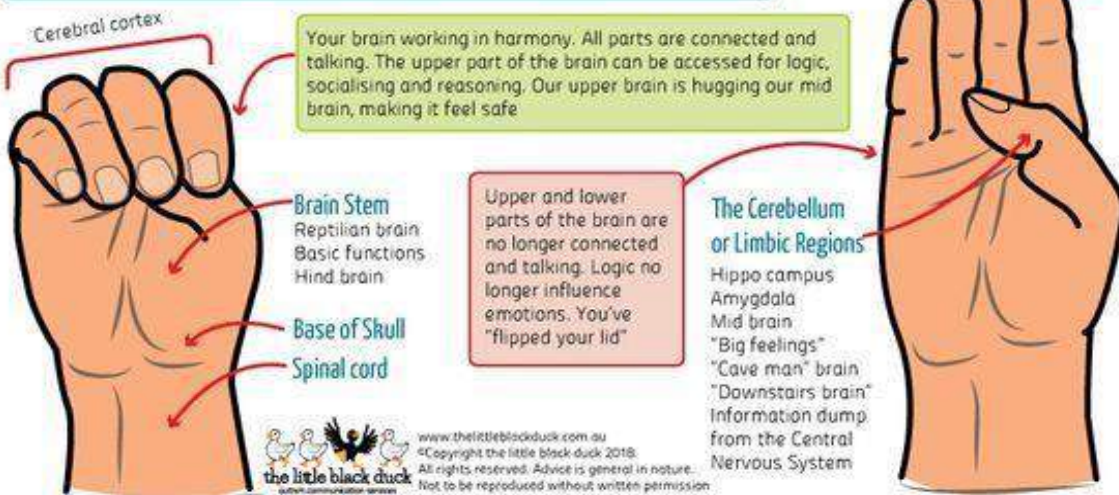
22. Hands on Experiences for you – Try It!!!

1. Understand and explore:

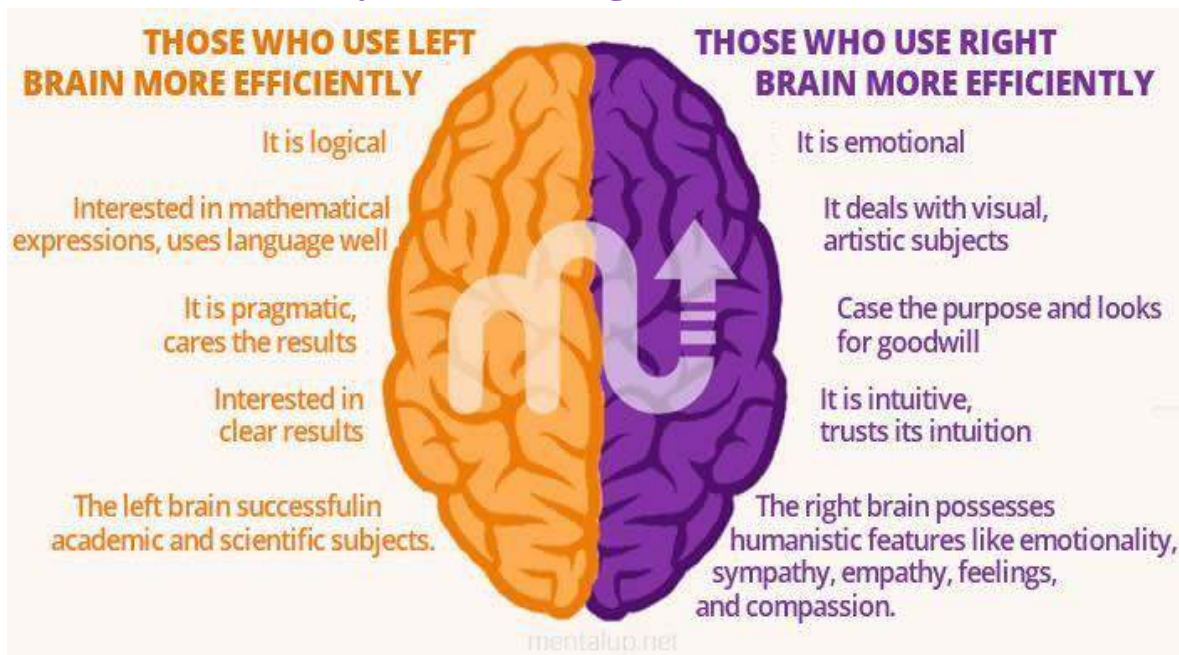
The Hand Model of the Brain

What happens when we “flip our lid”

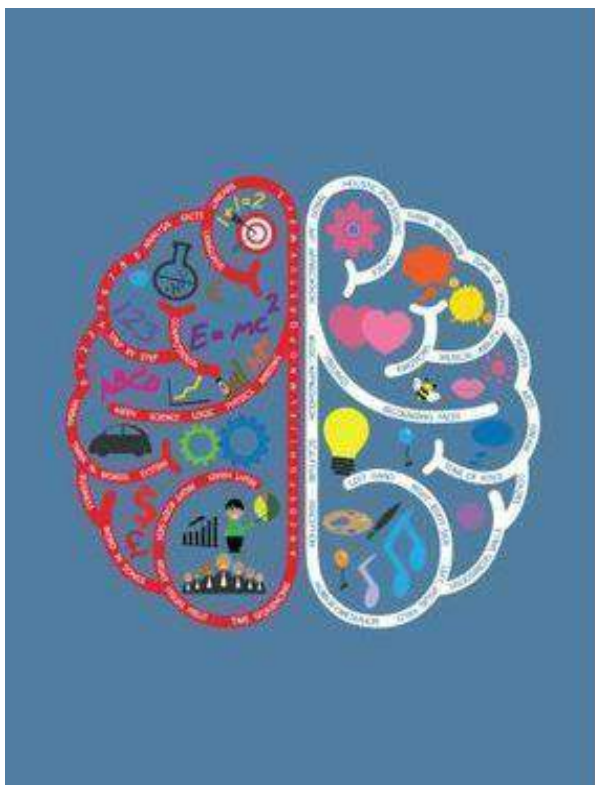
When our brain is working efficiently both the upper and mid brain are communicating effectively. Information comes in and is processed logically. Sometimes too much information is coming in for the Upper brain to process and it disconnects. We “flip our lid” and can no longer access the functions provided by the upper brain.



2. Know who you are!?! (Right or Left Brain oriented):



3. Have you decided who you are? Then take the tips:



Left Brain STUDY TIPS

- Study in a quiet room
- Read chapter headings first - absorb - then read text
- Take the lead when in a study group
- Join a debate team or academic competition
- Participate in scholarly competitions
- Challenge yourself with math puzzles
- Choose non-fiction for your book reports
- Multiple choice prep: predict how right answers could be twisted into "wrong" answers
- Number your class notes and keep them in order
- Color code your notebooks
- Don't argue with the teacher too much - you tend to try to correct others!
- Choose to do analytical essays when you have a choice
- Work alone when you have a choice - you get frustrated with others who "clown around"
- Predict possible essay questions and practice
- Take more risks - don't be afraid to be creative



Advice for Right Brain Students

- When you have a choice, pick personal essay assignments - you rock!
- Watch your daydreaming—keep it under control!
- Let your imagination work for you in the arts
- Go with your gut - it's usually right
- Let your deep thinking work for you during essay tests- but don't ponder too long
- Be creative with essays - you can use colorful language well
- Use images and charts when you study
- Write down directions - you'll forget otherwise
- Try to be more organized!
- Choose fiction for book reports
- You tell stories well, so write some!
- Put information into categories for better understanding
- Avoid getting bogged down by thinking of all possibilities when answering questions
- Finish things! You have so much talent, but you don't always complete things

23. Medical and other careers related to Nervous System

Education in neuroscience prepares students for a wide range of career paths. Since the brain is involved in every important human endeavor. Understanding brain function and dysfunction is critical in many fields, including medicine, psychology, law, engineering, education, and public policy. Since neuroscience is a highly interdisciplinary field, students learn to incorporate knowledge from many levels (from molecules to man) to solve complex problems. Rigorous training in a highly relevant field provides neuroscience students with a wide range of career options.

<u>Neuroscientist</u>	Someone who studies the nervous system.
<u>Neuroanatomist</u>	Studies the structure (anatomy) of the nervous system.
<u>Neurobiologist</u>	Studies the biology of the nervous system.
<u>Neurochemist</u>	Studies the chemistry (for example, neurotransmitters) of the nervous system.
<u>Neurological Surgeon</u>	An M.D. who performs surgery on the nervous system (brain, spinal, nerves).

<u>Neurologist</u>	An M.D. who diagnoses and treats disorders of the nervous system.
<u>Neuropathologist</u>	An M.D. or Ph.D. who studies diseases of the nervous system.
<u>Neuropharmacologist</u>	Studies the action of drugs on the nervous system and/or behavior.
<u>Neurophysiologist</u>	Studies the physiology (electrical responses) of the nervous system.
<u>Neuropsychologist</u>	Studies brain/behavior relationships especially cognitive function.
<u>Neuroradiologist</u>	Uses <u>imaging methods</u> such as X-ray, MRI, CT and angiography to diagnose diseases of the nervous system.
<u>Psychobiologist</u>	Studies the neural basis of behavior.
<u>Psychiatrist</u>	M.D. who diagnoses and treats mental disorders.
<u>Neuroscience Nurse</u>	Nurse cares for patients with neurological disorders and assists neuroscience-related health care professionals.
<u>Psychophysicist</u>	Measures perceptual abilities.
Electroneurodiagnostic <u>Technician</u>	Records electrical activity from the brain and spinal cord.
ENT Physician (Otolaryngologist)	Their special skills include diagnosing and managing diseases of the sinuses (Ear, Nose), larynx (voice box), oral cavity, and upper pharynx (mouth and throat), as well as structures of the neck and face.
Audiologist	Audiologists identify, assess and manage disorders of hearing, balance and other neural systems.
Special education teachers (High in Demand)	Work with students who have learning, mental, emotional, and physical disabilities. They teach reading, writing, and math, and for students with severe disabilities, they also teach communication and basic life skills.
Speech-language pathologists (SLPs)	Work to prevent, assess, diagnose, and treat speech , language, social communication, cognitive-

(High in Demand)	communication, and swallowing disorders in children and adults.
Rehabilitation Therapists (High in Demand)	Help people with a range of physical conditions recover effectively through various forms of physical exercise. Rehabilitation therapy is usually advised for people who are suffering due to accidents, diseases such as arthritis, and those recovering from surgeries, stroke, or paralysis.
Drug rehabilitation Therapists	Medical or psychotherapeutic treatment for dependency on psychoactive substances such as alcohol , prescription drugs , and street drugs such as cannabis , cocaine , heroin or amphetamines . The general intent is to enable the patient to confront substance dependence , if present, and cease substance abuse to avoid the psychological , legal, financial, social, and physical consequences that can be caused, especially by extreme abuse.
Psychiatrist	A psychiatrist is a medical doctor (an M.D. or D.O.) who specializes in mental health, treatment and prevention of mental, emotional and behavioral disorders including substance use disorders.

24. Answers for activities:

Answers to Activity: 11

Ans.1.: In most cases, the ion channels open in response to a specific stimulus. The main types of stimuli 1. Change in the voltage across the membrane (voltage-gated **channels**), 2. A mechanical stress (mechanically gated **channels**), 3. The binding of a ligand (ligand-gated **channels**) and 4. Some are non-gated, also called Leakage channels.

Ans.2.: Some **ion channels**, called passive or leakage **channels**, are **always open**. Some **ion channels** have gates that **open** and close, only under certain conditions.

Ans.3.: **Ion channels** are said to be "passive" because no energy (**ATP**) is **required** to activate the protein, only a ligand or change in voltage. **Ion pumps**, on the other hand, are active proteins.

Ans.4.: Some **channels**, known as **leak channels**, are **open** in resting neurons. The membranes are more permeable to K^+ than it is to Na^+ , so K^+ moves down its gradient (out of the cell) more readily than Na^+ moves into the cell. Hence K^+ ion leak channels are always open.

Ans.5.: Trafficking of small charged molecules (**ions**) thru the cell membrane of **neurons** determine their ability to signal and respond to each other. The electric charges of **ions are** in fact responsible for the membrane potential and action potential of neurons.

Answers to Activity:17

1. middle and inner ear	2. bulbs of krause	3. hypothalamus.	4. all-or-none law.
5. synapse	6. Touch and Pressure	7. medulla oblongata.	8. presynaptic neuron
9. neurotransmitter	10. depolarization	11. refractory period.	12. myelin.
13. cochlea	14. ganglion.	15. Rhodopsin	16. neurofibril node.
17. sodium-potassium ATPase pump.	18. proprioceptros	19. cerebellum.	20. meninges.

Answers to Activity:18

1. True	2. False (Corpus callosum)	3. False (Subarachnoid space)	4. True
5. True	6. False (Dorsal portion)	7. True	8. False (Cerebellum)
9. True	10. True	11. False (Cranial Nerve)	12. True
13. True	14. True	15. True	16. True
17. True	18. False (Vascular Tunic)	19. False (small depression)	20. True
21. True	22. False (Three tubes in One)	23. True	24. False (Organ of Corti)
25. True	26. True	27. False (Metacoel)	28. True
29. True	30. False (reduced ability to smell)	31. True	32. Ttrue

Answers to Activity:19

Que. No	Ans.	Explanation/Notes
LEVEL - 1		
1	C	
2	C	
3	B	The embryonic origin of microglia is distinct from other types of neuroglia. Whereas other neuroglia are derived from an embryonic layer of tissue known as “ <i>neuroectoderm</i> ”, which gives rise to nervous tissue, microglia are derived from “ <i>embryonic mesoderm</i> ”, which gives rise to cells of the blood and immune system.
4	B	
5	B	
6	A	
7	D	
8	C	
9	D	
10	A	
11	A	
12	B	
13	B	
14	C	
15	A	
16	D	
17	B	
18	B	
19	B	
20	B	
21	D	
22	C	The hippocampus is a site for decision making and committing information to memory for future safety uses.
23	B	Purkinje cells, also called Purkinje neurons, are neurons in vertebrate animals located in the cerebellar cortex of the brain.
24	B	The inferior colliculus is best known for its role in hearing. It is the largest nucleus of the auditory system in humans, and it is the point in the brainstem where all auditory pathways traveling through the brainstem converge.
25	D	
26	B	
27	D	
28	A	

29	C	
30	C	
31	C	
32	D	
33	A	
34	C	
35	C	
36	A	
37	B	
38	A	
39	B	
40	A	
LEVEL-2		
41	A	
42	C	
43	B	The amygdala is recognized as a component of the limbic system, and is thought to play important roles in emotion and behavior.
44	B	The medulla of your brain is the control center for your heart rate and breathing rate.
45	B	Wernicke area, region of the brain that contains motor neurons involved in the comprehension of speech. In addition to language production, it is now recognized that Broca's area plays an important role in language comprehension, involved in movement and action, and has been found to be active during planning movement, imitating movement, and understanding another's movement.
46	D	
47	A & C	
48	D	
49	B	
50	A	
51	B	Inter related questions. Analyze.
52	C	
53	A	
54	C	
55	C	
56	B	
57	A	
58	B	
59	C	
60	D	
61	B	
62	C	

63	A	
64	A	
65	D	
66	C	
67	D	
68	C	
69	A	
70	A	
71	D	
72	A	
73	A	
74	C	
75	B	
76	A	
77	D	
78	D	
79	D	
80	C	
81	D	
82	D	
83	D	
84	B	
85	D	
86	A	
87	B	
88	C	
89	B	
90	D	
91	D	
92	C	
93	A	
94	C	
95	B	
96	C	
97	D	
98	D	
99	C	
100	A	
101	B	
102	A	
103	B	
104	D	

105	D	Cornea consists of dense matrix of collagen and corneal epithelium. It is the most sensitive part of eye.
106	C	Lens in the human eye is held in its place by suspensory ligaments attached to the ciliary body.
107	A	
108	A	The marked label 1, 2, 3 and 4 are respectively Reissner's membrane, organ of Corti, Basilar membrane and Tectorial membrane. Organ of Corti (X) is a sensitive element in the inner ear. It is a spiral shaped structure located on the basilar membrane (3) which contains hair cells that acts as auditory receptors. The hair cells are present in rows on the internal side of the organ of corti.
109	C	
110	B	Hyperpolarising neuron B by 15 mV would make its membrane potential -65mV, actually taking it farther away from the threshold voltage needed to fire an action potential.
111	B	When an impulse or nerve signal reaches the end of axon, the synaptic vesicles release a neurotransmitter into the small space between the adjoining cells (synaptic gap). Neurotransmitters diffuse across the synapse and bind to receptors in the receiving cell that are specific for the neurotransmitter.
112	B	In the given figure of human eye, the part marked as "X" is iris. The iris is a thin, circular structure in the eye which is responsible for controlling the diameter and size of the pupil and thus the amount of light reaching the retina. The colour of the iris gives the eye its colour.
113	B	The label (2) represents tympanic membrane. Tympanic membrane converts sound waves into mechanical vibrations. The structure (1), (2), (3) and (4) are external auditory canal, tympanic membrane, cochlea and eustachian tube respectively.
114	D	
115	A	If the disease acts on a chemical synapse where the neurotransmitter is stored and released, it is affecting the axon terminals of the pre-synaptic cell. Ca ²⁺ channels are involved in regulating the release of acetylcholine by allowing Ca ²⁺ to enter the pre-synaptic cell and promoting the fusion of acetylcholine containing vesicles to the membrane.
116	C	
117	D	Oxygen consumption is greater in brain than in a nerve fibre.
118	A	
119	C	
120	B	
121	C	

122	B	Metabotropic receptors are coupled with proteins that bind GDP. When the receptor bind a neurotransmitter, the GDP is turned into GTP and a subunit of the G protein separates and activates effector proteins.
123	B	The photopigments of the human eye are composed of opsin (protein) and retinal. Upon light absorption, opsins can change their conformation from a resting state to a signalling state. Then it activates the G protein, thereby resulting in a signalling cascade that produces physiological responses. Retinal, also called retinaldehyde or vitamin A aldehyde, is a polyene chromophore which is bound to proteins called scotopsins and photopsins, and is the chemical basis of animal vision.

Answers to Activity 20: Assertion and reasoning:

1	2	3	4	5	6	7	8	9	10
C	C	C	B	B	A	C	B	C	A
11	12	13	14	15	16	17	18	19	20
D	B	C	C	B	C	B	A	A	B
21	22	23	24	25					
C	B	D	D	D					

UNIT –

**HUMAN ANATOMY AND
PHYSIOLOGY - IV**



UNIT –

**ENDOCRINE SYSTEM
AND
CHEMICAL CO-ORDINATION**

MAJOR LEARNING OBJECTIVE

- *Students will be able to identify and understand the nature, origin, mechanism of action and “Role of hormones in Chemical coordination”.*
- *Students will be able to appreciate “the tag line” - “The Biochemical Integrators”.*

LEARNING OUTCOMES:

- Be able to understand the types of Endocrine Glands in human endocrine system and their functions.
- Be able to integrate the role of different hormones and their action on human development and functioning of different organs of the body.
- Be able to understand and appreciate the mechanism of hormonal action.
- Be able to compare, understand and integrate the disorders involved in the hypo or hyper secretions and deficiencies of different hormones.

ADDITIONAL READING MATERIALS

- GIST OF HORMONES AND THEIR ACTIONS

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book
2. Defining key words
3. Expand the abbreviations
4. Identify and Label the locations of “Endocrine Glands”
5. Identify and Label the parts of the “Hypothalamus”
6. Identify and Label the hormones and their target organs
7. Define and add brief note on given concepts on hormones.
8. Understand and add brief note on “Mechanisms of Hormonal Action”
9. Give Hypo and Hyper secretion effects of hormones
10. Fill in the blanks
11. Answer “TRUE” or “FALSE”
12. Multiple Choice Questions for Competitive exams
13. Assertion & Reasoning Questions
14. Assignment Questions to answer
15. Hands on Experiences for you – Try It!!!
16. Medical and other careers related to Nervous System
17. Answers to the activities and note making

INSTRUCTIONS TO LECTURER

- Ask the students to take aid of the textbook and to work with a partner
- Explain each part of the worksheet & Come up with some examples to help
- Clarify doubts of the students before starting the work book

INSTRUCTIONS TO STUDENTS

- First read the text book thoroughly and logically with a friend cooperatively
- While attempting the activities analyze them carefully
- While attempting the multiple choice questions, make notes on the other options too

ADDITIONAL READING MATERIALS

GIST OF HORMONES AND THEIR ACTIONS

Although a given hormone may travel throughout the body in the bloodstream, it will affect the activity only of its target cells; that is, cells with receptors for that particular hormone. Once the hormone binds to the receptor, a chain of events is initiated that leads to the target cell's response. Hormones play a critical role in the regulation of physiological processes because of the target cell responses they regulate. These responses contribute to human reproduction, growth and development of body tissues, metabolism, fluid, and electrolyte balance, sleep, and many other body functions.

Endocrine Glands and Their Major Hormones			
Endocrine gland	Associated hormones	Chemical class	Effect
Pituitary (anterior)	Growth hormone (GH)	Protein	Promotes growth of body tissues
Pituitary (anterior)	Prolactin (PRL)	Peptide	Promotes milk production
Pituitary (anterior)	Thyroid-stimulating hormone (TSH)	Glycoprotein	Stimulates thyroid hormone release
Pituitary (anterior)	Adrenocorticotrophic hormone (ACTH)	Peptide	Stimulates hormone release by adrenal cortex
Pituitary (anterior)	Follicle-stimulating hormone (FSH)	Glycoprotein	Stimulates gamete production
Pituitary (anterior)	Luteinizing hormone (LH)	Glycoprotein	Stimulates androgen production by gonads
Pituitary (posterior)	Antidiuretic hormone (ADH)	Peptide	Stimulates water reabsorption by kidneys
Pituitary (posterior)	Oxytocin	Peptide	Stimulates uterine contractions during childbirth
Thyroid	Thyroxine (T₄), triiodothyronine (T₃)	Amine	Stimulate basal metabolic rate – Calorigenic Hormones

Endocrine Glands and Their Major Hormones			
Endocrine gland	Associated hormones	Chemical class	Effect
Thyroid	Calcitonin	Peptide	Reduces blood Ca ²⁺ levels
Parathyroid	Parathyroid hormone (PTH)	Peptide	Increases blood Ca ²⁺ levels
Adrenal (cortex)	Aldosterone	Steroid	Increases blood Na ⁺ levels
Adrenal (cortex)	Cortisol, corticosterone, cortisone	Steroid	Increase blood glucose levels
Adrenal (medulla)	Epinephrine, norepinephrine	Amine	Stimulate fight-or-flight response
Pineal	Melatonin	Amine	Regulates sleep cycles
Pancreas	Insulin	Protein	Reduces blood glucose levels
Pancreas	Glucagon	Protein	Increases blood glucose levels
Testes	Testosterone	Steroid	Stimulates development of male secondary sex characteristics and sperm production
Ovaries	Estrogens and progesterone	Steroid	Stimulate development of female secondary sex characteristics and prepare the body for childbirth
Calorigenic hormones	Hormones that involve generation of heat and energy from the food stuffs in the body are called "Calorigenic Hormones". (Thyroid Hormones)		

Activities

1. Locating in and rewriting the difficult key words from the text book

1	9	17
2	10	18
3	11	19
4	12	20
5	13	21
6	14	22
7	15	23
8	16	24

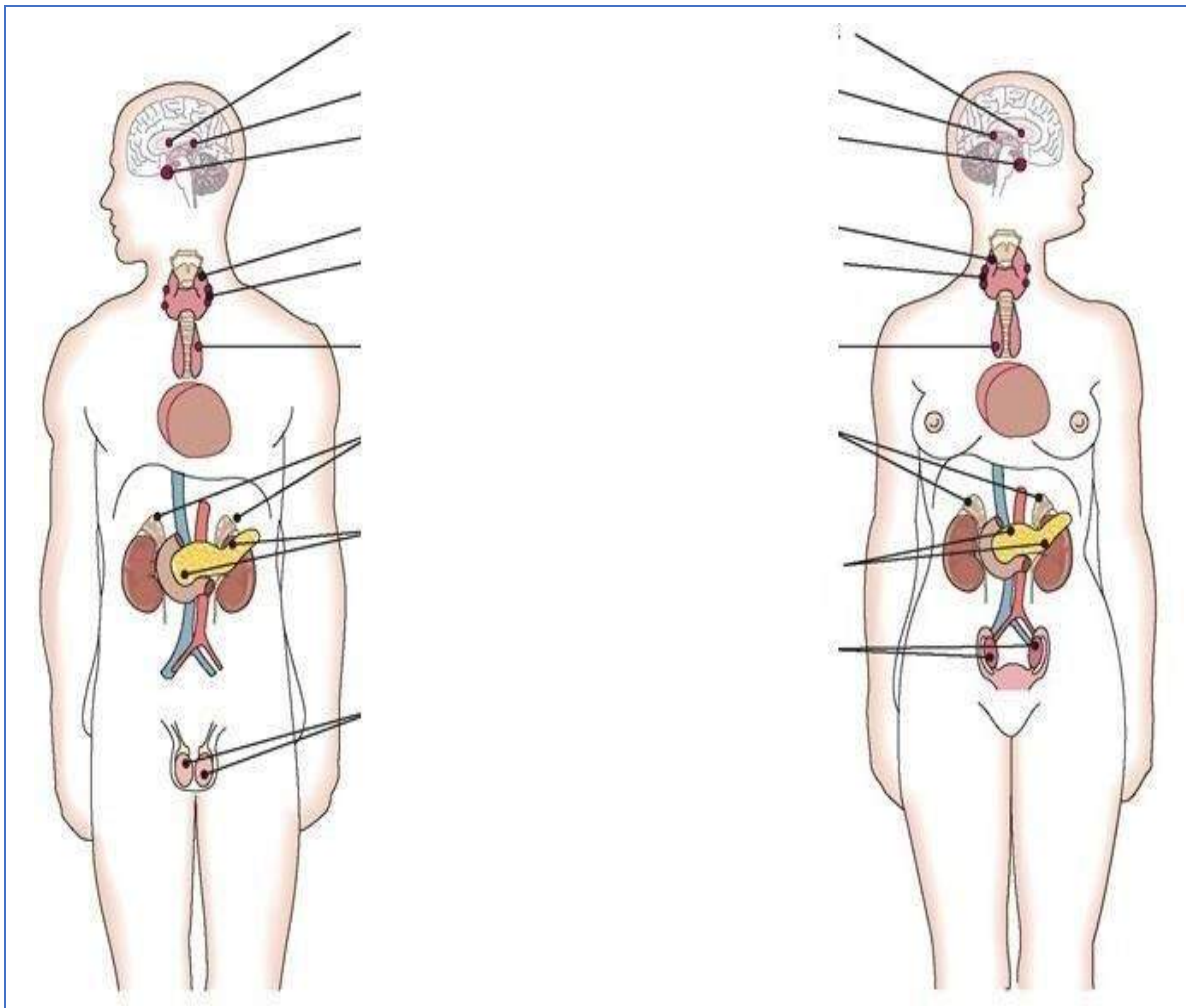
2. Defining key words (Write in your Assignment Book)

Eicosanoids	Sella turcica	Pars intermedia	Rathke's pouch
Isthmus	Biological Clock	Anti-Diuretic hormone	Thymosins
Cortisols	Catecholamines	Corpus leuteum	Acini
Nuclei	Erythropoetin	Cholecystokinin	Thyroid dwarf
Insulin shock	Diuresis	Atrial Natriuretic factor	Pilorection

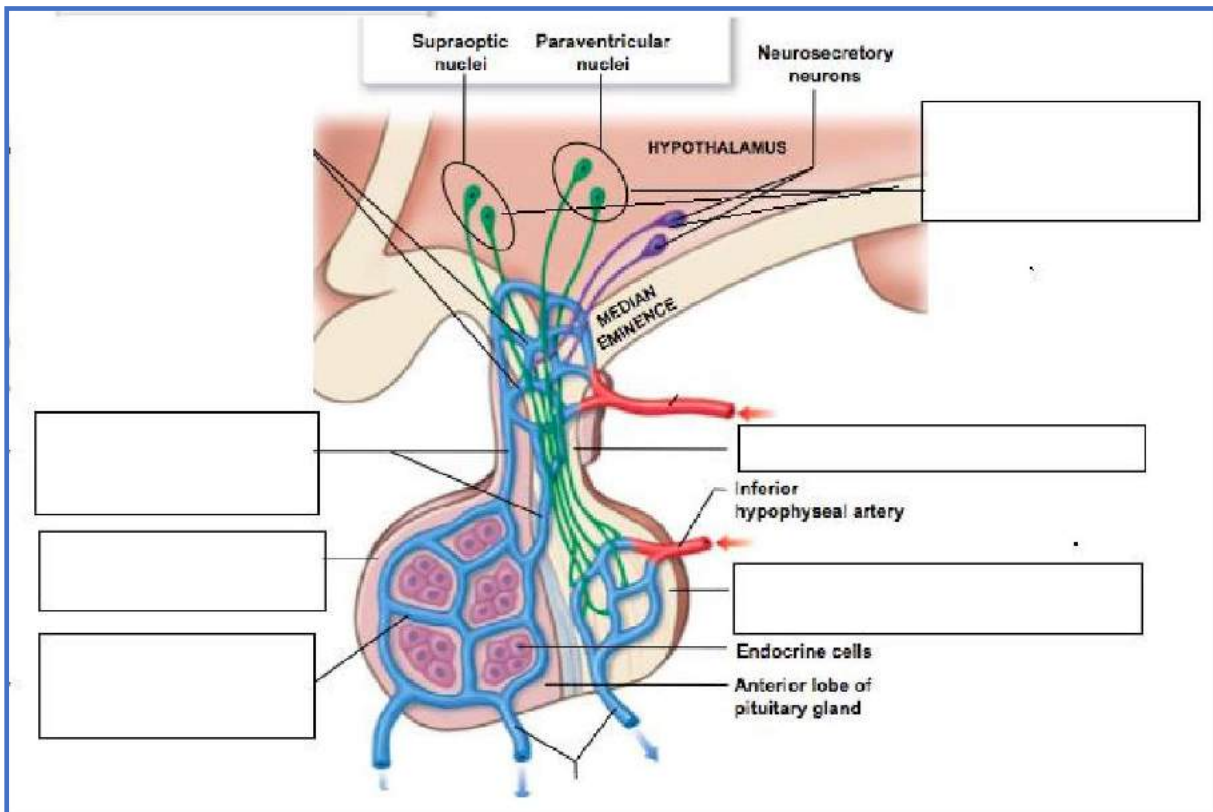
3. Expand the abbreviations

GHRH	GHIH
TCT	CCK
ANP	PTH
ACTH	BMR
c AMP	m RNA
SCN	CAMP

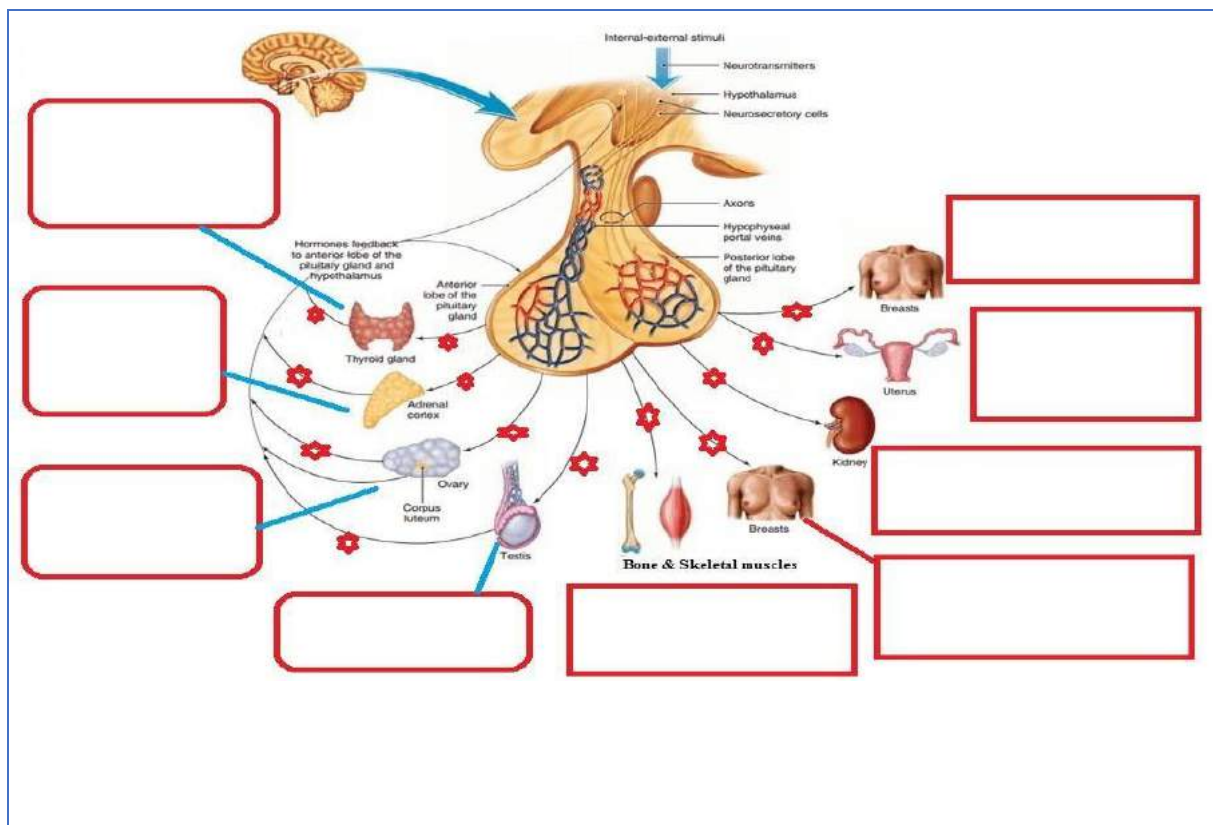
4. Identify and Label the locations of “Endocrine Glands”



5. Identify and Label the parts of the “Hypothalamus”



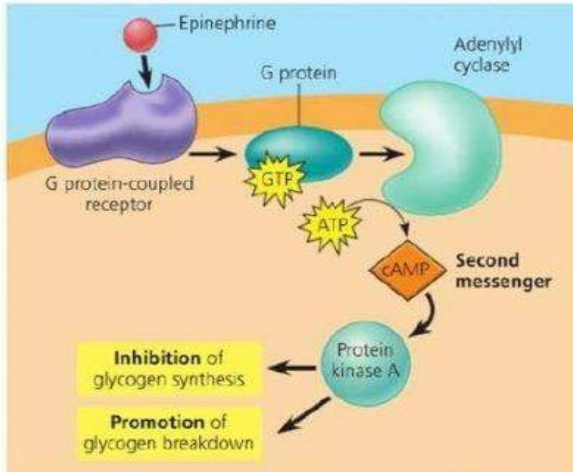
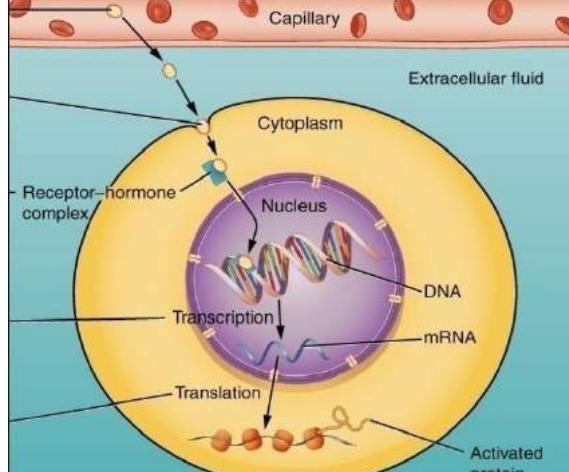
6. Identify and Label the hormones and their target organs



7. Define and add brief note on given concepts on hormones.

Define	Name hormones involved and add brief note
Hypophyseal Portal System	
Neuro-hormones	
Spermatogenesis	
Sleep-wake Cycle	
Erythropoiesis	
Thymosins	
Stress combat hormone	
Emergency hormones	

8. Understand, Relate and add brief note on “Mechanisms of Hormonal Action”

MEMBRANE BOUND RECEPTOR MECHANISM	INTRA CELLULAR RECEPTOR MECHANISM
 <p>The diagram illustrates the mechanism of a membrane-bound receptor. Epinephrine binds to a G protein-coupled receptor on the cell membrane. This activates a G protein, which then activates Adenylyl cyclase. Adenylyl cyclase converts ATP to cAMP, which acts as a second messenger. cAMP activates Protein kinase A, leading to the inhibition of glycogen synthesis and the promotion of glycogen breakdown.</p>	 <p>The diagram illustrates the mechanism of an intracellular receptor. A hormone binds to a receptor in the cytoplasm, forming a receptor-hormone complex. This complex enters the nucleus and binds to DNA, initiating transcription of a gene into mRNA. The mRNA is then translated in the cytoplasm into an activated protein.</p>

9. Give Hypo and Hyper secretion effects of hormones

HORMONES	EFFECTS OF HYPO SECRETION	EFFECTS OF HYPER SECRETION
SOMATOTROPIN		
THYROID HORMONE		
PARA THYROID HORMONE		
INSULIN		
VASOPRESSIN		
GLUCOCORTICOIDS		

10. Fill in the blanks

1.	The functional organization of the nervous system parallels that of the _____ system in many ways.
2.	Cells can respond to _____ hormones at a times
3.	Regulatory factors that control secretion of anterior pituitary hormones are released by neurons at the _____ of the hypothalamus
4.	The hypothalamus acts as both a neural and a _____ organ.
5.	TSH plays a key role in the _____ of thyroid hormones
6.	The ovaries secrete _____ when stimulated by FSH.
7.	PRL is to _____ as ACTH is to _____.
8.	Increased levels of the hormone _____ will lead to increased levels of calcium ions in the blood.
9.	Alpha cells are to _____ as beta cells are to _____
10.	In general, the effects of natriuretic peptides are _____ to those of the renin-angiotensin system.
11	The intracellular protein _____ binds calcium ions. This complex can than activate enzymes.
12	The two lobes of the thyroid gland are connected by the _____
13	The thyroid gland is composed of many _____ that produce and store thyroid hormone.
14	The _____ gland sits along the superior border of the kidney.
15	Thyroid hormones are structural derivatives of the----- amino acid.
16	The cells found within the parathyroid gland that secrete parathyroid hormone are called _____.
17	The two systems that act to control all body activities are the nervous and _____ systems.
18	The _____ system includes the glands that release their secretions directly into the blood.
19	In the body, both the blood sodium and potassium levels are regulated by _____.
20	The endocrine gland which contributes to setting the body's biological clock is the _____.

21	The hypophyseal portal system transports releasing and inhibiting hormones from the hypothalamus to the_____.
22	Melatonin is produced by_____gland
23	Glucagon is the antagonist of_____
24	The element necessary in the diet for proper thyroid function is _____
25	The body's major metabolic hormone is the_____hormone

11. Answer True or False

Sl.No	Statement	T/F
1	The hormone gastrin and secretin are made in the linings of the stomach and kidney.	
2	The small endocrine gland located in the center of the brain is known as pineal gland.	
3	The development of T- lymphocytes is regulated by hormones known as “mineralocorticoids”.	
4	Secondary male characteristics are influenced by hormones known as “androgens”.	
5	The “beta” cells of the pancreas are responsible for the production of glucagon.	
6	The parathyroid hormone acts in a manner that is antagonistic to the activity of “calcitonin”.	
7	The “adrenal gland” lies in the fold of mesenteries.	
8	Both thyroxin and triiodothyronine increase the rate of “metabolism” in the body.	
9	Contractions of the uterus may be stimulated by the hormone “vasopressin”.	
10	The hormone ACTH is produced by the adrenal gland and it regulates the activity of the adrenal cortex.	
11	The pituitary gland lies in a saddle of the "ethmoid" bone.	
12	Another name for human growth hormone is "somatotropin."	
13	The hormone prolactin stimulates the production of "urine."	

14	The thymus gland is located in the tissue of the "leg."	
15	Glucagon and insulin are both hormones produced by the "pancreas."	
16	Swelling of the thyroid glands due to a lack of iodine is referred to as "goiter."	
17	Insufficient secretion of thyroxin in adults may result in a condition called "myxedema."	
18	The composition of the hormone insulin is "carbohydrate."	
19	The hormone aldosterone is an example of the "glucocorticoids."	
20	Two important catecholamine hormones are epinephrine and "insulin."	
21	An inadequate secretion of hormones from the adrenal cortex can result in "Cushing's" disease.	
22	Many of the tissue cells of the body produce lipid hormones called "prostaglandins."	
23	The maturation of red blood cells is controlled by the hormone "melatonin."	
24	Swelling of the thyroid glands due to a lack of iodine is referred to as "goiter."	
25	Insufficient secretion of thyroxin in adults result in "myxedema."	

12. Multiple Choice Questions for Competitive exams:

LEVEL - 1	
1.	Which of the following organs is considered a neuroendocrine organ? A. pancreas B. pineal C. hypothalamus D. pituitary
2.	Which hormone is NOT being synthesized if a goiter forms? A. FSH B. TH C. rennin D. insulin
3.	Which of the following is true about water-soluble hormones? A. They are bound to a transport protein while circulating in the blood. B. They have a short half-life. C. They cannot be stored in secretory vesicles. D. They are composed of lipids.
4.	Which one is required for the synthesis of thyroid hormone? A. copper B. zinc C. iodine D. sulfur
5.	This is not a function of insulin A. decreasing glycogenolysis B. lipogenesis C. gluconeogenesis D. glycogenesis
6.	Action of parathormone in the human body A. decreases blood sodium level B. increases blood sodium level C. decreases blood calcium level D. increases blood calcium level
7.	Effects of hypothyroidism include all but this

A. Diarrhoea	B. lethargy	C. Anorexia	D. Weight gain
8. Glucagon			
A. accelerates protein synthesis within cells			
B. accelerates conversion of glycogen into glucose			
C. decreases conversion of glycogen into glucose			
D. slows down glucose formation from lactic acid			
9. Pituitary hormone triggering the male testes to generate sperm and in females, triggering follicular development on a monthly basis is			
A. prolactin		B. growth hormone	
C. follicle-stimulating hormone		D. luteinizing hormone	
10. This hormone is responsible for “fight-or-flight” response			
A. Thyroxine and melatonin		B. insulin and glucagon	
C. Epinephrine and norepinephrine		D. oestrogen and progesterone	
11. Difference between endocrine and exocrine glands is that			
A. endocrine glands release hormones, exocrine glands release waste			
B. endocrine glands are interconnected, exocrine glands are totally independent			
C. endocrine glands are formed by epithelial tissue, exocrine glands are connective tissues primarily			
D. endocrine glands are ductless, exocrine glands release secretions into ducts or at the surface of the body			
12. Chemical messengers secreted by ductless glands are called _____			
A. Lymph	B. Platelets	C. Plasma	D. Hormones
13. Endocrine glands secrete products into the ducts and transfer it into body cavities.			
A. True		B. False	
14. Which of the following is NOT an endocrine gland?			
A. Hypothalamus	B. Pituitary	C. Parathyroid	D. Pancreas
15. Which of this statement is INCORRECT regarding the function of hormones?			
A. Reproduction and sexual differentiation			
B. maintenance of the internal environment			
C. maintain body temperature		D. development and growth	
16. Mark the one, which is NOT the precursor of the hormone?			
A. Amino acids	B. Cholesterol	C. Phospholipids	D. proteins
17. What is the precursor of steroid hormone?			
A. Protein	B. Cholesterol	C. Carbohydrate	D. Lipid
19. Which of the is a fat soluble hormone?			
A. Amino hormone	B. Peptide hormone		
B. C. Thyroid hormone	D. Protein hormone		
20. Name the hormone which is synthesized from histidine amino acid?			
A. Histamine	B. Epinephrine	C. Norepinephrine	D. Dopamine
20. Which of the following is protein hormone?			
A. Oxytocin	B. Insulin	C. TSH	D. Antidiuretic Hormone
21. Name the gland, which releases Neurohormone			
A. Hypothalamus	B. Pituitary	C. Thyroid	D. Pancreas
22. Name the hormone which takes part in the release of FSH and LH from the anterior pituitary.			
A. Growth hormone	B. GnRH	C. Somatostatin	D. TRH
23. Which of the following is Growth hormone inhibiting hormone?			

A. FSH	B. TRH	C. GHRH	D. somatostatin
24. Mark the one, which is not inhibited by the effect of somatostatin.			
A. GH	B. TSH	C. Glucagon	D. Dopamine
25. Name the hormone, which is released by the posterior pituitary.			
A. Oxytocin	B. TSH	C. ICSH	D. Prolactin
26. This hormone is not secreted by Hypothalamus			
A. PRH	B. FSH	C. CRH	D. TRH
27. This is the most abundant hormone produced by the anterior pituitary			
A. LH	B. TSH	C. ACTH	D. GH
28. This is not an endocrine gland			
A. Adrenal	B. Pituitary	C. Lacrimal	D. Thyroid
29. Which one of the followings are male sex hormones?			
A. Insulins	B. Aldosterones	C. Androgens	D. Pheromones
30. In adults, insufficient thyroxine can lead to _____.			
A. Goiter	B. Tetany	C. Cretinism	D. Myxedema
31. In children, hypothyroidism (underactive thyroid gland) can lead to _____			
A. Goiter	B. Acromegaly	C. Cretinism	D. Myxedema
32. In Male the sex hormone that maintains sexual organs and secondary sex characteristics is			
A. Progesterone	B. Estrogen	C. Testosterone	D. Relaxin
33. In which of the following pairs, the hormone of endocrine glands and its primary action is mismatched.			
A. Calcitonin - Lower blood calcium levels			
B. Parathyroid - Raises blood calcium levels			
C. Somatostatin - Inhibits release of glucagon			
D. Melatonin - Regulates the rate of cellular metabolism			
34. Islets of Langerhans are found in			
A. Anterior Pituitary	B. Kidney Cortex	C. Spleen	D. Endocrine pancreas
35. Name the condition when the concentration of Ketone body increases in urine			
A. Acromegaly			
B. Diabetes mellitus			
C. Diabetes insipidus			
D. Cushing's disease			
36. Pituitary gland known as the 'master' endocrine gland is under the control of			
A. Pineal gland	B. Adrenal gland	C. Hypothalamus	D. Thyroid gland
37. Somatostatin			
A. Stimulates glucagon release while inhibits insulin release			
B. Stimulates release of insulin and glucagon			
C. Inhibits release of insulin and glucagon			
D. Inhibits glucagon release while stimulates insulin release			
38. In human adult females oxytocin			
A. Causes strong uterine contractions during parturition			
B. Is secreted by anterior pituitary			
C. Stimulates growth of mammary glands			
D. Stimulates pituitary to secrete vasopressin			
39. Concentration of the urine is controlled by _____			
A. MSH	B. ADH	C. Oxytocin	D. ACTH
40. Damage to thymus in children may lead to			
A. Loss of antibody mediated immunity			

<p>B. Reduction in stem cell production C. Reduction of hemoglobin content of blood D. Loss of cell-mediated immunity</p>
<p>41. ACTH stimulates the adrenal cortex to release a group of hormones called ____ A. Mineralocorticoid B. Glucocorticoid C. Endorphins D. Glucagon</p>
<p>42. Adrenocorticotrophic hormone stimulates the adrenal cortex to produce_____. A. Epinephrine B. Aldosterone C. Cortisol D. Testosterone</p>
<p>43. An enlarged thyroid is the result of_____deficiency. A. Calcium B. Iodine C. Iron D. Phosphorus</p>
<p>44. Anabolic steroids are_____versions of testosterone. A. Effective B. Synthetic C. Natural D. Ineffective</p>
<p>45. The hormone known to participate in metabolism of calcium and phosphorus is A. Mineralocorticoids B. Calcitonin C. Glucagon D. Glucocorticoids</p>
<p>46. Deficiency of adrenal cortex hormones results in A. Tetany B. Acromegaly C. Addison disease D. Cretinism</p>
<p>47. During growth period release of too much growth hormone can lead to A. Cretinism B. Acromegaly C. Gigantism D. Simmond's disease</p>
<p>48. Glucagon hormone is secreted by the_____. A. Thyroid gland B. Adrenal gland C. Pituitary gland D. Pancreas</p>
<p>49. Hormone responsible for the secretion of milk after parturition A. ICSH B. Prolactin C. ACTH D. LH</p>
<p>50. This is not a function of insulin A. decreasing glycogenolysis B. lipogenesis C. gluconeogenesis D. glycogenesis</p>
<p>51. Action of parathormone in the human body A. decreases blood sodium level B. increases blood sodium level C. decreases blood calcium level D. increases blood calcium level</p>
<p>52. Effects of hypothyroidism include all but except this A. Diarrhoea B. ethargy C. Anorexia D. Weight gain</p>
<p>53. Glucagon A. accelerates protein synthesis within cells B. accelerates conversion of glycogen into glucose C. decreases conversion of glycogen into glucose D. Slows down glucose formation from lactic acid</p>
<p>54. This hormone is responsible for "fight-or-flight" response A. Thyroxine and melatonin B. insulin and glucagon C. epinephrine and norepinephrine D. oestrogen and progesterone</p>
<p>55. This hormone is not secreted by Hypothalamus A. PRH B. FSH C. GRH D. TRH</p>
<p>56. This is not an endocrine gland A. Adrenal B. Pituitary C. Lacrimal D. Thyr</p>
<p>57. Neurohypophysis releases A. Vasopressin B. oxytocin C. oxytocin and vasopressin D. vasopresson and relaxin</p>
<p>58. Term hormone was coined by A. W. B. Bayliss B. E. H. Schally C. E.H. Starling D. Haris</p>

59. Trophic hormones are secreted by A. Thyroid B. Adrenal C. Hypothalamus D. Hypophysis
60. The function of pineal body A. lighter the skin colour B. control sexual behavior C. regulate the period of puberty D. All of the above
LEVEL - 2
61. Vasopressin is responsible for A. Controlling oogenesis B. Regulating blood pressure and act on the nephron tubules C. Regulating formation of pigment D. Controlling spermatogenesis
62. Rathke's pouch forms A. Pineal gland B. thyroid gland C. Spleen D. pituitary gland
63. Ovulation in mammals occurs mainly under the influence of A. TSH and ACTH B. FSH and LH C. TSH and STH D. MTH and ACTH
64. Growth hormone from the pituitary has its effect on metabolism of A. Fat B. carbohydrate C. Protein D. All of the above
65. Low levels of the GH of pituitary causes A. Grave's disease B. Acromegaly C. Cushing's disease D. Simmond's disease
66. MSH is secreted by which part of the pituitary A. Pars distalis B. Pars tuberalis C. Pars intermedia D. Pars nervosa
67. Chemical signals released by an organism that influence the behavior of other individuals of the same species are called _____. A. Pheromone B. Insulin C. Androgen D. Steroid
68. Endemic goitre is a state of A. increased thyroid function B. Normal thyroid function C. Decreased thyroid function D. Moderate thyroid function
69. In addition to thyroxine (T4), triiodothyronine (T3), thyroid gland produces _____. A. Thyroid-stimulating hormone B. Adrenocorticotrophic hormone C. Calcitonin D. Gonadotropic hormones
70. Pituitary hormone triggering the male testes to generate sperm and in females, triggering follicular development on a monthly basis is A. prolactin B. growth hormone C. follicle-stimulating hormone D. luteinizing hormone
71. Difference between endocrine and exocrine glands is that A. endocrine glands release hormones, exocrine glands release waste B. endocrine glands are interconnected, exocrine glands are totally independent C. endocrine glands are formed by epithelial tissue, exocrine glands are connective tissues primarily D. endocrine glands are ductless, exocrine glands release secretions into ducts or at the surface of the body
72. This is the most abundant hormone produced by the anterior pituitary A. LH B. TSH C. ACTH D. GH
73. Which of the following homeostatic imbalances usually results from deficits in both glucocorticoids and mineralocorticoids?

A. Grave's disease B. Cretinism C. Cushings syndrome D. Addison's disease
74. Which amino acid is required for synthesis of adrenaline? A. Glycine B. Cysteine C. Arginine D. Tyrosine
75. When a person suffers from marked fall in B.P. it is helpful to administer him the following hormone. A. Insulin B. Thyroxine C. Growth hormone D. Adrenaline
76. Hypersecretion of a hormone is responsible for the change of emotional state as fear, anger, pain and rise of blood pressure and heart rate. It is A. Insuline B. Adrenaline C. Progesterone D. Thyroxine
77. The steroid responsible for balance of water and electrolytes in our body is A. Insulin B. Melatonin C. Testosterone D. Aldosterone
78. Which of the following hormones is correctly matched with its deficiency disease? A. Relaxin - Cretinism B. Parathormone- Tetany C. Insulin - Diabetes insipidus D. Prolactin - Asigmatism
79. Identify the hormones, labelled as A, B, and C in the following figure <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-left: 20px;"> <p>A. A-GH, B-FSH, C-LH B. A-GnRH, B-FSH, C-LH C. A-GH, B-GnRH, C-PRT D. A-GnRH, B-GH, C-PRT</p> </div> </div>
80. Deficiency of ADH will result in A. Increased volume of urine C. Decreased volume of urine B. Excessive secretion of urochrome D. change in pH from acidic to alkaline
81. A tadpole with surgically removed thyroid gland can be made to undergo metamorphosis. If A. Given an injection of TSH C. Given an injection of oxytocin B. Given an injection of thyroxine D. Feed on dried thyroid gland
82. Which of the following is incorrect in relation to catecholamines? A. These are called emergency hormones or hormones of fight or flight B. These hormones increase the heart beat, the strength of heart contraction and the rate of respiration C. They inhibit the lipolysis and proteolysis D. They increase the alertness, pupillary dilation, piloerection and sweating
83. A paracrine signal that relaxes smooth muscle cell is A. Vitamin-D B. Nitric oxide C. cortisol D. ADH
84. On surgical removal of pituitary gland there is a fall in levels of glucocorticoids and sexsteroids. This is due to A. Oxytocin is no longer available from pituitary B. Atrophy of adrenal medulla C. Atrophy of adrenal cortex D. LTH from pituitary is no longer available

85. If thyrectomy is done during adult hood which possibility is there
 A. Die immediately C. immunosupressent
 B. No adverse reactions D. myesthenia gravis
86. Somu has high level of calcium in his blood. Excess of which hormone can cause it
 A. Thyrocalcitonin B. Growth hormone C. parattharmone D. Insulin
87. The specific region of Hypothalamus responsible for the physiological sweat secretion
 A. Para ventricular nucleus C. supra optic nucleus
 B. Median eminance D. pars distalis
88. Damage to thymus in children may lead to
 A. Loss of antibody mediated immunity B. Reduction of cells production
 C. Loss of cell mediated immunity D. Both 1 and 3
89. In humans (A) parathyroid glands are present on the (B) side of thyroid gland, (C) each in two lobes of the thyroid gland
- | | | |
|---------|-------|------------|
| (A) | (B) | C |
| A. Four | Front | One pair |
| B. Four | Back | One pair |
| C. Four | Back | One |
| D. Four | Back | Twon pairs |

90. Identify A, B, C, D

Hormone	Hyposecretion results	Hyper secretion results
Insulin	Dabetis millitus	A
Thyroxin	B	Exphalmic goitre
Minerlocorticoid and gluco corticoid	C	Conn's syndrome and cushing's syndrome
Paratharmone	Tetany	D

S. No.	A	B	C	D
A	Hypo-glycemia	Cretinism	Addison's disease	Osteoporosis
B	Hyper-glycemia	Cretinism	Addison's disease	Osteoporosis
C	Hyper-glycemia	Cretinism	Osteoporosis	Addison's disease
D	Hypo-glycemia	Addison's dis	Cretinism	Osteoporosis

91. select the correct maching of hormones , its source and function.

	Hormone	Source	Function
A	Vasopressin	Posterior pituitary	Increase loss of water through urine
B	Norepinephrine	Adrenal cortex	Increased heartbeat and altered respiration
C	Glucagon	Islets of Langerhans	Stimulates glycogenolysis
D	prolactin	Posterior pituiory	Regulate growth of mammary gland and milk formation in females

92. Identify A, B, C, D in the table Hormone, chemical nature, source and function

Hormone	Chemical nature	Source	Function
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A	steroids	Zona glomerulosa	Water and electrolyte balance
Glucocorticoids	B	Adrenal cortex	Gluconeogenesis
C	steroid	D	Secondary sexual character development

	A	B	C	D
A	Mineralocorticoids	steroids	Sex corticoids	Zona reticulosa
B	Aldosterone	Steroids	Sex corticoids	Zona fasciculaa
C	Cortisol	peptide	Sex corticoids	Zona glomerulosa
D	Sex corticoids	Steroids	Sex corticoids	Zona reticularis

93. In which of the following pairs, the hormone of endocrine glands and its primary action is mismatched

- A. Calcitonin- Lower blood calcium levels
- B. parathyroid_ Raises blood calcium levels
- C. somatostatin- inhibits release of glucagon
- D. Regulates the rate of cellular mettabolism

94. Name the condition when the concentration of ketone body increases in urine

- A. Acromegaly
- B. Diabetes mellitus
- C. Diabetes insipidus
- D. Cushing's disease

95. Which of the following hormone is chemically glycoprotein?

- A. Growth hormone
- B. Prolactin
- C. Erythropoietin
- D. Estrogen

96. which of the following hormones synchronizes circadian rhythms and may be involved in onset of puberty?

- A. Thymopoietin
- B. Thymosin
- C. Melatonin
- D. Paratthyroid

97. which of the hormone(s) has effects on the stomach, pancreas, and gallbladder?

- A, Secretin
- B. Cholecystikin
- C. Gastrin
- D. All the above

98. which one of the following pairs is mismatched?

- A. Antidiuretic hormone – Kidneys
- B. Luteinzing hormone – Mammary glands
- C. Prolactin – Mammary glands
- D. adrenocorticotropic hormone- Adrenal cortex

99. Which one of the followings is the primary target organ of aldosterone?

- A. Kidney
- B. Pancreas
- C. Liver
- D. Both(B) And (C)

100. which one of the following is the correct matching of the events occuring during menstrual cycle?

- A. Menstruation- breakdown of myometrium and ovum is not fertilised
- B. Ovulation_ LH and FSH attain peak level and sharp fall in the secretion of progesteron
- C. Proliferative phase- Rapid regeneration of myometium and maturation of Grafian follicle
- D. Development of corpus luteum- Secretory phase and increased secretion of progesteron

Level—III

101. Which one of the following pairs of organs includes the endocrine glands?

(CBSC. PMT, 2008)

1. Thymus and Testes
2. Adrenal and Ovary
3. Parathyroid and Adrenal
4. Pancreas and Parathyroid

102. Which hormone causes dilation of blood vessels, increases oxygen consumption and glycogenesis (CBSC. PMT, 2006)

1. Glucagon
2. ACTH
3. Insulin
4. Adrenalin

103. A person is having problem with calcium and phosphorus metabolism in his body. Which one of the following glands may NOT functioning properly? (CBSC. PMT, 2007)

1. Parotid
2. Pancreas
3. Thyroid
4. Parathyroid

104. A health disorder that results from the deficiency of thyroxine in adults is characterized by i. A low metabolic rate AND ii. Increase in body weight and tendency to retain water in issues is

1. Cretinism
2. Hypothyroidism
3. Simple goitre
4. Myxoedema

105. Toxic agents present in food which interfere with thyroxine synthesis lead to the development of (AIPMT, 2010)

1. Simple goiter
2. Thyrotoxicosis
3. Toxic goiter
4. Cretinism

106. Injury to the adrenal cortex is not likely to affect the secretion of which one of the following

1. Adrenaline,
2. Cortisol,
3. Aldosteron
4. Both androstenadeione and dihydroepiandrosterone

107. which one of the following pairs is incorrectly matched (AIPMT, 2010)

1. corpus luteum—relaxin(secretion)
2. Insulin—Diabetes mellitus(disease)
3. glucagon—beta cells (source)
4. Somatostatin—Delta cells(source)

108. Low Ca^{++} in the body fluid may be the cause of (AIPMT, 2010)

1. Gout,
2. Tetany,
3. Anaemia,
4. Angina pectoris

109. Which one of the following is an accumulation and release centre of neurohormones? (CBSE PMT, 2006)

1. Anterior pituitary lobe
2. Intermediate lobe of the pituitary
3. Posterior pituitary lobe
4. Hypothalamous

110. Which one of the following is NOT a second messenger in hormone action?

(CBSE PMT, 2006)

1. cAMP
2. cGMP
3. Calcium
4. Sodium

111. About which day in a normal human menstrual cycle does rapid secretion of L.H.(popularly called L.H- surge) normally occurs? (CBSE Mains 2010)

1. 14th day
2. 20th day
3. 5th day
4. 11th day

112. The 24 hour (diurnal) rhythm of our body such as sleep-wake cycle is regulated by the hormone (CBSE Mains 2010)

1. Calcitonin
2. Prolactin
3. Adrenaline
4. Melatonin

113. Given below is an incomplete table about certain hormones, their source glands and one major effect of each on the body in humans. Identify the correct option for the three blanks A, B, C. (CBSE Pre 2011)

Gland	Secretion	Effect on body
A	Estrogen	Maintenance of secondary sexual characters
Alpha cells of islets of Langerhans	B	Raises blood sugar level
Anterior Pituitary	C	Over secretion leads to gigantism

A	B	C
1. Ovary	Insulin	Calcitonin
2. Placenta	Glucagon	Calcitonin
3. Ovary	Glucagon	Growth hormone
4. Placenta	Insulin	Vasopressin

114. The secretory phase in the human menstrual cycle is also called: (CBSE Mains 2012)

1. Luteal phase and lasts for about 13 days
2. Follicular phase and lasts for about 13 days
3. Luteal phase and lasts for 6 days
4. Follicular phase and lasting for about 6 days

115. Identify the hormone with its correct matching of source and function: (AIPMT 2014)

1. Atrial natriuretic factor- ventricular wall, increases the blood pressure
2. Oxytocin- posterior pituitary, growth and maintenance of mammary glands.
3. Melatonin – pineal gland, regulates the normal rhythm of sleep wake cycle.
4. Progesterone – corpus luteum, stimulation of growth and activities of female secondary sex organs.

116. Fight-or-flight reactions cause activation of: (AIPMT 2014)

1. The pancreas leading to a reduction in the blood sugar levels
2. the parathyroid glands, leading to increased metabolic rate
3. the kidney, leading to suppression of rennin-angiotensin-aldosterone pathway
4. the adrenal medulla, leading to increased secretion of epinephrine and norepinephrine

117. Which one of the following hormones is not involved in sugar metabolism?

1. Glucagon
2. Cortisone
3. Aldosterone
4. Insulin

118. Which one of the following hormones though synthesised elsewhere, is stored and released by the master gland? (AIPMT 2015)

1. Melanocyte stimulating hormone
2. Luteinizing hormone
3. Antidiuretic hormone
4. Prolactin

119. A chemical signal that has both endocrine and neural roles is: (AIPMT 2015)

1. Epinephrine
2. Cortisol
3. Melatonin
4. Calcitonin

120. The amino acid, tryptophan is the precursor for the synthesis of (NEET, 2016)

1. Thyroxin and tri-iodothyronine
2. Estrogen and progesterone
3. Cortisol and cortisone
4. Melatonin and serotonin

121. The two polypeptide of human insulin are linked together by (NEET 2016)
1. Phosphodiester bonds 2. Covalent bonds 3. Disulphide linkage 4. Hydrogen bonds
122. Which one of the following pairs of hormones are not antagonistic (having opposite effects) to each other? (NEET, 2016)
1. Insulin - Glucagon 2. Aldosterone - Atrial Natriuretic factor 3. Relaxin - Inhibin 4. Parathormone - Calcitonin
123. GnRH, a hypothalamic hormone, needed in reproduction, acts on (NEET, 2017)
1. Posterior pituitary gland and stimulates secretion of oxytocin and FSH 2. Posterior pituitary gland and stimulates secretion of LH and relaxin 3. Anterior pituitary gland and stimulates secretion of LH and relaxin 4. Anterior pituitary gland and stimulates secretion of LH and FSH
124. A temporary endocrine gland in the human body is (NEET, 2017)
1. Corpus cardiacum 2. Corpus luteum 3. Corpus allatum 4. Pineal gland
125. Hyposecretion of Growth Hormone in adults does no cause further increase in height, because. (NEET, 2017)
1. Epiphyseal plates close after adolescence 2. Bones loose their sensitivity to Growth Hormone in adults. 3. Muscle fibres do not grow in size after birth. 4. Growth hormone becomes inactive in adults.
126. Which of the following hormones can play a significant role in osteoporosis? (NEET, 2018)
1. Aldosterone and Prolactin 3. Estrogen and Parathyroid hormone 2. Progesterone and Aldosterone 4. Parathyroid hormone and Prolactin
127. Which of the following hormone is a derivative of amino acid (NEET, 2018)
1. Oestrogen 2. Epinephrine 3. Progesterone 4. Prostaglandin
128. Fight- or –flight reactions cause activation of (NEET, 2018)
1. The adrenal medulla, leading to increased secretion of epinephrine and norepinephrine 2. The pancreas leading to reduction in the blood sugar levels 3. The parathyroid glands, leading to increased metabolic rate 4. He kidney, leading to suppression of rennin angiotensin-aldosterone pathway
129. Which of the following statements is incorrect?
1. Pars intermedia atropies during foetal development 2. Pitutary gland is lodged in Sella turcica 3. Neurohypophysis synthesizes two hormones 4. Herring bodies are present in neurohypophysis.
130. Mammalian thymus is mainly concerned with
1. Regulation of body temperature 2. Regulation of body growth 3. Immunological functions 4. secretion of thyrotropin.

13. Assertion & Reasoning Questions

<p>In each of the following question a statement of Assertion (A): is given followed by a corresponding statement of Reason (R): just below it.</p> <p>Of the statements, mark the correct answer as</p> <p>A. If both assertion and reason are true and reason is the correct explanation of assertion</p> <p>B. If both assertion and reason are true but reason is not the correct explanation of assertion</p> <p>C. If assertion is true but reason is false</p> <p>D. If both assertion and reason are false</p>	
1	<p>Assertion (A): Diabetes incipidus is marked by excessive urination and too much thirst for water.</p> <p>Reason (R) : Anti-Diuretic hormone (ADH) is released by the posterior lobe of pituitary gland.</p>
2	<p>Assertion (A): Insulin is not given orally.</p> <p>Reason (R) : Insulin hormone is lipid-soluble and directly enters into the cell membrane.</p>
3	<p>Assertion (A): Chorionic gonadotropin prevents corpus leuteum from involuting.</p> <p>Reason (R) : It has the property similar to luteinizing hormone.</p>
4	<p>Assertion (A): Thyroxine shows calorogenic effect.</p> <p>Reason (R) : Thyroxine increases catabolism, produces energy and increases body temperature.</p>
5	<p>Assertion (A): Insulin is secreted by Corpus leuteum.</p> <p>Reason (R) : They inhibit the FSH and GnRH.</p>
6	<p>Assertion (A): Adrenal gland have dual origin.</p> <p>Reason (R) : The adrenal cortex develops from endoderm and the adrenal medulla develops from the mesoderm.</p>
7	<p>Assertion (A): Vasopressin is also called as Anti-Diuretic hormone (ADH).</p> <p>Reason (R) : Vasopressin reduces the loss of water in urine by increasing water reabsorption in nephrons.</p>
8	<p>Assertion (A): Oxytocin is also known as Anti-Diuretic hormone (ADH).</p> <p>Reason (R) : Oxytocin can cause an increase in the renal reabsorption of water.</p>
9	<p>Assertion (A): The failure of secretion of hormone vasopressin causes diabetes mellitus in the patient.</p> <p>Reason (R) : Vasopressin reduces the volume of urine by increasing the reabsorption of water from the urine.</p>
10	<p>Assertion (A): Adrenal Cortex is called the gland for “Fight, Fright and Flight”</p> <p>Reason (R) : The hormones epinephrine and nor-epinephrine help the body to combat against stress and emergency conditions.</p>

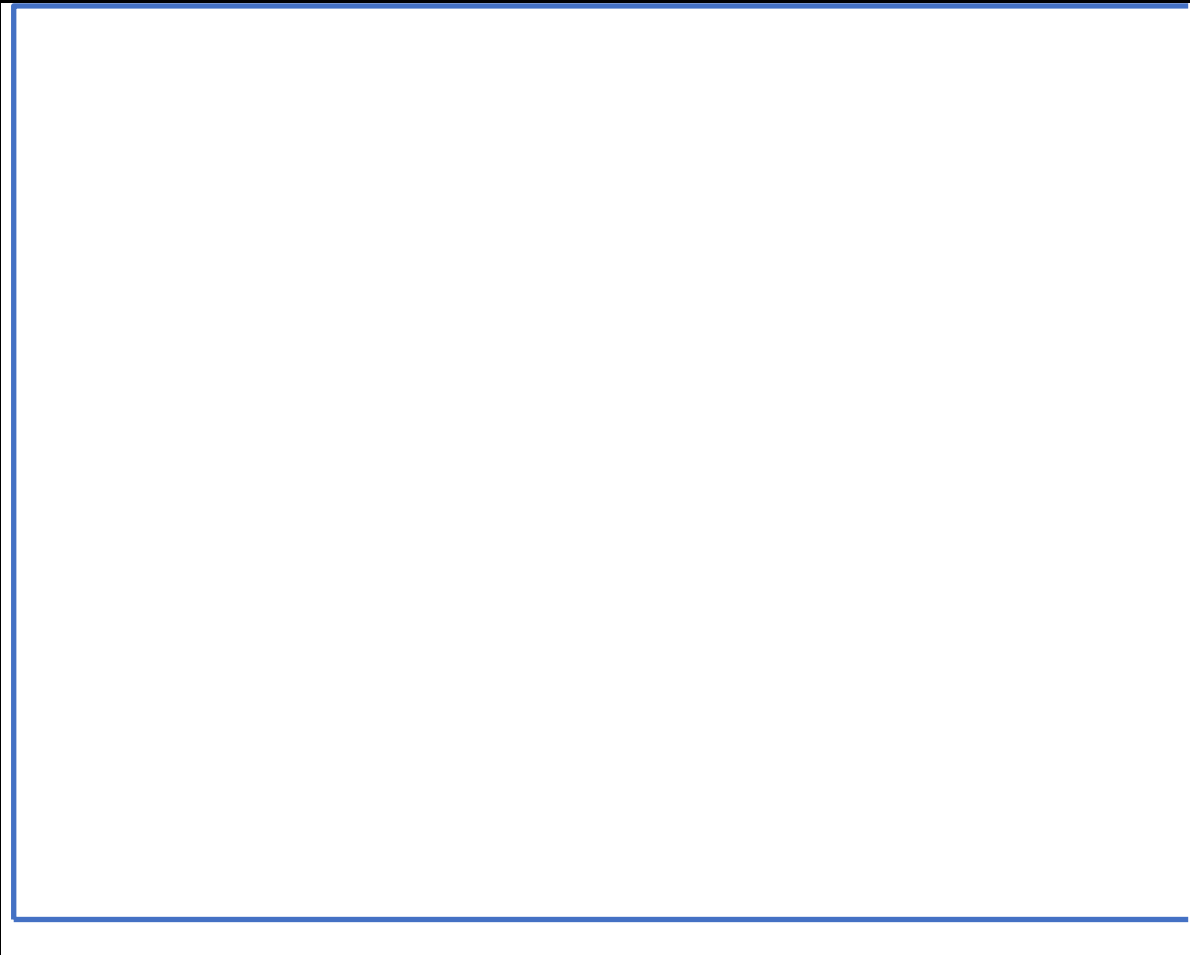
14. Assignment Questions to answer

VSAQ***	1	What is Acromegaly? Name the hormone responsible for the disorder?
***	2	Which hormone is called “Anti-Diuretic Hormone”? Write the name of the gland that secretes it.
***	3	Distinguish between Diabetes mellitus and Diabetes insipidus.
***	4	What are Islets of Langerhans?
**	5	What is “Insulin Shock”?
*	6	What is Erythropoetin? What is its function?
SAQ**	1	Give an account of the secretions of the Pituitary gland.
***	2	Compare a “Pituitary Dwarf” and a “Thyroid dwarf” in respect of similarities and dissimilarities they possess.
***	3	Write a notes on “Addison’s Disease” and the “Cushing’s Syndrome”.
**	4	Write a note on the mechanism of hormones.

15. Hands on Experiences for you – Try It!!!

1. Preparing Activity cards on each hormones:

**Dear students, observe below flow chart:
Prepare same flow charts for each hormone answering the
questions in each box.**



2. 12” Natural Ways to Balance Your Hormones:

- **Eat Enough Protein at Every Meal:** Consuming an adequate amount of protein is extremely important. Dietary protein provides essential amino acids that your body can't make on its own and must be consumed every day in order to maintain muscle, bone and skin health. In addition, protein influences the release of [hormones that control appetite](#) and food intake.
- **Engage in Regular Exercise:** Physical activity can strongly influence hormonal health. A major [benefit of exercise](#) is its ability to reduce insulin levels and increase insulin sensitivity. Insulin is a hormone that has several functions. One is allowing cells to take up sugar and amino acids from the bloodstream, which are then used for energy and maintaining muscle
- **Avoid Sugar and Refined Carbs:** [Sugar](#) and refined carbs have been linked to a number of health problems. Indeed, avoiding or minimizing these foods may be instrumental in optimizing hormone function and avoiding obesity, diabetes and other diseases.

- **Learn to Manage Stress:** Stress can wreak havoc on your hormones. Two major hormones affected by stress are cortisol and adrenaline, which is also called epinephrine. [Cortisol](#) is known as “the stress hormone” because it helps your body cope with stress over the long term.
- **Consume Healthy Fats:** Including high-quality natural fats in your diet may help reduce insulin resistance and appetite. [Medium-chain triglycerides](#) (MCTs) are unique fats that are taken up directly by the liver for immediate use as energy. They have been shown to reduce insulin resistance in overweight and obese people, as well as in people with diabetes. MCTs are found in coconut oil, palm oil and pure MCT oil.
- **Avoid Overeating and Undereating:** Eating too much or too little may result in hormonal shifts that lead to weight problems. Overeating is shown to increase insulin levels and reduce insulin sensitivity, especially in overweight and obese people who are insulin resistant
- **Drink Green Tea:** [Green tea](#) is one of the healthiest beverages around. In addition to metabolism-boosting caffeine, it contains an antioxidant known as epigallocatechin gallate (EGCG), which has been credited with several health benefits. Research suggests that consuming green tea may increase insulin sensitivity and lower insulin levels in both healthy people and those with insulin-resistant conditions like obesity and diabetes.
- **Eat Fatty Fish Often:** Fatty fish is by far the best source of long-chain [omega-3 fatty acids](#), which have impressive anti-inflammatory properties.
- **Get Consistent, High-Quality Sleep:** No matter how nutritious your diet is and how much exercise you get, your health will suffer if you don’t get enough restorative sleep. Poor sleep has been linked to imbalances of many hormones, including insulin, cortisol, leptin, ghrelin and growth hormone
- **Stay Away From Sugary Beverages:** Sugar in any form is unhealthy. However, [liquid sugars](#) appear to be the worst by far.
- **Consume a High-Fiber Diet:** Fiber, especially the soluble type, is an important component of a healthy diet. Studies have found that it increases insulin sensitivity and stimulates the production of hormones that make you feel full and satisfied
- **Eat Eggs Anytime:** Eggs are one of the [most nutritious foods](#) on the planet. They’ve been shown to beneficially affect hormones that regulate food intake, including lowering levels of insulin and ghrelin. Importantly, these positive effects on hormones seem to occur when people eat both the [egg yolk](#) and egg white.

16. Medical and other careers related to Nervous System

Clinical Endocrinology

Clinical endocrinologists use a variety of methods and techniques to treat patients with hormonal imbalances and deficiencies. These professionals may have expertise in a subspecialty like pediatric or reproductive endocrinology. They are experts on growth and development, metabolism and fertility among other areas. Clinical endocrinologists may also help patients with diabetes, hyperthyroidism and other disorders.

Research Endocrinology

Endocrinologists working within a laboratory actively investigate the causes of endocrine disease and work to create and evaluate new treatment options. These specialists participate in drug discovery and are presented with opportunities to publish their research. They may work for academic institutions, pharmaceutical companies and other organizations.

Answers to the activities and note making

10. Fill in the banks

1	Endocrine	10	Antagonistic	19	Cortisol
2	Several	11	Calmodulin	20	Thymus gland
3	Median eminence	12	Isthmus	21	Anterior Pitutary gland (Adenohypophysis)
4	Endocrine	13	Thyroid follicles	22	Penial
5	Synthesis and release	14	Adrenal	23	Insulin
6	Estrogen	15	Tyrosine	24	Iodine
7	Prolactin; and Corticotropin	16	Parathyroid cells	25	Thyroid
8	PTH	17	Endocrine		
9	GLUCAGON & Insulin	18	Endocrine		

11. TRUE OR FALSE STATEMENTS

(Correct answers given for false statements)

1	FALSE	SMALL INTESTINE
2	TRUE	
3	FALSE	HYMOSIN
4	TRUE	
5	FALSE	ALPHA
6	TRUE	
7	FALSE	PANCREAS
8	TRUE	
9	FALSE	OXYTOSIN
10	FALSE	ADRENAL CORTEX

11	FALSE	SPHENOID BONE
12	TRUE	
13	FALSE	MILK
14	FALSE	THORAX
15	TRUE	
16	TRUE	
17	TRUE	
18	FALSE	PROTEIN
19	FALSE	MINERALO CORTICOID
20	FALSE	NOR EPINEPHRINE
21	FALSE	ADDISONS DISEASE
22	TRUE	
23	FALSE	ERYTHROPOETIN
24	TRUE	
25	TRUE	

12. Multiple choice questions

Sl.No.	Answer	
1.	C	
2.	B	
3.	B	
4.	C	
5.	C	
6.	D	
7.	A	
8.	B	
9.	C	
10.	C	
11.	D	

12.	D	
13.	B	
14.	A	
15.	C	
16.	D	
17.	B	
18.	C	
19.	A	
20.	B	
21.	A	
22.	B	
23.	D	
24.	D	
25.	A	
26.	B	
27.	D	
28.	C	
29.	C	
30.	D	
31.	C	
32.	C	
33.	D	
34.	D	
35.	B	
36.	C	
37.	C	
38.	A	
39.	B	
40.	D	
41.	B	
42.	C	
43.	B	
44.	C	
45.	B	
46.	C	
47.	C	
48.	D	

49.	B	
50.	C	
51.	D	
52.	A	
53.	B	
54.	B	
55.	B	
56.	C	
57.	C	
58.	C	
59.	D	
60.	D	
LEVEL - II		
61.	B	
62.	D	
63.	B	
64.	D	
65.	D	
66.	C	
67.	A	
68.	C	
69.	B	
70.	C	
71.	D	
72.	D	
73.	-	
74.	D	
75.	D	
76.	B	
77.	D	
78.	C	
79.	B	
80.	A	
81.	C	
82.	C	
83.	B	
84.	C	

85.	B	
86.	C	
87.	A	
88.	D	
89.	B	
90.	A	
91.	B	
92.	A	
93.	D	
94.	B	
95.	C	
96.	B	
97.	B	
98.	B	
99.	A	
100.	D	
LEVEL - III		
101.	3	
102.	3	
103.	4	
104.	3	
105.	1	
106.	1	
107.	3	
108.	2	
109.	2	
110.	4	
111.	1	
112.	4	
113.	3	
114.	1	
115.	3	
116.	4	
117.	3	
118.	3	
119.	1	
120.	4	

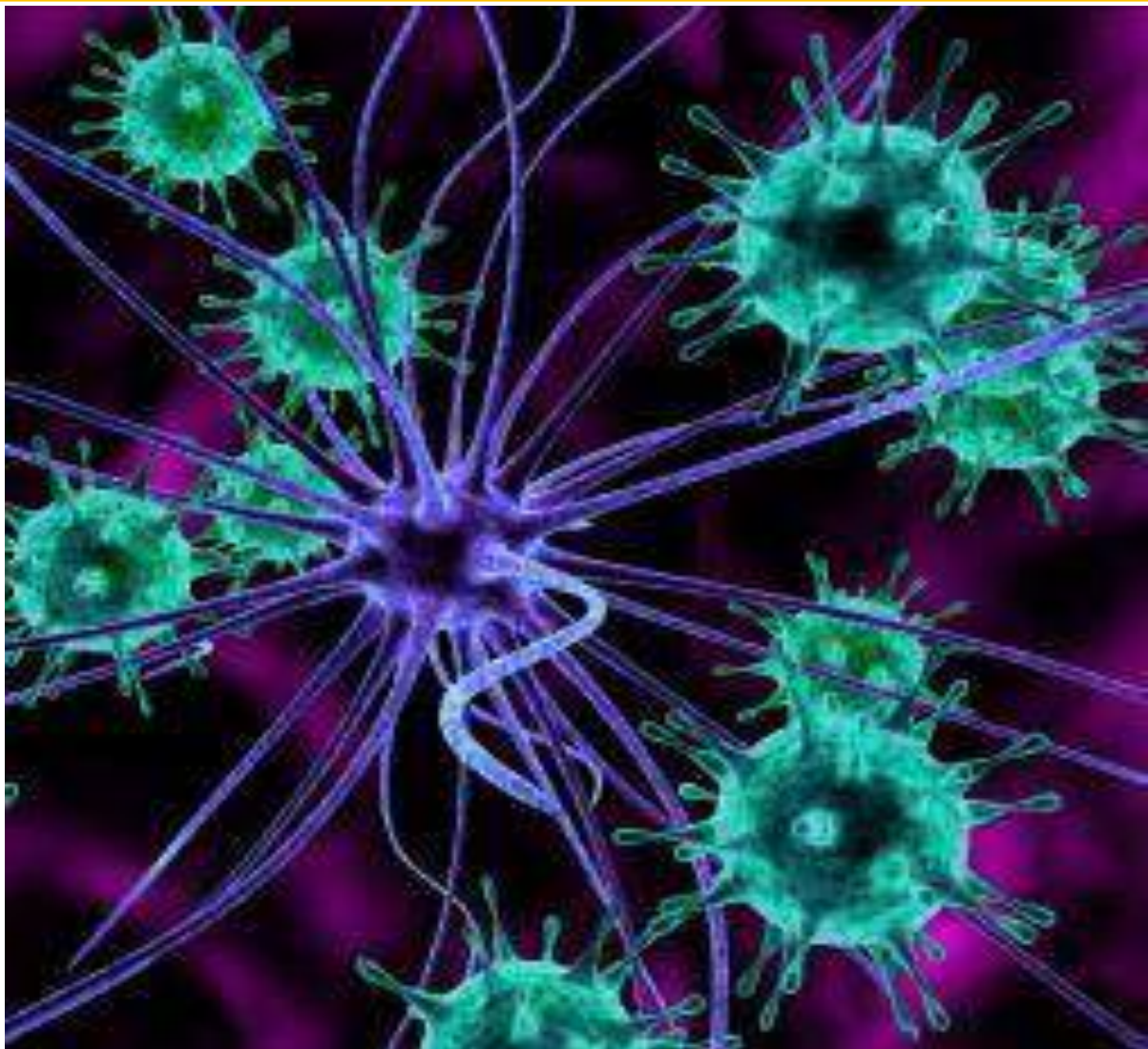
121.	3	
122.	3	
123.	4	
124.	2	
125.	1	
126.	3	
127.	2	
128.	1	
129.	3	
130.	3	

13. Assertion & Reasoning Questions

1	2	3	4	5
Ans: 2	3	1	1	2
6	7	8	9	10
Ans:3	1	4	4	4

UNIT – IV

HUMAN ANATOMY AND PHYSIOLOGY - IV



UNIT – IV B

IMMUNE SYSTEM

MAJOR LEARNING OBJECTIVE

- Students will be able to identify and understand the operating mechanisms and the significance of the **“Immune System”**
- Students will be able to appreciate **“the tag line”** - **“The Body Guard with Powerful Arsenal”**.

LEARNING OUTCOMES:

- Be able to understand the basic concepts and the cells of the immune system.
- Be able to understand, integrate, and appreciate the role of: 1. Different soluble mediators of immunity and 2. The Antibodies.
- Be able to understand, analyze and apply the knowledge of the types of immunity and appreciate the role of different cells of immunity.
- Be able to explain how the phagocytic neutrophils, macrophages, dendritic cells, and natural killer cells contribute to innate immunity
- Be able to Define **“cytokines”** and explain their role in the immune response
- Be able to compare, understand and differentiate the **“Humoral and Cell-Mediated”** mechanisms of immunity.
- Be able to understand the various types of immunological disorders and the precautions to be taken by the human beings.

ADDITIONAL READING MATERIALS

- COVID-19

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book
2. Defining key words
3. Expand the abbreviations
4. Name the Organs/ Cells in the lines of defense in the body
5. Note making about “Cells of Immune System”
6. Note making on “Soluble mediators of Immunity”
7. Label the parts of Antibody
8. Add brief note on “Processing of Antigens”
9. Name the MNPs in these organs
10. Define and add brief note on “Types of Immunity”
11. Understand and add brief note on “Types of Immune Responses”
12. Give brief note on “Immunological Disorders”
13. Fill in the blanks
14. Answer “TRUE” or “FALSE”
15. Multiple Choice Questions for Competitive exams
16. Assertion & Reasoning Questions
17. Assignment Questions to answer
18. Hands on Experiences for you – Try It!!!
19. Medical and other careers related to Immune System
20. Answers to the activities and note making

INSTRUCTIONS TO LECTURER

- Explain each part of the worksheet & Come up with some examples to help
- Clarify doubts of the students before starting the work book

INSTRUCTIONS TO STUDENTS

- First read the text book thoroughly and logically with a friend cooperatively
- While attempting the activities analyze them carefully

ADDITIONAL READING MATERIALS

Pandemic: An outbreak of a disease that occurs over a wide geographic area and affects an exceptionally high proportion of population and spread easily from human to human.

Ex: influenza pandemics, COVID-19

Epidemic: An epidemic is the rapid spread of disease to a large number of people in a given population within a short period of time and it may be restricted to one location.

Ex: Cholera, Chikungunya , Ebola disease

Herd immunity (or community immunity): It is the indirect protection from contagious disease that happens when a population is immune either through vaccination or immunity developed through previous infection. Once herd immunity has been established for a while, and the ability of the disease to spread hindered, the disease can be eventually be eliminated. This is how the world eradicated small pox is the best example for herd immunity.

COVID-19:

- Corona virus disease (COVID-19) is caused by novel corona virus (SARS-COV2). It has single stranded RNA (positive sense) and belongs to the family Coronaviridae in the order Nidovirales. Coronaviruses are zoonotic, meaning they can be transmitted between animals and people, but most infect only their specific animal host. COVID-19 affects different people in different ways.
- Most infected people will develop mild to moderate illness and recover without hospitalization.

Most common symptoms:

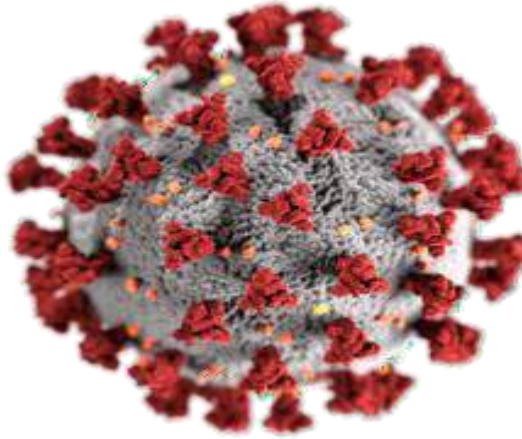
- Fever
- Dry cough
- Tiredness
- Loss of taste or smell
- A rash on skin,

Less common symptoms:

- Aches and pains
- Sore throat
- Diarrhoea
- Conjunctivitis
- Headache

Severe Symptoms

- Discolouration of fingers or toes
- Difficulty in breathing
- Low Oxygen levels <80%



- Red protrusion: Spike proteins
- Grey coating: The envelope, composed mainly of lipids, which can be destroyed with alcohol or soap
- Yellow deposits: envelope proteins
- Orange deposits: membrane proteins

Precautions

- Protect yourself and others around you by knowing the facts and taking appropriate precautions.
- Follow advice provided by your local health authority.
- Sanitization, Hygiene habits

Masks

- Masks can help prevent the spread of the virus from the person wearing the mask to others.
- Masks alone do not protect against COVID-19, and should be combined with physical distancing and hand hygiene.

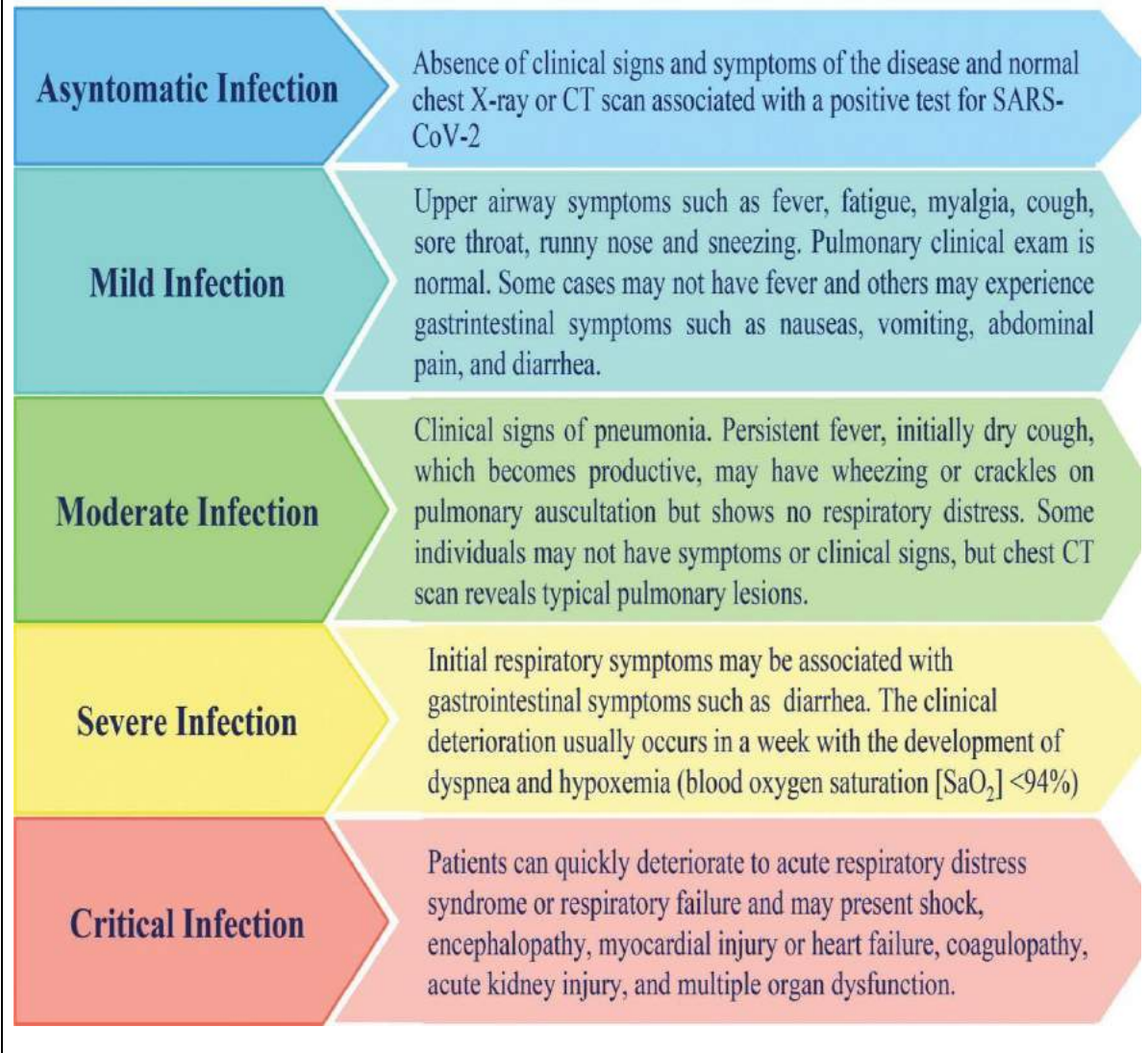
Self-care

- If you feel sick you should rest, have good sleep, drink plenty of fluid, and eat nutritious food. Stay in a separate room from other family members, and use a dedicated bathroom if possible. Clean and disinfect frequently touched objects and surfaces.
- Everyone should keep a healthy lifestyle at home. Maintain stay active, and make social contact with loved ones through the phone or internet. Children need extra love and attention from adults during difficult times. It is normal to feel sad, stressed, or confused during a crisis. Talking to people you trust, such as friends and family, can help. If you feel overwhelmed, talk to a health worker or counselor.
- COVID-19 affects different people in different ways. Most infected people will develop mild to moderate illness and recover without hospitalization.

To date, no specific vaccines or medicines for COVID-19. Research is in progress.

Cytokine storm: A severe immune reaction in which the body releases too many cytokines into the blood too quickly. Cytokines play an important role in normal immune response, but having a large amount of them released in the body all at once can be harmful. A cytokine storm can occur as a result of an infection, autoimmune condition, or other disease. It may also occur after treatment with some types of immunotherapy. Signs and symptoms include high fever, inflammation and severe fatigue and nausea. Sometimes, a cytokine storm may be severe or life threatening and lead to multiple organ failure.

Clinical Presentation of Covid-19



1. Locate and rewrite difficult key words from the text book

1	9	17
2	10	18
3	11	19
4	12	20
5	13	21
6	14	22
7	15	23
8	16	24

2. Define key words

1. Innate immunity	
2. Acquired Immunity	
3. Immune deficiency disorders	
4. Immunological Memory	
5. Inflammations	
6. Immunosuppressants	
7. Opsonization	
8. Inoculation	
9. Immunization	
10. Immune-competent T-Cells	
11. Immuno-competent B-cells	
12. Immunoglobulins	
13. Immunization	

3. Expand the abbreviations

1. CD markers	
2. CTLs	
3. LGLs	
4. MNPs	
5. PMNs	
6. APCs	
7. MHC	
8. MALT	
9. MAC	
10. IFNs	
11. ILs	
12. HLA	
13. PMNL	
14. IgA	
15. ATS	
16. CTLs	
17. CMI	
18. SCID	
19. AIDS	
20. HIV	
21. ssRNA	
22. ELISA	
23. NACO	

24. gp41 /gp120	
25. ASR	

4. Name the organs / cells in the lines of defense in the body

FIRST LINE	
SECOND LINE	
THIRD LINE	

5. Note making about “Cells of Immune System”

1. B - Lymphocytes	
2. T- Lymphocytes	
3. NK-Cells	
4. T_H – Cells	
5. T_C – Cells	
6. Auxillary Cells	
7. MNPs	
8. PNPs	

6. Note making on “Soluble mediators of Immunity”

1. Complement Proteins	
2. Cytokines	
3. Interleukins	
4. Interferons	
5. Antibodies	
6. Class-I MHC	
7. Class – II MHC	
8. Antigen Specific Receptors	

7. Label the parts of Antibody

	<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6.
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8. Add brief note on “Processing of Antigens”

(Observe and relate diagram at Page 147 in Text Book)

<p>Processing of Exogenous Antigen</p>	<p>Write Brief Note:</p>
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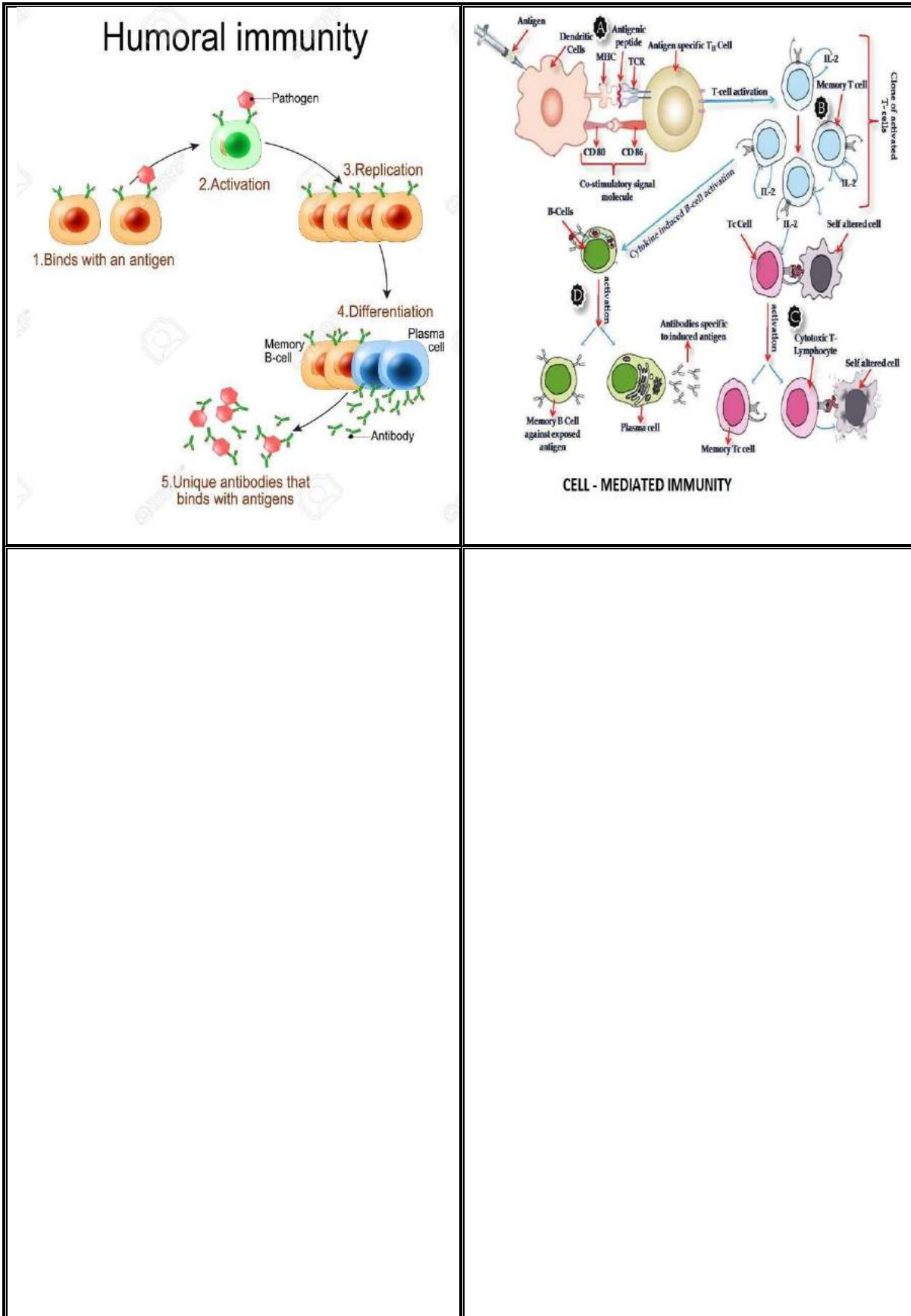
9. Name the “Mononuclear Phagocytes” in these ocations/organs:

Connective Tissue	
Liver	
Brain	
Bone	
Synovial Fluid	

10. Define and add brief note on “Types of Immunity”

Innate Immunity	Physical Barriers	
	Physiological Barriers	
	Cellular Barriers	
	Cytokine Barriers	
Active Acquired Immunity	Natural Active Immunity	
	Artificial Active Immunity	
Passive Acquired Immunity	Natural Passive Immunity	
	Artificial Passive Immunity	

11. Understand and add brief note on “Types of Immune Responses” (Go through pages 149-151 in Text book)



12. Give brief note on “Immunological Disorders”

1. Hypersensitivity Disorders

2. Auto-Immune Disorders

3. Graft Rejections

4. Acquired Immuno Deficiency Syndrome

13. Fill in the blanks

1.	_____ immunity involves the production of antibody molecules that bind to specific antigens.
2.	The study of immune system is called-----
3.	-----is the burial ground of the old RBC.
4.	The part of the antibody that recognizes an antigen is called the -----
5.	The basic structure of an antibody was proposed by -----
6.	The colostrums is rich in ----- antibodies
7.	HIV was first reported in _____ - year by _____
8.	Virus infected cells secrete proteins called -----
9.	Primary lymphoid organs are -----and -----
10.	Lymphoid tissue located within the lining of the major tracts called-----
11.	Chemically an antibody is a -----
12.	World AIDS day-----
13.	Pentameric form of antibody-----
14.	Father of immunology-----
15.	Interleukins are produced by -----
16.	The principle of vaccination is based on the property of the ----- of the immune system.
17.	The time between the first exposure to HIV and the production of antibodies by the immune system in response to HIV infection is called-----
18.	Corona virus belongs the family-----
19.	The antigenic site that binds to a paratope of antibody is called the _____
20.	_____ of birds is a Primary Lymphoid organ like thymus gland of mammals.
21.	Tears from the eyes are the _____ barriers that fight against microbes.
22.	_____ is a pentameric form of antibody, like IgA is dimeric form of antibody.

23.	_____ is a viral enzyme, present in the form of provirus
24.	The two molecules of enzymes present along with two ssRNA as genetic material in HIV virus are called _____
25.	Allergies are Type I hypersensitivity reactions due to the release of chemicals such as _____ and _____ from mast cells.

14. Answer “TRUE” or “FALSE”

1.	Antibodies are produced by T-lymphocytes.	
2.	The antigen-receptors on the surface of beta-lymphocytes are made by proteins.	
3.	Secondary immune response produces much more antibodies than primary immune response but it is slower than the primary one.	
4.	During primary immune response, beta-lymphocytes will proliferate and divide into memory-B cells and helper-B cells.	
5.	Antibodies are Y-shaped molecules formed by four protein chains which have similar length.	
6.	Epitopes are the specific sites on the antibodies which can bind to antigen molecules.	
7.	Antibodies binding domain(ABD) are the specific sites on the antigens which can bind to antibodies.	
8.	Polyclonal antibodies can response to multiple antigens	
9.	Each antigen has less than two antibodies-binding domain.	
10.	Membrane-bound antibodies cannot directly eliminate harmful substances in our antibodies.	
11.	T cells represent a small portion of the lymphocytes in the circulatory system.	
12.	HIV attacks helper T cells by binding into the CD4 proteins.	
13.	Plasma cells are responsible for "remembering" and responding to a pathogen that has already invaded the body.	
14.	Neutrophils respond to infection by releasing antibody proteins into the blood.	

15.	The polio vaccine is an example of active artificial immunity.	
16.	Self-antigens are ignored by T cells.	
17.	Dendritic cells are important antigen-presenting cells.	
18.	The purpose of the human immune system is to defend the body against non-self pathogens	
19.	COVID-19 has been detected by ELISA test.	
20.	Corona virus has dsRNA virus .	
21.	Complement proteins and their activities are together called “Complement System”.	
22.	Peyer’s patches of small intestine are Primary Lymphoid organs.	
23.	Bursa fabrisius of birds acts as a “filter of the blood” by trapping blood borne micro organisms.	
24.	There are three types of “Interferons” – alpha, beta and gamma.	
25.	Certain proteins called “Caspases” help in the destruction of the infected cells – this process is called “Apoptosis”.	

15. Multiple Choice Questions for Competitive exams

LEVEL - I	
1.	Innate immunity is also called A. Familial B. Inborn C. Genetic D. All of these
2.	Immunity acquired after an infection is A. Active immunity B. Passive immunity C. Innate immunity D. Both B and C
3.	Which of the following cells is not phagocytic cell? A. Macrophage B. Monocyte C. neutrophil D. Basophil
4.	Inflammation reaction is brought about by A. Plasma cells B. Mast cells C. Macrophages D. Adipose cells
5.	Inflammatory response in allergy is due to release by mast cells of A. Antibodies B. Antigens C. Histamines D. All the above
6.	Innate immunity is A. Active acquired immunity B. Passive acquired immunity C. Inborn immunity D. Both B and C
7.	Innate immunity is provided by A. Phagocytes B. Antibodies C. T-Lymphocytes D. B-Lymphocytes
8.	Which one engulf foreign materials A. Macrophages B. Plasma cells C. Masmacrophage cells D. Lymphocytes
9.	Macrophages are derived from

A. Neutrophils B. Lymphocytes C. Monocytes D. Basophils
10. The cells that actually release the antibodies are A. Helper T- cells B. Cytotoxic T-cells C. Plasma cells D. Memory cells
11. The class of antibodies made up of five immunoglobulin units is A. IgG B. IgM C. IgA D. IgD
12. Which of the following antibody is related to allergic response? A. IgA B. IgE C. IgM D. IgG
13. memory cells are formed from A. Erythropoietic stem cells B. Monocytes C. T- lymphocytes D. B- lymphocytes
14. Which of the following word equals to the word “antibody”. A. Immunoglobulin B. Antibiotics C. Immunoglobulin D. Immunobody
15. Which one helps in differentiation of cells of immune system A. Cortisol B. Thymosin C. Steroid D. Thyroxine
16. Passive immunity is obtained through injecting A. Antibiotics B. Vaccines C. Antibodies D. Antigens
17. Resistance developed in an individual as a result of antigenic stimulus is A. Natural immunity B. Active acquired immunity C. Passive acquired immunity D. Artificial immunity
18. Segments of antigen that are recognized by antibody are A. Memory regions B. Epitopes C. Nondeterminants D. Self limitation
19. Both B-cells and T-cells of immune system are produced in A. Spleen B. L lymphoid nodes C. Bone marrow D. Thymus
20. Cells of immune system that cause pore formation in the antigen are A. Helper T-cells B. Killer T-cells C. Suppressor T-cells D. B-cells
21. .Which is not involved in elicitation of immune response A. Thymus B. Spleen C. Brain D. Lymph nodes
22. Antigen binding site of immunoglobulin is A. Variable region of heavy chain B. Variable region of light chain C. Constant region of light chain D. Variable region of both heavy and light chains
23.. Antigens are found A. Inside cytoplasm B. Inside nucleus C. On nuclear envelope D. On cell surface
24. ELISA is used in detection of A. Hay fever B. Tetanus C. AIDS D. Tuberculosis
25. AIDS spread due to A. Unprotected sexual contact B. Infected needles and syringes C. Infected mother to foetus D. All of these
26. world AIDS day A. September 16 th B. December 31 st C. December 1 st D. April 25 th
27. Which is not a secondary lymphoid organ A. Thymus B. Appendix C. Spleen D. MALT

28. Example of primary lymphoid organ A. Thymus B. Appendix C. Spleen D. Tonsil
29. Naturally active acquired immunity is given by A. Vaccination B. Antiserum C. NK cells D. Infections
30. The site where B-Lymphocytes mature in Aves A. Bone marrow B. Bursa of fabricius C. Spleen D. Lymph nodes
31. The four polypeptide chains of antibody molecules are held together by A. peptide bond B. Disulphide bonds C. Ionic bonds D. Hydrogen bonds
32. The use of antihistamine, adrenaline and steroids quickly reduce the symptoms of A. Fungal disease B. Viral disease C. allergy D. Helminthes disease
33. The principle of vaccination is based upon the following property of immune system A. Memory B. Diversity C. specificity D. All of the above
34. Which of the following cells is involved in cell-mediated immunity? A. Leukaemia B. T cells C. Mast cells D. Thrombocytes
35. Which of the following statements is true about the IgM of humans? A. IgM can cross the placenta B. IgM can protect the mucosal surface C. IgM is produced by high-affinity plasma cells D. IgM is primarily restricted in the circulation
36. Which one engulfs foreign materials A. Macrophages B. Plasma cells C. Mast cells D. Lymphocytes
37. Short lived immunity acquired by foetus/ infant from mother through placenta/milk is A. Active immunity B. passive immunity C. Cellular immunity D. Innate nonspecific immunity
38. Vaccination provides A. Natural immunity B. Passive immunity C. Active immunity D. Both A and B
39. The disease erythroblastosis foetalis of human baby is due to A. Incompatibility of blood groups of the couple B. Incompatibility of blood groups of embryo and mother C. Maladjustment of Rh factor D. All the above
40. humoral immunity is mediated by A. B lymphocytes B. Macrophges C. both A and B D. Phagocytes
41. Humoral immunity is also called A. antibody mediated immunity B. non-specific immune response C. antigen mediated immunity D. all of these
42. B cells differentiate to form A. plasma cells B. effector cells C. plasma cells and memory B cells D. none of these
43. the function of memory B cell is A. antibody production B. immunological memory C. regulated antibody production D. none of these
44. Generally antibodies produced against a pathogen is

A. monoclonal specificity	B. homogenous	C. polyclonal	D. all of same
45. antibodies produced by plasma cells are			
A. specific	B. produced by the epitope that triggered B cell activation		
C. Both A and B D. diverse			
46. The letter T in T-lymphocytes refers to			
A. Thyroid	B. Thymus	C. Thalamus	D. Tonsil
47. What is true about T-lymphocytes in mammals?			
A. There are three main types – cytotoxic, helper and suppressor			
B. They originate in lymphoid tissues			
C. They scavenge damaged cells and cellular debris			
D. They are produced in thyroid			
48. when a quick immune response is required due to infection of a deadly microbe, the patient is injected with			
A. protein of pathogen		B. inactivated or weakened pathogen	
C. preformed antibodies		D. Vaccine	
LEVEL - II			
1. which of the following is an autoimmune disorder?			
A. Parkinson's disease		B. Myasthenia Gravis	
C. AIDS		D. SCID	
2. Immunological destruction of the body tissue or product due to antibodies reacting with it as antigen is called			
A. Anaphylaxis		B. Autoimmune disease	
C. Prophylaxis		D. Immunodeficiency disease	
3. Increased asthmatic attacks in certain seasons are due to			
A. Inhalation of seasonal pollen		B. Heat and humidity	
C. Low temperature		D. Eating preserved fruits	
4. In which type of barriers under innate immunity do fever and pH of body belong?			
A. Physical barriers		B. Physiological barriers	
C. Cellular barriers		D. Cytokine barriers	
5. Passive immunity is provided through			
A. Exogenous supply of antigens			
B. Endogenous supply of antigens			
C. Exogenous supply of antibody			
D. Endogenous supply of antibody			
6. Spleen is a large bean-shaped organ which mainly contains lymphocytes and phagocytes. It acts as a filter of the blood by trapping -----microorganisms			
A. Tissue fluid borne		B. Blood-borne	
C. Water-borne		D. Lymph-borne	
7. Fc end of IgG binds to			
A. Phagocytes		B. RBC	
C. Mast cells		D. Basophils	
8. number of Antigen binding sites in IgA is			
A. 3		B. 4	
C. 10		D. 5	
9. Passive immunity is			
A. Acquired through natural overt or latent infection			
B. Acquired through Vaccination			

C. Acquired through readymade antibodies D. Acquired by activating immune system of the body
10. Which of the element must be found in antibodies : A. Sulphur B. Phosphorus C. Sodium D. Copper
11. Character of acquired immunity is A. differentiation of self and nonself B. specificity of antigen C. retains memory D. all the above
12. Conversion of antigen into harmless insoluble matter by antibodies is A. Agglutination B. Opsonisation C. Neutralisation D. Activation
13. During inflammation which of the following is secreted by connective tissue A. Heparin B. Serotonin C. Glucagon D. Histamine
14. Gamma-globulins are synthesized in A. Lymph and lymph nodes B. Liver C. Bone marrow D. Kidney
15. Hay fever is due to A. Hepatitis B. Allergy C. Dengue D. Helper T-cells
16. Husband and wife should know their Rh factors because the situation can be serious due to biological incompatibility in one of the following cases A. Rh+ husband and Rh+ wife B. Rh- husband and Rh- wife C. Rh- husband and Rh+ wife D. Rh+ husband and Rh- wife
17. Hypersensitivity to an allergen is due to A. Increase in temperature B. Food habits C. Age D. Aberrant functioning of immune system
18. If a man is Rh+ and woman Rh- A. Their first child will die B. No child will be born C. the first child will survive D. All the children will survive
19. Antigen determinant differs from antigen binding site in its A. Location B. Function C. Structure D. All the above
20. Study of immune responses to foreign substances in blood is known as A. Haematology B. serology C. immunology D. angiology
21. Surgical removal of thymus of a new born shall result in failure to produce A. Monocytes B. B-Lymphocytes C. T- lymphocytes D. Basophils
22. The disorder in which both B-lymphocytes and T-lymphocytes are not formed is A. SCID B. AIDS C. Cystic fibrosis D. Muscular dystrophy
23. Stomach clears out pathogens with the help of A. Secreting HCl B. Secreting hormones C. Tears from eyes D. All of these
24. The exaggerated response of immune system to certain antigens in the environment is A. Autoimmunity B. Immuno deficiency C. Allergy D. Passive immunity
25. Non specific immunity is provided by all except A. kuffer cells B. Alveolar macrophage C. lymphocytes D. Neutrophils
26. Antivenom against snake poison contains

A. Antigen	B. Antigen-antibody complex	C. Antibody	D. Enzymes
27. Incorrect about spleen			
A. secondary lymphoid organ		B. Bean-shaped organ	
C. Contains phagocytes only		D. Traps blood-borne micro organisms	
28. which of the following immunoglobulin is responsible for passive immunity in infants?			
A. Ig-E, because it can cross the placenta			
B. Ig-M, because it is heaviest immunoglobulin present in the colostrums			
C. Ig-A, because it is present in abundance in colostrum.			
D. Ig-A, because It can cross the placenta and reaches the foetus.			
29. what is the wrong statement about passive acquired immunity			
A. Host immune system does not participate			
B. Induced by antigen			
C. Applicable in immune deficient host			
D. Used for treatment in acute infection			
30. The treatment of snake bite given by antivenom is an example			
A. Artificially acquired passive immunity			
B. Artificially acquired active immunity			
C. Naturally acquired active immunity			
D. Naturally acquired passive immunity			
31. Following vaccine has been produced from yeast by recombinant DNA technology			
A. Hepatitis A	B. Hepatitis B	C. Hib	D. Oral polio
32. The HIV virus genome is			
A. double stranded RNA		B. double stranded DNA	
C. single stranded DNA		D. single stranded RNA	
33. AIDS is characterized by			
A. decrease in the number of killer T-cells			
B. decrease in the number of suppressor T-cells			
C. decrease in the number of helper T-cells			
D. increase in the number of helper T-cells			
34. Viral DNA after being converted from viral RNA by X, incorporate into hos genome to undergo replication. What is 'X' ?			
A. DNA polymerase		B. Restriction endonuclease	
C. RNA polymerase		D. Reverse transcriptase	
35. Choose the incorrect statement with respect to AIDS			
A. Viral RNA genome is converted into copy DNA by reverse transcriptase			
B. It is caused by an enveloped retrovirus HIV			
C. It is an immunodeficiency disease			
D. HIV selectively infects and kills B-lymphocytes			
36. Retro virus contains an enzyme o carry out biochemical activities in host. Name the enzyme			
A. Polymerase	B. Exonuclease	C. Reverse transcrptiase	D.
Ligase			
37. What is true about T-lymphocytes in mammals?			
A. There are three main types – cytotoxic, helper and suppressor			
B. They originate in lymphoid tissues			
C. They scavenge damaged cells and cellular debris			
D. They are produced in thyroid			

38. Which of the following is a non-organ-specific (systemic) autoimmune disease: A. Myasthenia gravis. B. Systemic lupus erythematosus (SLE) C. pernicious anemia D. insulin dependent diabetes mellitus
39. The circulation of a two month old breast-fed baby will contain maternal: A. Ig A B. Ig D C. IgE D. Ig G
40. Which one of the following diseases has been completely eradicated world-wide?: A. Measels B. Small pox C. Cowpox D. Psittacosis
LEVEL - III
1. HIV that causes AIDS , first starts destroying (2006) 1. helper T-lymphocytes 2. B- lymphocytes 3. Leucocytes 4. Thrombocytes
2. antibodies in our body are complex (2006) 1. glycoproteins 2. Lipoproteins 3. Steroids 4. Prostaglandins
3. If you suspect major deficiency of antibodies in a person, to which of the following would you look for confirmatory evidence? (2007) 1. serum albumins 2. Fibrinogen in the plasma 3. Heamocytes 4. Serum globulins
4. lysozyme that is present in saliva and tears destroy (2007) 1. certain types of bacteria 2. All viruses 3. Most virus-infected cells 4. Certain fungi
5. Increased asthmatic attacks in certain seasons are related to (2007) 1. low temperature 2. Hot and humid environment 3. eating fruits preserved it in containers 4. Inhalation of seasonal pollen
6. To which type of barriers under innate immunity, do the saliva in the mouth and the tears from the eyes, belong? (2008) 1. physiological barrier 2. Physical barrier 3. Cytokine barriers 4. Cellular barriers
7. which of the following is a pair of diseases? (AIPMT 2009) 1. common cold, AIDS 2. Dysentery, common cold 3. typhoid, tuberculosis 4. Ringworm, common cold
8. Use of antihistamines and steroids give a quick relief from (AIPMT 2009) 1. headache 2. Allergy 3. Nausea 4. Cough
9. The letter T in T-lymphocyte refers to (AIPMT 2009) 1. Thymus 2. Thyroid 3. Thalamus 4. Tonsil
10. Person likely to develop tetanus is immunized by administering(AIPMT 2009) 1. weakened germs 2. Dead germs 3. preformed antibodies 4. Wide spectrum antibiotics
11. Which of the following statements is correct with respect to AIDS (AIPMT 2010) 1. the HIV can be transmitted through eating food together with an infected person 2. drug addicts are least susceptible to HIV infection 3. AIDS patients are being fully cured cent percent with proper care and nutrition. 4. the causative HIV retrovirus enters helper T-lymphocytes thus reducing their numbers.
12. Infectious proteins are present in (AIPMT 2010) 1. Gemini viruses 2. Prions 3. Viroids 4. Satellite viruses
13. common cold is not cured by antibiotics because it is (AIPMT 2011) 1.caused by virus 2. caused by Gram-Positive bacterium 3. caused by Gram-negative bacterium 4. not an infectious disease

<p>14. A certain patient is suspected to be suffering from acquired immunodeficiency syndrome. Which diagnostic technic will you recommended for its detection? (AIPMT 2011)</p> <p>1. WIDAL 2. ELISA 3. MRI 4. Ultra sound</p>																																				
<p>15. Which of the following acts as a physiological barrier to the entry of microorganisms in human body? (AIPMT 2011)</p> <p>1. skin 2. Epithelium of urogenital tract 3. tears 4. Monocytes</p>																																				
<p>16. At which stage of HIV infection does one usually shown symptoms of AIDS? (AIPMT 2011)</p> <p>1. within 15 days of sexual contact with an infected person 2. when viral DNA is produced by reverse transcriptase 3. when the infecting retrovirus enters host cells 4. when HIV replicates rapidly in helper T-lymohocytes damages them.</p>																																				
<p>17. Widal test is carried out to test (CBSE2012)</p> <p>1. malaria 2. Diabetes mellitus 3. HIV/AIDS 4. Typhoid fever</p>																																				
<p>18. An insect bite may result in the inflammation of that spot. This is triggered by the alarm chemicals such as (AIIMS 2005)</p> <p>1. Histamin and Dopamine 2. Histamin and Kinin 3. Interferon and Opsonin 4. Interferons and Histones</p>																																				
<p>19. Which of the following statements is correct regarding sexually transmitted diseases (STDs) ? (NEET2013)</p> <p>1. a person may contact syphilis by sharing milk with already suffering from the disease 2. Haemophilia is one of the STDs 3. Genital herpes and sickle-cell anaemia are both STDs 4. The chances of a 5- years boy contacting a STD are very little</p>																																				
<p>20. the cell- mediated immunity inside the human body is carried by: (NEET2013)</p> <p>1. T- lymphocytes 2. B- lymphocytes 3. Thrombocytes 4. Erythrocytes</p>																																				
<p>21. which of the following sexually transmitted diseases (Column-I) with their causative agent (Column-II) and select the correct option. (NEET2017)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">Column – I</th> <th style="width: 50%; text-align: center;">Column – II</th> </tr> </thead> <tbody> <tr> <td>a. Gonorrhoea</td> <td>i. HIV</td> </tr> <tr> <td>b. Syphilis</td> <td>ii. Neisseria</td> </tr> <tr> <td>c. Genital warts</td> <td>iii. Treponema</td> </tr> <tr> <td>d. AIDS</td> <td>iv. Human pailloma - virus</td> </tr> </tbody> </table> <table style="width: 100%; border-collapse: collapse;"> <tr> <td></td> <td style="text-align: center;">a</td> <td style="text-align: center;">b</td> <td style="text-align: center;">c</td> <td style="text-align: center;">d</td> </tr> <tr> <td>1.</td> <td style="text-align: center;">iii</td> <td style="text-align: center;">iv</td> <td style="text-align: center;">I</td> <td style="text-align: center;">ii</td> </tr> <tr> <td>2.</td> <td style="text-align: center;">iv</td> <td style="text-align: center;">ii</td> <td style="text-align: center;">iii</td> <td style="text-align: center;">i</td> </tr> <tr> <td>3.</td> <td style="text-align: center;">iv</td> <td style="text-align: center;">iii</td> <td style="text-align: center;">ii</td> <td style="text-align: center;">i</td> </tr> <tr> <td>4.</td> <td style="text-align: center;">ii</td> <td style="text-align: center;">iii</td> <td style="text-align: center;">iv</td> <td style="text-align: center;">i</td> </tr> </table>		Column – I	Column – II	a. Gonorrhoea	i. HIV	b. Syphilis	ii. Neisseria	c. Genital warts	iii. Treponema	d. AIDS	iv. Human pailloma - virus		a	b	c	d	1.	iii	iv	I	ii	2.	iv	ii	iii	i	3.	iv	iii	ii	i	4.	ii	iii	iv	i
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<p>22. HIV that causes AIDS , first starts destroying (AIPMT 2015)</p> <p>1. helper T-lymphocytes 2. Thrombocytes 3. B-lymphocytes 4. Leucocytes</p>																																				
<p>23. Transplantation of tissues/organs fails often due to non-acceptance by the patient's body. Which type of of immune response is (NEET 2017)</p> <p>1. cell – mediated immune response 2. hormonal immune response 3. physiological immune response 4. Autoimmune response</p>																																				

<p>24. Grafted kidney may be rejected in a patient due to (AIPMT 2015)</p> <p>1. passive immune response 2. Innate immune response 3. humoral immune response 4. Cell-mediated immune response</p>
<p>25. which of the following immunoglobulins does constitute the largest percentage in human milk? (AIPMT 2015)</p> <p>1. IgA 2. IgG 3. IgD 4. IgM</p>
<p>26. if you suspect major deficiency of antibodies in a person to which of the following would you look for confirmatory evidence? (AIPMT 2015)</p> <p>1. haemocytetes 2. Serum globulins 3. Fibrinogen in plasma 4. Serum albumins</p>
<p>27. which of the following viruses is transferred through semen of an infected male? (AIPMT 2015)</p> <p>1. Ebola virus 2. Hepatitis virus 3. Human immune deficiency virus 4. Chikungunya virus</p>
<p>28. In higher vertebrates, the immune system distinguish self- cells and non-self. If this property is lost due to genetic abnormality and it attacks self-cells, then it leads to (NEET-2016 PHASE-2)</p> <p>1. allergic response 2. Graft rejection 3. auto-immune disease 4. Active immunity</p>
<p>29. antivenom injection contains preformed antibodies while polio drops that are administered into the body contain (NEET-2016 PHASE-2)</p> <p>1. activated pathogen 2. Harvested antibodies 3. Gamma globulin 4. Attenuated pathogen</p>
<p>30. It helps in differentiation of cells. It is (CET 2008)</p> <p>1. Cortisol 2. Thyroxine 3. Thymosin 4. Steroid</p>
<p>31. Which one of the following is correct with reference to AIDS? (CBSE 2010)</p> <p>1. Drug addict are least susceptible to HIV infection 2. AIDS patients are being fully cured cent percent with proper care and nutrition. 3. The causative HIV retrovirus enters helper T-Lymphocytes, thus reducing their number. 4. HIV can be transmitted through eating food together with an infected person.</p>
<p>32. Common cold differs from pneumonia in that .....(AIPMT 2012)</p> <p>1. Pneumonia can be prevented by a live attenuated bacterial vaccine whereas common cold has no effective vaccine. 2. Pneumonia is caused by a virus while common cold is caused by bacterium <i>Haemophils influenzae</i>. 3. Pneumonia pathogen infects alveoli where as common cold affects nose and respiratory passage but not the lungs. 4. Pneumonia is a communicable disease where as common cold is a nutritional deficiency disease.</p>
<p>33. Pulse polio programme is organized in our country for</p> <p>A. Curing polio B. eradicating polio C. Spreading polio D. none of the above</p>
<p>34. Vaccines are available for the disease</p> <p>A. Covid-19 B. AIDS C. breast cancer D. polio</p>
<p>35. Viruses have the genetic material</p> <p>A. Single stranded RNA C. double stranded RNA B. Double stranded DNA D. all the above</p>
<p>36. Corona virus can be transmitted from one person to the other through</p> <p>A. Droplets released by infected person C. mosquito bite B. Flies D. all the above</p>

37. Viruses have															
A. Only genetic material B. Lipids	B. Genetic material and protein D. glycoprotein only														
38. Covid-19 can be detected by															
A. ELISA B. RT-PCR C. Antigen test	D. Both B and C														
39. Covid-19 is															
A. Pandemic B. Epidemic C. Sporadic	D. none of the above														
40. Which one of the following cannot be used for the preparation of vaccine for the plague? (CBSE MAINS 2010)															
A. Heat killed suspension of virulent bacteria. B. Formalin -inactivated suspension of virulent bacteria C. A virulent live bacteria D. Synthetic capsular polysaccharide material															
41.	<table border="0"> <thead> <tr> <th style="text-align: center;">Set I</th> <th style="text-align: center;">Set-II</th> </tr> </thead> <tbody> <tr> <td>A. Natural active immunity</td> <td>i. Developes due to vaccination</td> </tr> <tr> <td>B. Natural passive immunity</td> <td>ii. Anti-rabies serum</td> </tr> <tr> <td>C. Artificial active immunity</td> <td>iii. Acquired after small pox infection</td> </tr> <tr> <td>D. Artificial passive immunity</td> <td>iv. Transferred from mother to child</td> </tr> <tr> <td>A. A-iv, B-iii, C-I, D-ii</td> <td>B. A-ii, B-iv, C-Iii, D-i</td> </tr> <tr> <td>C. A-iii, B-iv, C-I, D-ii</td> <td>D. A-ii, B-iii, C-Iv, D-i</td> </tr> </tbody> </table>	Set I	Set-II	A. Natural active immunity	i. Developes due to vaccination	B. Natural passive immunity	ii. Anti-rabies serum	C. Artificial active immunity	iii. Acquired after small pox infection	D. Artificial passive immunity	iv. Transferred from mother to child	A. A-iv, B-iii, C-I, D-ii	B. A-ii, B-iv, C-Iii, D-i	C. A-iii, B-iv, C-I, D-ii	D. A-ii, B-iii, C-Iv, D-i
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C. A-iii, B-iv, C-I, D-ii	D. A-ii, B-iii, C-Iv, D-i														
42. Match the following															
1. Main antibody both primary and secondary response 2. Protects mucosal barrier 3. Involved in allergies 4. Along with IgM, this is a B cell receptor 5. Activates complement A. 1-A, 2-B, 3-D, 4-C, 5-E B. 1-A, 2-B, 3-E, 4-C, 5-D C. 1-B, 2-A, 3-D, 4-C, 5-E D. 1-E, 2-B, 3-D, 4-C, 5-A	A. IgG B. IgA C. IgD D. IgE E. IgM														
43. Match the following															
1. First line of defense 2. second line of defense 3. third line of defense 4. Innate defense system Skin and mucous membrane A. 1-A, 2-B, 3-D, 4-C B. 1-B, 2-A, 3-D, 4-C C. 1-A, 2-B, 3-C, 4-D D. 1-B, 2-C, 3-A, 4-D	A. immune response B. Skin and mucous membrane C. Inflammatory response D. Inflammatory response and Skin and mucous membrane														
44. In which one of the following options are the two examples correctly matched with their particular type of immunity? (AIPMT Pre 2012)															
EXAMPLES	TYPE OF IMMUNITY														
A. Anti tetanus and Anti snake bite	Active immunity injections														
B. Saliva in mouth and tears in eyes	Physical barriers														
C. Mucus coating of epithelium lining	Physiological barriers														
D. Polymorphonuclear Leukocytes and monocytes	Cellular Barriers														

16. Assertion & Reasoning Questions

<p>In each of the following question a statement of Assertion (A): is given followed by a statement of Reason (R): just below it. Of the statements, mark the correct answer as</p> <p>A. If both assertion and reason are true and reason is the correct explanation of assertion B. If both assertion and reason are true but reason is not the correct explanation of assertion C. If assertion is true but reason is false D.If both assertion and reason are false</p>	
1	<p>Assertion (A): Live attenuated vaccine is better in terms of immunity provided to the recipient. Reason (R) : As secondary lymphoid organs, example Peyer's patches, are stimulated to protect the society.</p>
2	<p>Assertion (A): Asthma patients must never be exposed to dust. Reason (R) : Allergic response may cause vasoconstriction and death.</p>
3	<p>Assertion (A): Colostrum is very best way of transferring immunity to a new born. Reason (R) : IgM from the mother's milk protects the baby from the respiratory infections usually affecting in the young age.</p>
4	<p>Assertion (A): Vaccine against HIV has not been made in spite of repeated attempts. Reason (R) : HIV has the ability to get mutated to form several sub types.</p>
5	<p>Assertion (A): Antibiotics such as penicillin can be used to treat common cold. Reason (R) : Penicillin causes lysis of Viral cells.</p>
6	<p>Assertion (A): SCID is a primary immunodeficiency. Reason (R) : It is a serious congenital immunodeficiency.</p>
7	<p>Assertion (A): AIDS spreads between the blood of an infected and a healthy persons. Reason (R) : AIDS manifests as tumors or as pathogenic infections.</p>
8	<p>Assertion (A): Syphilis spreads by sexual inter course with infected person. Reason (R) : Syphilis is caused by Spirochaete bacterium, <i>Treponema pallidum</i>.</p>
9	<p>Assertion (A): All types of cancer result in tumors. Reason (R) : Cancer is easily treatable with antibiotics.</p>
10	<p>Assertion (A): Mother can pass on syphilis bacteria to the developing fetus. Reason (R): Placenta in the later parts of pregnancy becomes permeable to pathogens.</p>
11	<p>Assertion (A): UV rays are carcinogenic in nature. Reason (R): UV rays rupture DNA strands and induce mutations to cause cancers.</p>
12	<p>Assertion (A): Metastatic cancers are more serious. Reason (R): These spread from one organ to other body organs and there is increased interference with metabolic functioning.</p>
13	<p>Assertion (A): Sedatives are used in sleeping pills. Reason (R): Sedatives contain opiates which reduce tension and anxiety.</p>
14	<p>Assertion (A): Heroin addicts have more chances of getting AIDS, Hepatitis etc., Reason (R): Heroin is the most dangerous and addictive opiate.</p>
15	<p>Assertion (A): The Widal test is commonly used to detect Typhoid fever. Reason (R): The presence of specific agglutinins in the patients blood indicates the presence of typhoid bacteria.</p>

17. Assignment Questions to answer

VSAQ**	1	Write the names of any four “Mononuclear Phagocytes”.
***	2	“Colostrum is very much essential for the new born infants” , -Justify.
*	3	Explain the mechanism of Vaccination or Immunisation.
*	4	Mention various types of immunological disorders.
***	5	What are ‘Auto-immune’ disorders? Give any two examples.
SAQ***	1	Write short notes on B-Cells.
*	2	Write short notes on Immunoglobulins.
***	3	Explain the mechanism of Humoral Immunity.
***	4	Explain the mechanism of Cell-Mediated Immunity.
*	5	Explain the mechanism by which HIV multiplies and lead to AIDS.

18. Hands on Experiences for you – Try It!!!

1. Why has the nasal mucus (snot) changed the colour?

- The nose is the dirtiest organ in the body. Why? Because it acts as a filter cleaning the air that we breath, removing harmful dirt and germs from the air that goes to our lungs.
- Mucus is our body’s equivalent to fly paper; it lines the nose trapping the dirt and germs stopping them from damaging the lungs. But it does better than just stick to them – mucus is loaded with protective proteins that kill and disable germs, like bacteria and viruses.
- The final step is to remove them from the body, and this is done by coughing or sneezing but most of it is actually eaten!!!! Yes that’s right, eaten, where anything that was living is destroyed by stomach acid.
- How does our body make something that is quite so disgusting and gloopy? Well it’s all thanks to a group of proteins called MUCINS, these large proteins are covered in sugar that absorb water giving mucus its sticky gooey consistency.
- The remaining proteins in mucus give it a protective function, these include:
 - ✓ antibodies – these tiny proteins produced by B cells, activate the immune system alerting it to the presence of foreign objects such as dust and germs
 - ✓ lysozyme – an enzyme that chops up bacteria
- While most of the time mucus is clear, it can turn bright yellow or green. We all know that this means we’re sick, but why has the mucus changed colour?
- NEUTROPHILS are part of the immune system’s rapid response system. Once on the scene they swallow bacteria and viruses (a process known as phagocytosis) and spray antiseptic chemicals to kill nearby germs. Sadly however they also kill themselves while doing this and end up in the mucus like the germs. These neutrophils have a green colour (due to iron within the cell) which is why your snot turns green when you’re sick!

2. Creating a Personal Health Journal

You can check on the status of your health habits by creating a personal health journal for your own use.


Taking Care of Your Immune System	
Eat a well-balanced and healthful diet.	Avoid tobacco, drugs, and alcohol.
Get plenty of exercise and rest.	Abstain from sexual activities.
Brush your teeth and bathe or shower regularly.	Get vaccinations that prevent diseases.
Keep your home clean.	Read about immune activities

- ❖ Look at the list of behaviors in the table above.
- ❖ Write each of the behaviors at the top of a separate piece of paper.
- ❖ Jot down your habits related to each behavior during a typical week.
- ❖ **Analyze Your Results:**
- ❖ Do you think that your weekly habits are healthy?
- ❖ Clip the pages together and place them in your journal. Continue to record your health behaviors in your journal.

3. Investigate

- ❖ In a healthy immune system, white blood cells can tell the body's own cells from foreign cells, such as pathogens. A healthy immune system attacks only the foreign cells. In some diseases, however, the immune system begins to attack the body's own cells. These diseases are called autoimmune diseases.
- ❖ Investigate different types of autoimmune diseases and how they are treated. Find out the symptoms, what population are most affected, generic and environmental factors, and any late-breaking research regarding the disease.

4. Know, Apply, Appreciate:



British Society for
immunology
www.immunology.org

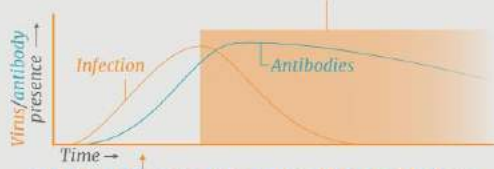
Antibody testing for COVID-19

What is an antibody?
A protein made by our immune system to precisely match the shape of an invading virus antigen, which is a unique feature of the virus. Protective antibodies help fight an infection.

How does the test work?
A patient's blood sample is used to test if there are any **antibodies** present that match and bind to the viral antigen.

What does the test tell us?
The test determines previous exposure to the virus. The presence of antibodies does not necessarily mean a person is protected from future infection.

When is the test used?
From a week to several months after infection.



A patient may test negative if tested before the body has had time to produce antibodies.

How accurate is it?
Optimising, evaluating and validating these tests is important. There are two approved lab tests being used in the UK but neither are 100% accurate.

5. Immune yourself from COVID-19:



COVID-19 Crisis



Ministry of AYUSH recommendations, based on Ayurvedic literature and scientific publications, for preventive health measures and boosting immunity with special reference to respiratory health.

Measures for Enhancing Immunity

- Drink warm water throughout the day.
- Daily practice of Yogasana, Pranayama and Meditation for at least 30 minutes.
- Spices like Haldi (Turmeric), Jeera (Cumin), Dhaniya (Coriander) and Lahsun (Garlic) recommended in cooking.

Simple Ayurvedic Procedures

- **Nasal Application**– Apply Sesame Oil/Coconut oil or Ghee in both the nostrils (Pratimarsh Nasya) in morning and evening.
- **Oil Pulling Therapy**– Take 1 table spoon Sesame or Coconut Oil in mouth. Do not drink, swish in the mouth for 2 to 3 minutes and spit it off followed by warm water rinse. This can be done once or twice a day.

Immunity Boosting Measures for Self-Care

Ayurvedic Immunity Enhancing Tips

- Take Chyavanprash 10gm (1tsf) in the morning. Diabetics should take sugar free Chyavanprash.
- Drink Herbal Tea/Decoction (Kadha) made from Tulsi (Basil), Dalchini (Cinnamon), Kalimirch (Black Pepper), Shunthi (Dry Ginger) and Munakka (Raisin) - once or twice a day. Add jaggery (Natural Sugar) and/or fresh Lemon Juice to your taste, if needed.
- Golden Milk- half tea spoon Haldi (Turmeric) powder in 150 ml Hot Milk - once or twice a day.

Actions During Dry Cough/Sore Throat

- Steam inhalation with fresh Pudina (Mint) leaves or Ajwain (Caraway Seeds) can be practiced once in a day.
- Lavang (Clove) powder mixed with Natural Sugar/Honey can be taken 2-3 times a day in case of cough or throat irritation.
- These measures generally treat normal dry cough and sore throat. However, it is best to consult doctors if these symptoms persist.

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KBK

AYURVEDA'S IMMUNITY BOOSTING MEASURES FOR SELF CARE DURING COVID 19 CRISIS

GENERAL MEASURES TO ENHANCE THE BODY'S NATURAL DEFENCE SYSTEM

- 1 Drink warm water throughout the day
- 2 Daily practice of Yogasana, Pranayama and meditation for at least 30 minutes
- 3 Use Haldi (Turmeric), Jeera (Cumin), Dhaniya (Coriander) and Lahsun (Garlic) in cooking

Note: In Ayurvedic practice, preventive care revolves around "Dinacharya" - daily regimes and "Ritucharya" - seasonal regimes

Graphic: 2/4

MINISTRY OF AYUSH

19. Medical and other careers related to Immune System

Immunologist: An allergist/immunologist is a medical doctor who specializes in treating and managing allergies, asthma, and other immune system disorders. An allergist/immunologist treats conditions involving the immune system.

Pediatric Immunologists: They are also called “Pediatric Allergists”, find and treat problems associated with allergies and malfunctions of immunity in children. They specialize in treating children ranging from infants to teenagers. Immunologists must have key skills, such as strong communication skills, leadership skills, attention to detail, organizational skills, problem-solving skills, patience and empathy. More specifically, they must have knowledge of human allergies and other issues related to the immune system.

Clinical immunologists: They undertake a range of clinical and laboratory duties. Their clinical work is largely outpatient based and involves:

- primary immunodeficiency (diseases where part of the immune system is missing or doesn't function properly)
- allergy
- autoimmune disorders (where the immune system attacks itself), eg rheumatoid arthritis, Type- 1 diabetes and vasculitis (inflammation of the blood vessels which can cause narrowing or damage)
- joint paediatric clinics for children with immunodeficiency
- immunoglobulin (antibody) infusion clinics for patients with antibody deficiency

Epidemiologists: Epidemiologists are public health professionals who investigate patterns and causes of disease and injury in humans. They seek to reduce the risk and occurrence of negative health outcomes through research, community education and health policy.

Cytotechnologists: Cytotechnologists are laboratory professionals who study cells and cellular anomalies. Using a microscope, they examine slides of human cells for any indication that a cell is abnormal and/or diseased (i.e., cancerous or precancerous lesions, infectious agents or inflammatory processes). The overall job outlook for CytoTechnologist careers has been positive since 2004. Cytotechnologists **must** have strong analytical, problem-solving, and decision-making abilities. They **must** be able to handle pressure and responsibility, often performing highly detailed microscopic work for long periods of time, either independently or under the supervision of a pathologist. **Demand** for Cytotechnologists is expected to go up year after year.

Clinical pathologist: They look at blood, urine, and other body fluid samples under a microscope, or with other diagnostic tools. He or she watches levels of certain chemicals or other substances in the body. A diagnosis or decision to do further study is then made based on the test results.

20. Answers to the activities and note making

13. Fill in the blanks:

1	Humoral immunity	9	Bone marrow and Thymus	17	Window period
2	Immunology	10	MALT- Mucosa Associated Lymphoid Tissue	18	Coronaviridae
3	Spleen	11	protein	19	Epitope
4	Paratope	12	December 1	20	Bursa Fabricius
5	Rodney porter	13	IgM	21	Physiological
6	IgA	14	Edward Jenner	22	Pentameric
7	1981, CDC center for disease control	15	Leucocytes	23	Integrase
8	Interferon	16	Memory	24	Reverse transcriptase
				25	Histamine and Serotonin

14. TRUE OR FALSE

1	False	9	True	17	True
2	False	10	True	18	True
3	False	11	False	19	False
4	False	12	True	20	False
5	False	13	False	21	True
6	False	14	False	22	False
7	False	15	True	23	False
8	False	16	True	24	True
				25	True

15. Multiple Choice Questions

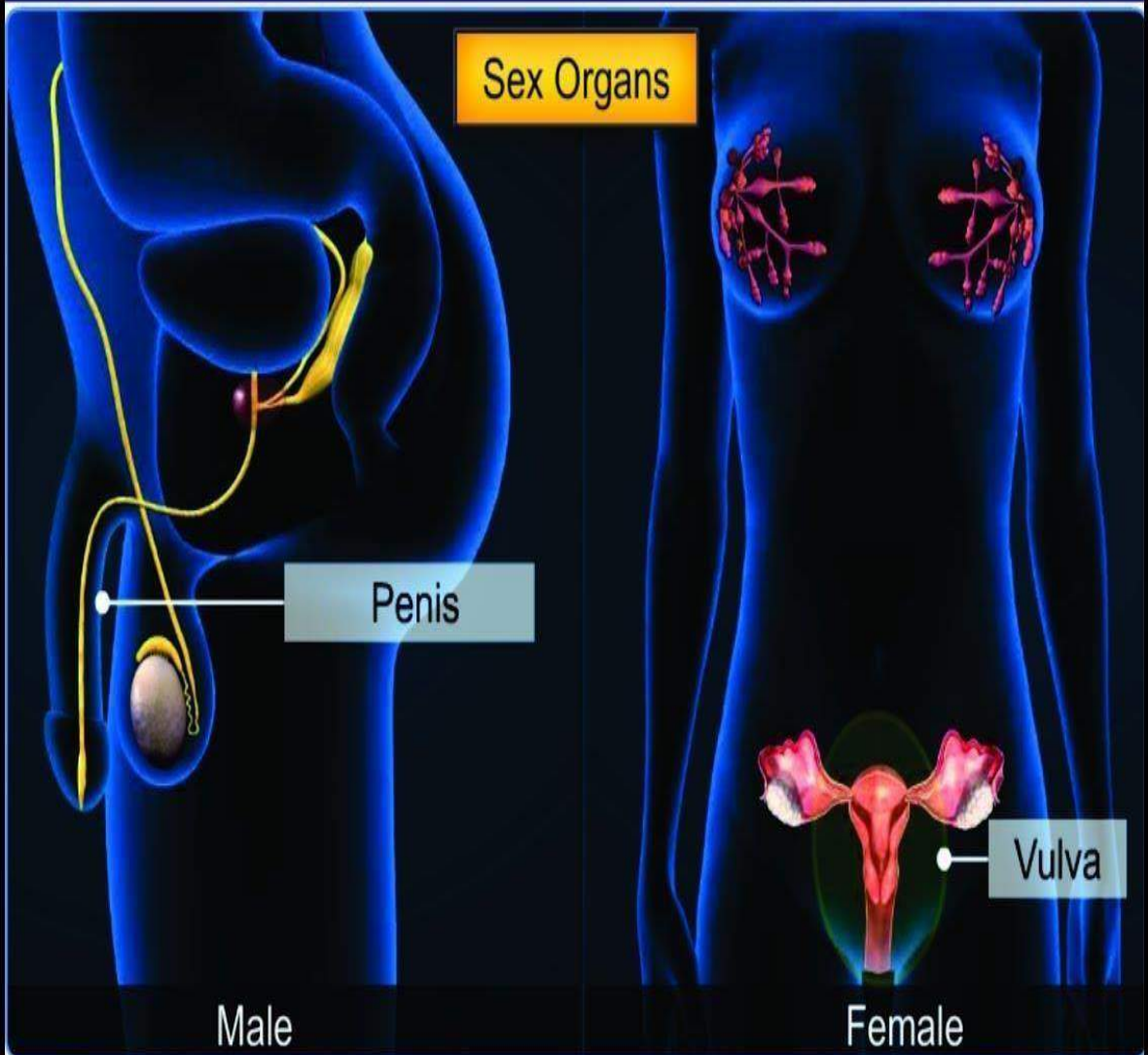
LEVEL – I					
1. B	9. C	17. B	25. D	33. A	41. A
2. A	10. C	18. B	26. D	34. B	42. c
3. D	11. C	19. C	27. A	35. D	43. B
4. B	12. B	20. B	28. A	36. A	44. C
5. C	13. D	21. C	29. D	37. B	45. C
6. C	14. A	22. D	30. B	38. C	46. B
7. A	15. B	23. D	31. B	39. C	47. A
8. A	16. C	24. C	32. C	40. A	48. C

Level -II				
1. B	9. C	17. D	25. C	33. C
2. B	10. A	18. D	26. D	34. D
3. A	11. D	19. D	27. C	35. B
4. B	12. A	20. B	28. C	36. C
5. C	13. D	21. C	29. B	37. A
6. b	14. A	22. A	30. A	38. C
7. A	15. B	23. A	31. B	39. D
8. B	16. D	24. C	32. D	40. B
Level -III				
1. 1	11. 4	21. 4	31. 3	
2. 1	12. 2	22. 1	32. 3	
3. 4	13. 1	23. 4	33. C	
4. 1	14. 2	24. 4	34. D	
5. 4	15. 3	25. 1	35. D	
6. 1	16. 4	26. 2	36. A	
7. 1	17. 4	27. 2	37. B	
8. 2	18. 2	28. 3	38. D	
9. 1	19. 4	29. 4	39. A	
10. 3	20. 1	30. 4	40. C	
MATCH THE FOLLOWING				
41. C	42. A	43. D	44. D	

16. ASSERTION AND REASONING

1	A	6	A	11	A
2	D	7	B	12	A
3	C	8	B	13	D
4	A	9	D	14	B
5	D	10	A	15	A

MALE REPRODUCTIVE SYSTEM



MAJOR LEARNING OBJECTIVE

- *Students will be able to recognize, identify, understand and apply the knowledge of the Human Reproductive System, Menstrual Cycle and Reproductive events.*
- *Students will be able to understand the importance of reproduction in living organisms” (continuity of life and independent existence)*

LEARNING OUTCOMES:

- Be able to name the organs of reproductive system.
- Be able to describe the major functions of each organ in the reproductive system.
- Be able to explain the role of primary sex organs.
- Be able to list the secondary sexual organs
- Be able to describe the function of sexual hormones
- Be able to describe the role of pituitary hormones in reproduction
- Be able to know the events of reproductive events
- Be able to know the causes of irregular menstruations, abortions etc.,

ADDITIONAL READING MATERIALS

- Significance of Sexual Reproduction

ACTIVITIES

21. Locating in and rewriting the difficult key words from the text book
22. Defining key words
23. Study the Concept map on Reproductive System and fill the blanks
24. Identify the unlabeled parts of Male Reproductive System
25. Name the location and functions of organs of Male Reproductive System
26. Identify the numbered parts of Female Reproductive System
27. Name the location and functions of organs of Female Reproductive System
28. Label the parts and add brief note on Spermatogenesis
29. Label the parts and add brief note on Structure of Sperm
30. Relate the stages in Oogenesis and add brief
31. Read the Text, Compare and label the parts of Ovarian Follicle
32. Fill boxes in the diagrammatic representation of Menstrual Cycle
33. Relate the picture of “Gastrulation” and understand the process
34. Write functions of placenta
35. Fill in the blanks
36. Answer “TRUE” or “FALSE”
37. Multiple Choice Questions for Competitive exams
38. Assertion & Reasoning Questions
39. Assignment Questions to answer
40. Hands on Experiences for you – Try It!!!
41. Medical and other careers related to Immune System
42. Answers to the activities and note making

INSTRUCTIONS TO LECTURER

- Ask the students to take aid of the textbook and to work with a partner
- Explain each part of the worksheet & Come up with some examples to help
- Clarify doubts of the students before starting the work book

INSTRUCTIONS TO STUDENTS

- First read the text book thoroughly and logically with a friend cooperatively
- While attempting the activities analyze them carefully
- While attempting the multiple choice questions, make notes on the other options too

ADDITIONAL READING MATERIALS

Significance of Sexual Reproduction:

One parent or two?

That is the main difference between sexual and asexual reproduction. Sexual reproduction is combining genetic material from two parents, usually from two gametes. How the two cells combine may take many forms, but does not necessarily involve physical contact. Sexual reproduction produces offspring that are genetically distinct from other offspring and from their parents. Asexual reproduction produces offspring from just one parent. These offspring are genetically identical to that one parent.

Reproduction:

Some organisms look and act exactly like their parent. Others share many similar traits, but they are definitely unique individuals. Some species have two parents, whereas others have just one. How an organism reproduces determines the amount of similarity the organism will have to its parent. Reproduction is the process by which organisms give rise to offspring. It is one of the defining characteristics of living things. There are two basic types of reproduction: asexual reproduction and sexual reproduction. Each of these processes ensures that the parental generation gives genetic material, DNA, to its offspring.

The process of cell division is how multicellular organisms grow and repair themselves. It is also how many organisms produce offspring. For many single-celled organisms, asexual reproduction is a similar process. The parent cell simply divides to form two daughter cells that are identical to the parent. Asexual reproduction produces offspring that are genetically identical to the parent, whereas sexual reproduction produces a similar, but genetically unique offspring. In sexual reproduction, meiosis produces haploid gametes that fuse during fertilization to produce a diploid zygote figure below. In other words, a child inherits half of the genetic material from each parent. Look at the family in figure below. The children resemble their parents, but they are not identical to them. Instead, each has a unique combination of characteristics inherited from both parents. The children, of course, result from sexual reproduction.

The main significance of reproduction is to maintain continuity of species. It also helps in studying evolution as sexual reproduction results in variation among the species.

Sexual reproduction allows an organism to combine half of its genes with half of another individual's genes, which means new combinations of genes are produced every generation. In addition, when eggs and sperm are produced, genetic material is shuffled and recombined in ways that produce new combinations of genes. Sexual reproduction thus increases genetic variation, which increases the raw material on which natural selection operates. Genetic variation within a species -- also known as genetic diversity -- increases a species' opportunity for change over successive generations.

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book

1	9	17
2	10	18
3	11	19
4	12	20
5	13	21
6	14	22
7	15	23
8	16	24

2. Defining key words

1. Gametogenesis	
2. Insemination	
3. Fertilisation	
4. Implantation	
5. Gestation	
6. Parturition	
7. Scrotum	
8. Seminiferous tubules	
9. Sertoli cells	

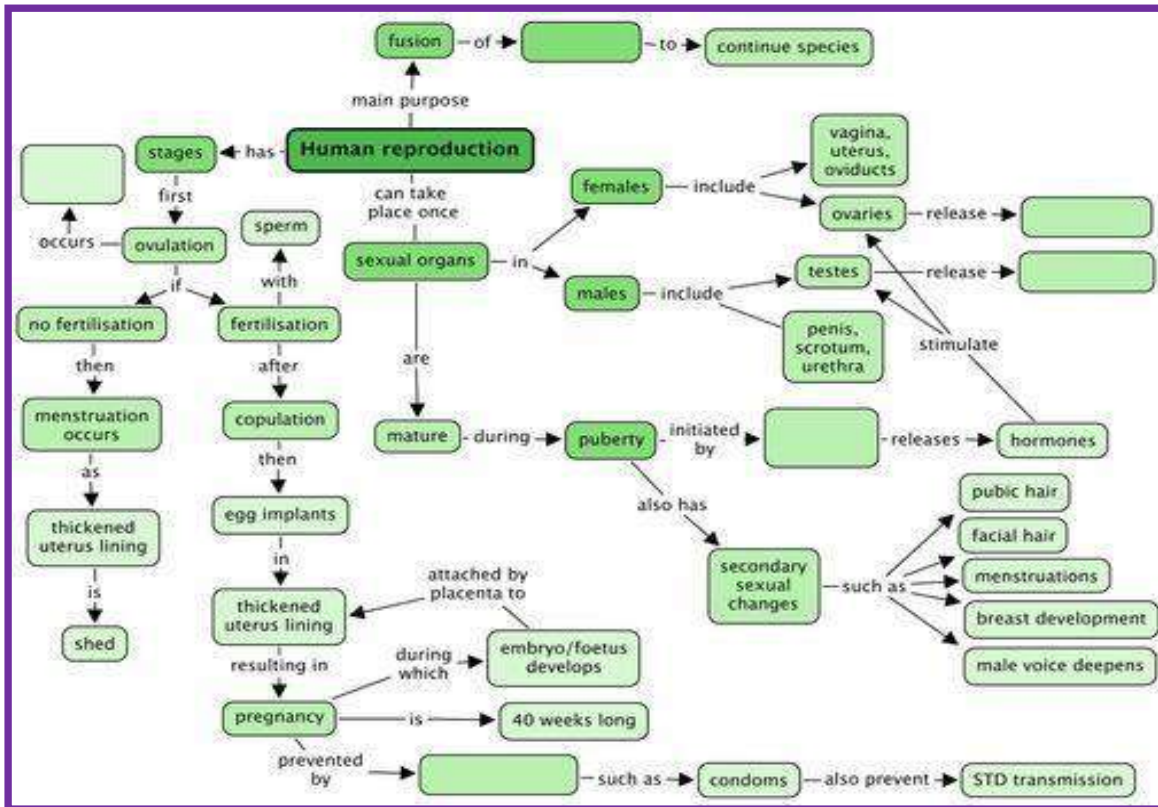
10. Leydig cells	
------------------	--

11. Mesoovarium	
12. Spermato genesis	
13. Oogenesis	
14. Corpus luteum	
15. Menstrual cycle	
16. Ovulation	
17. Morula	
18. Placenta	
19. Pregnancy	
20. Lactation	
21. Compaction	
22. Hypoblast	
23. Hensen's Node	
24. Somatomammotropin	
25. Three Trimester	
26. Fetal Ejection Reflex	
27. Ampullary ischemic junction	

27. Graffian follicle

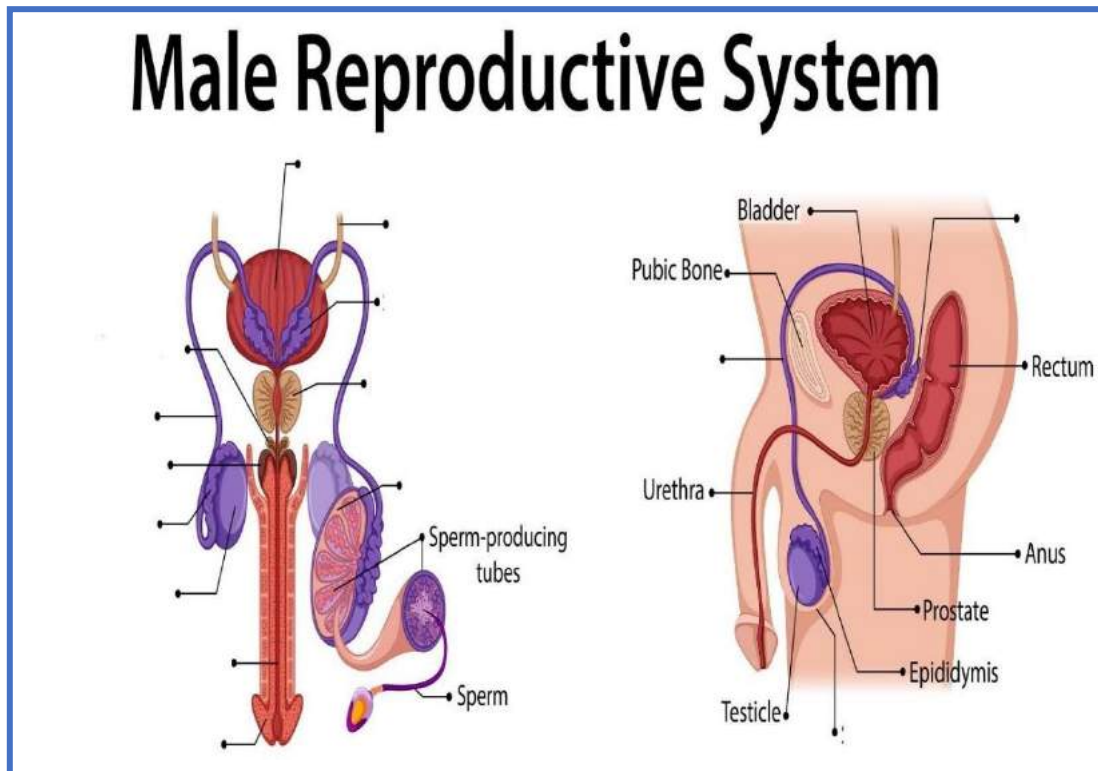
3. Study the Concept map on Reproductive System and fill the blanks:

This concept map shows all that we have learned about reproduction in humans. Complete it by filling in the blank spaces. You might find this quite tricky, but you need to learn to "read" a concept map by constructing sentences. Write down the sentences.



Write at least five sentences:

4. Identify the unlabeled parts of Male Reproductive System



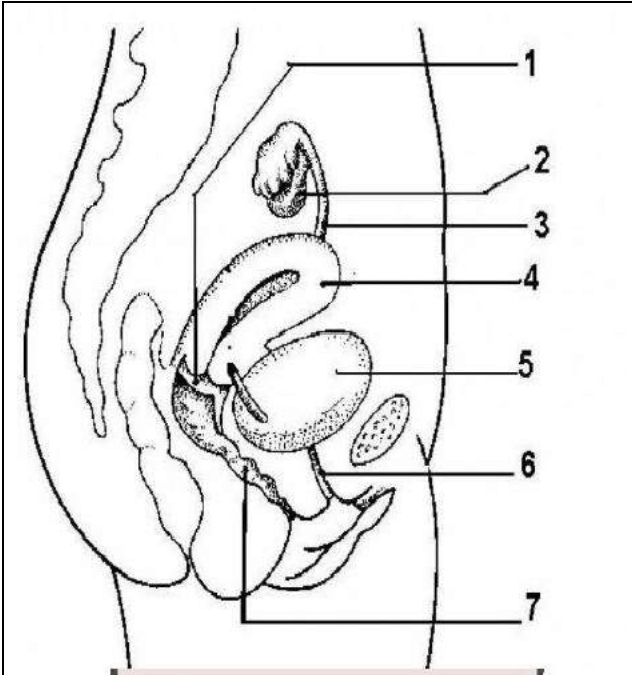
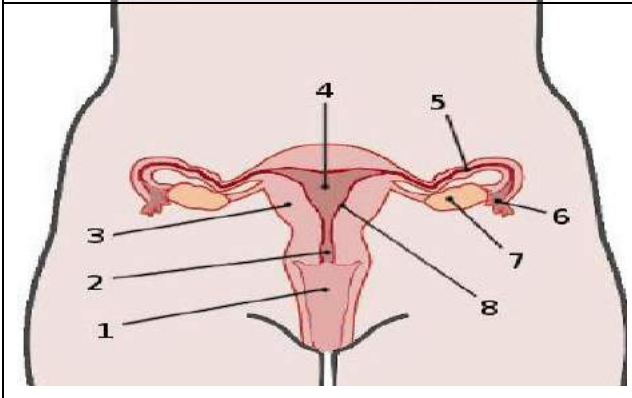
5. Name the location and functions of organs of Male Reproductive System

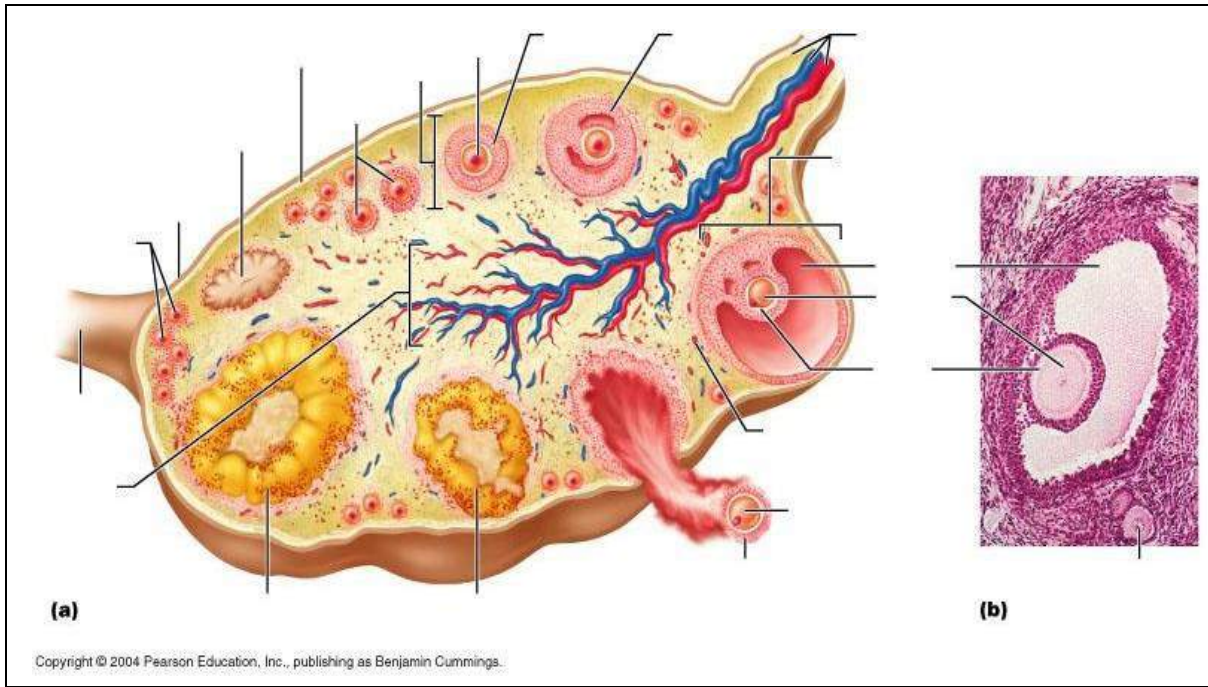
Name of the organ	Location	Function
1. Testes		
2. Seminiferous tubules		
3. Epididymis		
4. Retetesis		
5. Vasa deference		
6. Urethra		
7. Penis		
8. Seminal vesicles		

9. Prostate gland

10. Bulbourethral gland

6. Identify the numbered parts of Female Reproductive System

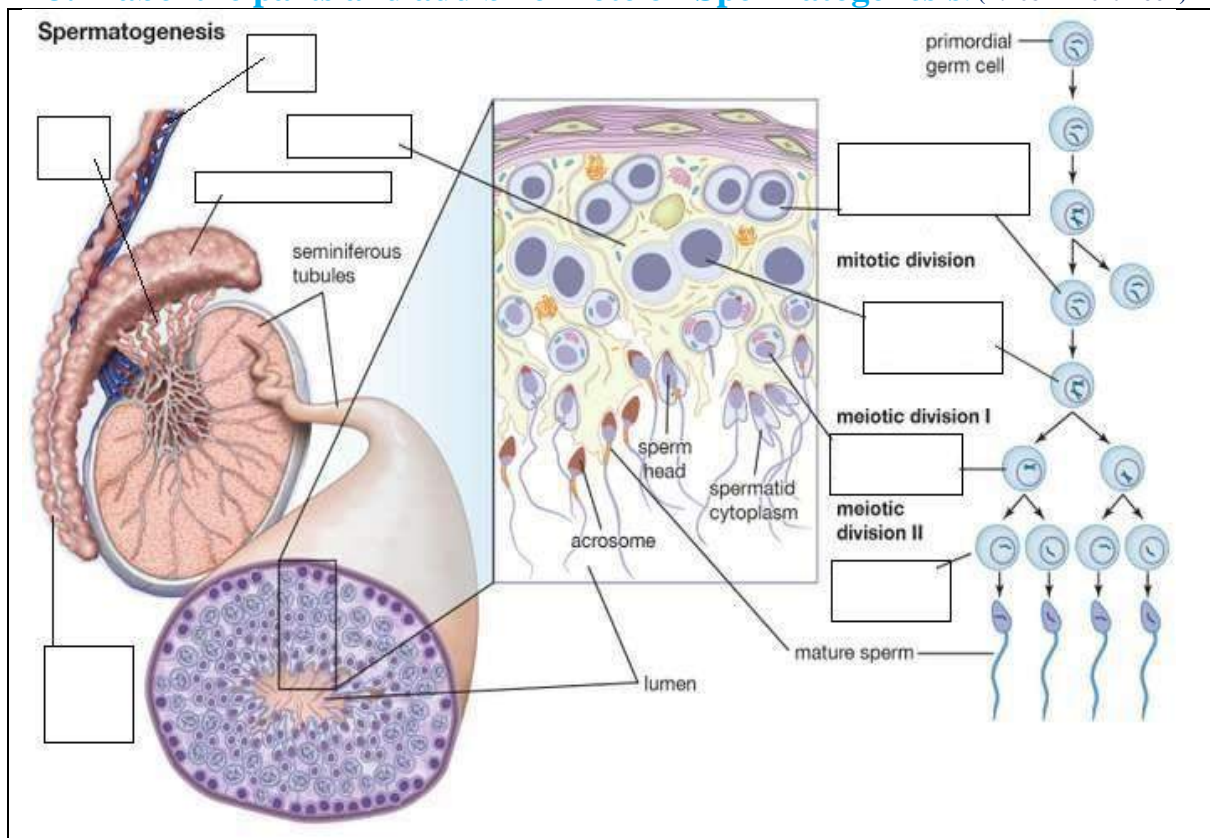


7. Name the location and functions of organs of Female Reproductive System

Name of the organ	Location	Functions
1. Ovary		
2. Fallopian tube (oviduct)		
3. Uterus		
4. Vagina		
5. Vulva		
6. Hymen		
7. Clitoris		
8. Bartholin glands		
9. Skene's gland		

10. Mammary glands		
11. Luteinizing hormone		
12. FSH		
13. Estrogen		
14. Progesteron		
15. Isthmus		
16. Mons pubis		

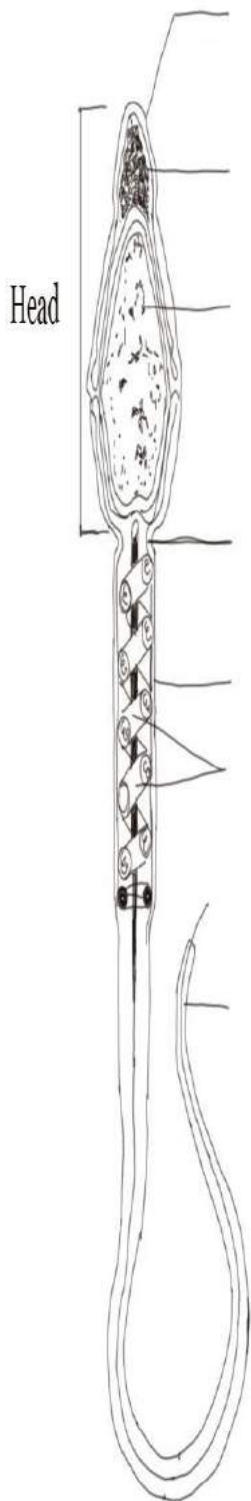
8. Label the parts and add brief note on Spermatogenesis: (P.168 in Text Book)



Make a brief note:



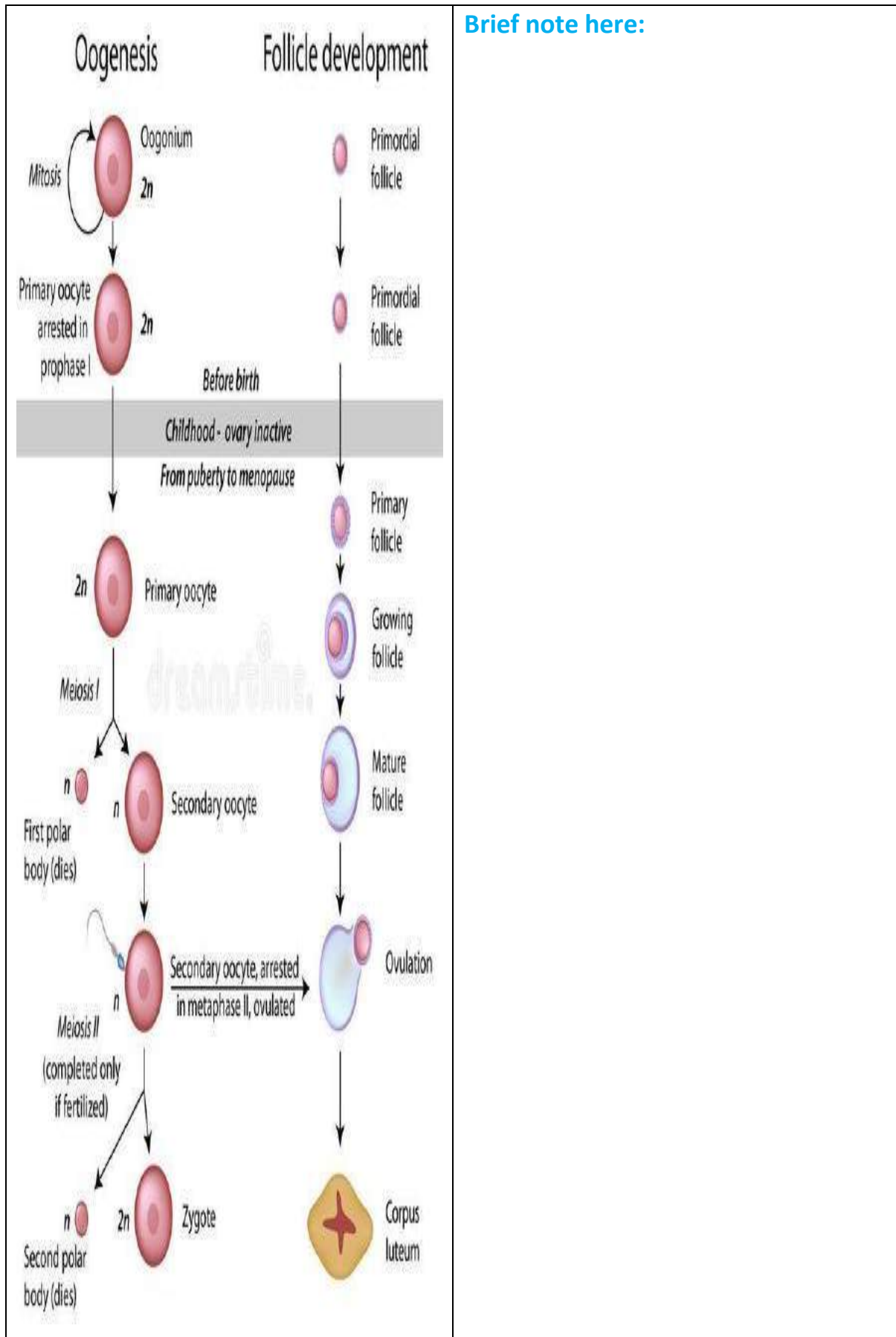
9. Label the parts and add brief note on Structure of Sperm



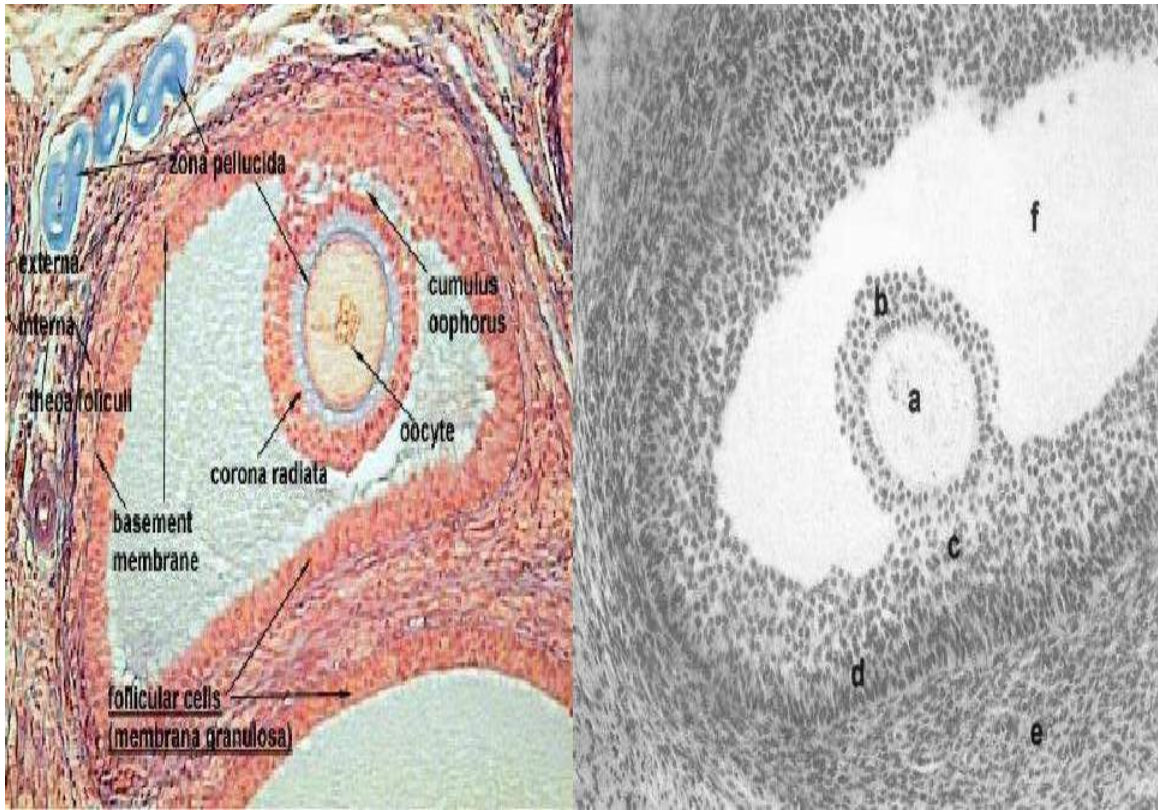
Structure of sperm

Give a brief note:

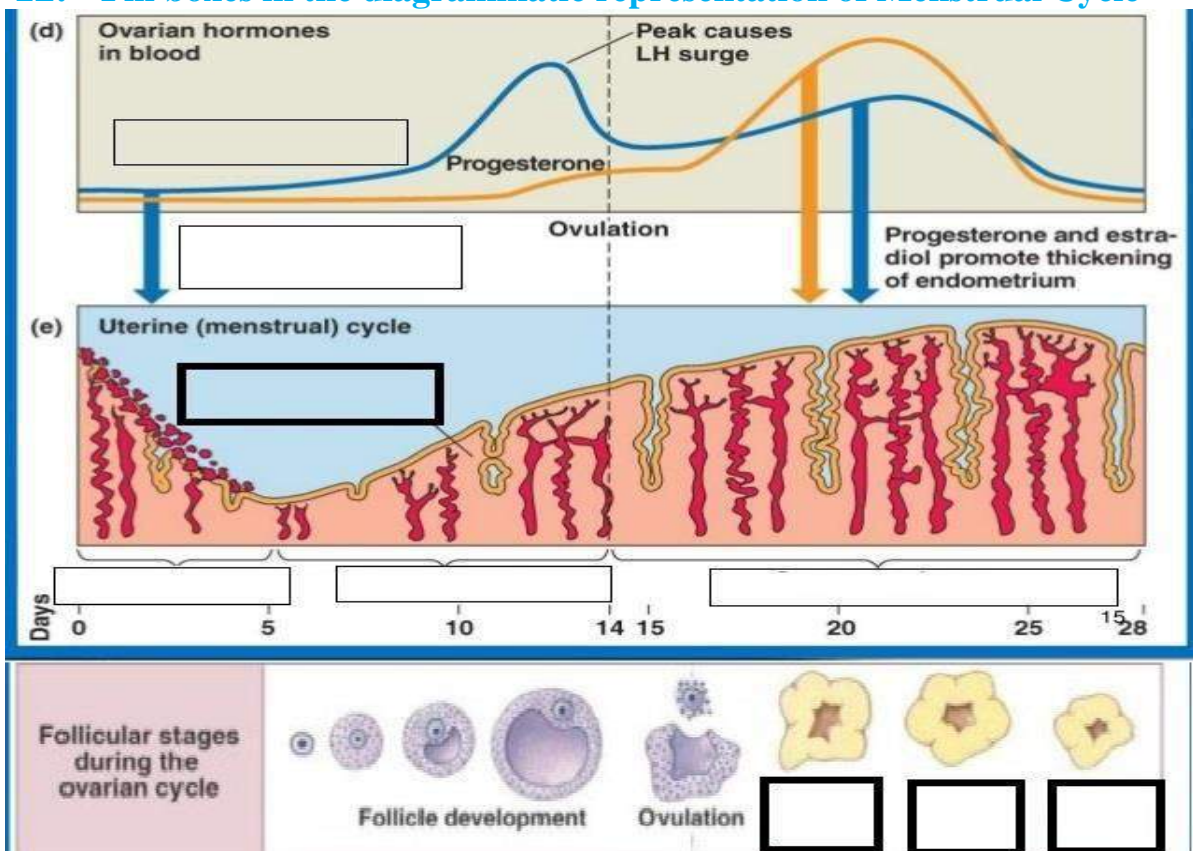
10. Relate the stages in Oogenesis and add brief note:



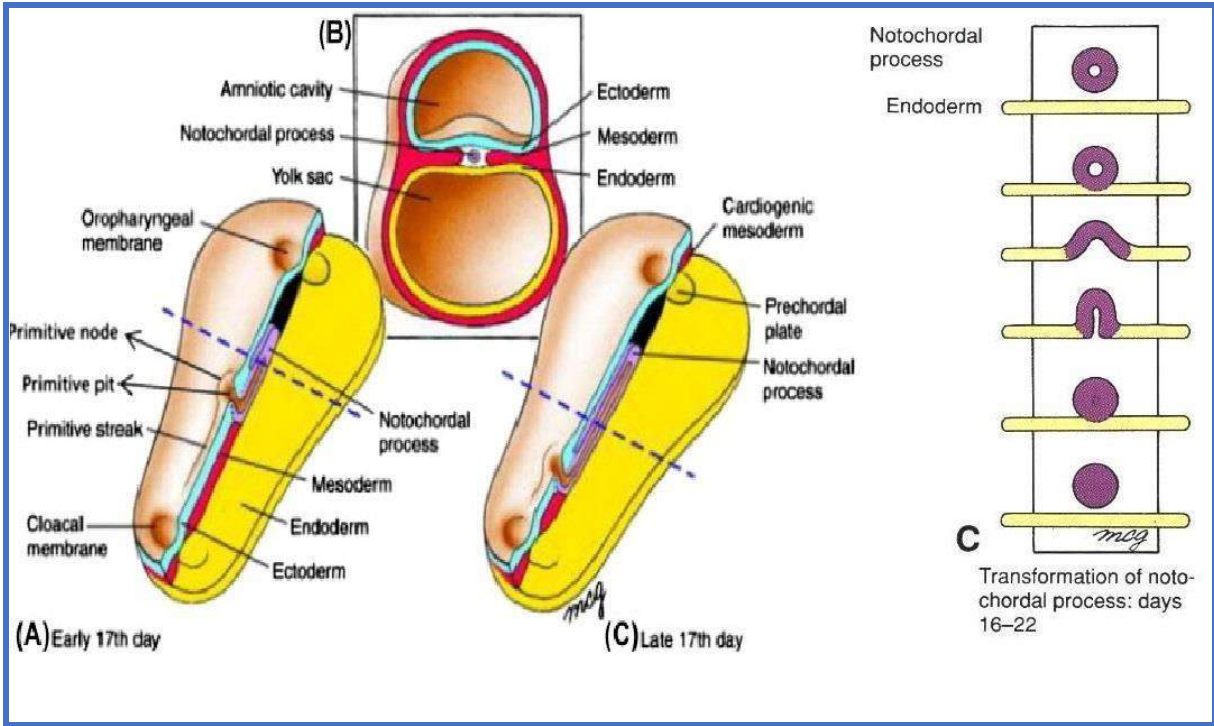
11. Read the Text, Compare and label the parts of Ovarian Follicle



12. Fill boxes in the diagrammatic representation of Menstrual Cycle



13. Read text and relate the picture of “Gastrulation” and understand the process (P.177)



14. Write functions of placenta

1.
2.
3.
4.
5.
6.

15. Fill in the blanks

1.	The testis are the male primary sex organs suspended outside the abdominal cavity within a pouch called
----	---

2.	The cavity of the scrotal sac is connected to the abdominal cavity through
3.	Testis is held in position in the scrotum by the a fibrous cord that connects the testis with the bottom of the scrotum.
4.	..... Is the fibrous envelop that encloses testis and extends inward to form septa that divides the testes into lobules.
5.	..... is a network of tubules in the testis carrying the spermatozoa from the seminiferous tubules to the vasa efferentia.
6.	The enlarged bulbous end of the penis is called
7.	..... glands are also called as “Cowper’s gland”.
8.	The edges of the infundibulum possess finger like projections called which help in collection of the ovum after “Ovulation”.
9.	The fallopian tube is attached to the abdominal wall by a peritoneal fold called
10.	The term refers to the external genitals of the female.
11.	The clitoris is homologous to the penis of a male as both are supported by internally.
12.	..... is the cushion of fatty tissue covered by skin and pubic hair present above the labia majora.
13.	..... glands are located on the anterior wall of the vagina, around the lower end of the urethra.
14.	GnRH stands for.....Hormone.
15.	..... in the sperm contains numerous enzymes that help in the fertilization of the ovum.
16.	A cavity appears within the membrana granulosa of mature ovum.
17.	Corpus leuteum degenerates and forms a mass of white body fibrous tissue called
18.	..... Is the occurrence of a first menstrual period in the female adolescent.
19.	Rapid secretion of Leutenising hormone leading to its maximum level during the mid-cycle of menstruation is called
20.	..... is the cessation of menstrual cycle in female human beings.
21.	..... is called so because it involves changes in the spermatozoa in the female genital tract leading to fertilization with ovum.
22.	..... enzyme released by the acrosome of the sperm, is called as “Corona penetrating enzyme”,
23.	..... enzyme released by the acrosome as an effect of acrosome reaction helps in the digestion of Zona pellucida.
24.	The part of the decidua that separates the embryo from the uterine lumen is called the
25.	Along the longitudinal axis of the embryonic disc, a “Primitive streak” is formed. The thickened part of the primitive streak is called as
26.	The Embryonic membranes Allantois and Yolk sac are formed from the
27.	The placenta of humans is called
28.	The human placenta is also called.....because the maternal blood comes into direct contact with the foetal chorion.
29.	..... secreted by the placenta is essential for the maintenance of pregnancy after the 4 th month when the corpus luteus degenerates.
30.	The process of delivery of foetus is called..... (the child birth).

16. Answer “TRUE” or “FALSE”

Sl. No.	Statement	True/ False
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1.	Human exhibit sexual dimorphism.	
2.	Male reproductive system consists of testis, oviducts, uterus, accessory glands, and penis.	
3.	Testis is a small pinkish, oval, and composite structure.	
4.	Ovaries are almond shaped, 3 cms long, 1.5 cms wide and 1 cm thick structure.	
5.	Each ovary consists of outer cortex and inner medulla.	
6.	Seminiferous tubules are situated in the testicular lobules of the testes.	
7.	Germinal epithelium consists of spermatogonia, only situated in the testicular lobules of the testes.	
8.	Leydig cells are named after the German anatomist – Franz von Leydig.	
9.	The stroma of cortical region is composed of spindle-shaped fibroblasts.	
10.	The penis is not an erectile copulatory organ.	
11.	Oogenesis is not influenced by endocrine hormones.	
12.	Leutinizing hormone (LH) is secreted by Corpus leuteum.	
13.	Oestrogen is synthesized by granulosa cells of developing ovarian follicle.	
14.	Both oestrogen and progesterone are synthesized by corpus leuteum.	
15.	Menstrual cycle starts in 25 – 40 years of age.	
16.	Raising the level of FSH stimulate sthe growth of the ovarian follicles and the formation of oestrogens.	
17.	Degenerated Corpus leuteum is called a s “Corpus albicans”.	
18.	The phenomenon of sperm activation is known as “Capacitation”.	
19.	Fertilization of only one spermatozoan is called “Polyspermy”.	
20.	“Amnion, Chorion, Allantois, and Yolk sac, are the fetal embryonic membranes.	
21.	The process of formation of mature ovum is called spermatogenesis.	
22.	The cells of the “primordial follicle” are squamous cells. These surround the primary oocyte.	
23.	The acrosome of sperm is rich in mitochondria.	
24.	The perivitelline space is the space between the vitelline membrane and zona pellucida.	
25.	The cleavage in human embryonic development is holoblastic, and radial.	
26.	The morula undergoes a process called “Compaction”, the tight packing of blastomeres forming gap junctions enabling the exchange of ions and small molecules to pass from one cell to the other.	
27.	Ootid is another name for ‘Ovum”.	
28.	The fusion of gametes is called “Syngamy” and the fusion of nucleus is called “Amphimixis”.	
29.	The process by which the blastocyst gets implanted into the uterine mucosa till the whole of it comes to lie within the thickness of the endometrium is called “Interstitial Implantation”.	
30.	The process of gastrulation coverts the “Bilaminar Embryonic Disc” into the “Trilaminar Embryonic Disc”.	

17. Multiple Choice Questions

1. Which of the following is primary sex organ a. scrotum b. vagina c. penis d. testes
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2. Which muscles help to maintain temperature of testes a. Dartos b. Creamaster c. both a&b d. none
3. Testes are connected with scrotum a. spermatic cord b. inguinal canal c. vas deferens d. gubernaculum
4. In males' failure of testes to descend into the scrotum is known as a. cryptorchidism b. circumcision c. impotency d. compaction
5. Testicular lobules of testis formed by the invagination of a. tunica vaginalis b. mesorchium c. tunica albugenia d. epididymis
6. Sertoli cells produce a. inhibin b. testosterone c. FSH d. LH
7. Interstitial cells in between seminiferous tubules produce a. estrogens b. androgens c. testosterone d. progesterone
8. The common duct formed by the union of vas deferens and duct of seminal vesicle a. spermatic duct b. urethra c. ejaculatory duct d. fallopian duct
9. Major part of semen contributed by a. prostate gland b. Bartholin gland c. skene's gland d. seminal vesicles
10. Funnel shaped part of oviduct closer to the ovary a. Infundibulum b. fimbriae c. ampulla d. isthmus
11. The main function of fimbriae of oviduct a. collection of ova b. development of ovary c. help in fertilization d. help in implantation
12. Which female glands are homologous to the prostate gland of male a. skene's gland b. mammary gland c. Bartholin gland d. Cowper's gland
13. which of the following undergoes Meiosis-II division a. spermatogonium b. primary spermatocytes c. Secondary spermatocytes d. sertoli cells
14. In oogenesis cell division stops at prophase-I of meiosis –I at the stage of a. primary oocyte b. secondary oocyte c. oogonium d. ootid
15. At which stage of the development ,ovum is released from the ovary of the human female a. primary oocyte b. secondary oocyte c. oogonium d. ootid
16. when does ovulation occur in a healthy woman a. 16-20 days b. 14-16 days c. 10-13 days d. 20-24 days
17. Fertilization takes place a. isthmus b. ampullary isthmic Junction c. cervix d. follicle
18. In human females, Meiosis-II is not complete upto a. Implantation b. puberty c. Fertilization d. Insemination
19. Relaxin is secreted by a. placenta b. ovary c. pituitary d. testes
20. Desiccation of the embryo prevented by a. Amnion b. Chorion c. Allantois d. yolk sac
21. Progesterone and estrogen are secreted by ? a. testes b. kidney c) placenta d)ovum
22. Leydig cells are found in a. seminal vesicle b. testes c. ovary d. uterus
23. The duct opening at the tip of the mammary gland is a. Lactiferous duct b. Stensens duct c. Rivinus duct d. Umbilical duct
24. Corpora cavernosa muscle is present in a) Penis b) Penis& Clitoris c) Penis only d) Clitoris only

25. Human placenta is derived from (a) mesoderm (b) tropho blast (c) ectoderm (d) endoderm
26. movement of sperms in female reproductive tract by help of (a) middle piece (b) head (c) tail & middle piece (d) only tail
27. Number of spermatozoa produced by two primary spermatocytes a) two only b. 4 only c) 8 d) 16
28. corpus luteum produces (a) estrogen (b) testosterone (c). thyroxin (d). progesterone
29. sertoli cells are regulated by the (a) FSH (b) LH (c) GH (d) TSH
30. which hormone can be administered to begin the parturition (a) oxytocin (b) relaxin (c) prolactin (d) estrogen
31. which of the following hormone is not secreted by placenta (a) oxytocin (b) relaxin (c) prolactin (d) hcG
32. Mammalian foetus directly surrounded by a) yolk sac cavity b) amniotic cavity c) allantoic cavity d) scrotal cavity
33. Capacitation of sperm occurs in a) ovary b) testes c) epididymis d) female reproductive tract
34. one million oocytes and one million spermatocytes will give (a). 2 million ova & 2million sperms (b) 1 million ova & 2million sperms (c) 1 million ova & 1million sperms (d) 2 million ova & 1 million sperms
35. oogonium is (a) haploid (b) haplo-diploid (c) diploid (d) triploid
36.how many centrioles are normally present in a sperm a) no centrioles b) more than two c) two d) One
37. In which phase of the following progesterone hormone is active a) proliferative b) menstrual c) secretory d) follicular
38. After menopause which hormone rise in urine a) LH b) FSH c) ACTH d) GnRH
39. The secretion of FSH from pituitary is lowered by? a) Inhibin b) ABP c) Prolactin d) oxytocin
40. The process of capacitation usually occurs in the a. epididymis b. vagina c. oviduct d. seminal vesicle
41. Seminal plasma in humans is rich in (a) fructose, calcium, citric acid and prostaglandins (b) fructose and calcium, but has no enzymes (c) fructose, glucose and amino acids, but has no calcium (d) fructose, prostaglandins, without calcium
42. the second maturation division of the mammalian ovum starts (a) when the ovum enters into the fallopian tube (b) when the graafian follicle ruptures (c) when the sperm penetrated into ovum (d) after completion of the fertilization
43. signals for parturition originate from a) pituitary gland b) corpus luteum c) placenta d) placenta and fully developed fetus
44. The hormone “relaxin” is secreted by a) placenta only b) corpus luteum, placenta and prostate gland c) corpus luteum only d) by pituitary gland only
45.In human menstrual cycle LH surge occurs exactly on (a) 12 th day (b) 10 th day (c) 14 th day (d) 24 th day

46. which gland secretes alkaline mucous in the urethra to neutralize the acidity of urine a. seminal vesicles b. prostate gland c. cowpers gland d. epididymis
47. which hormones are produced in women only during pregnancy? a) Human chorionic gonado tropin(hCG) b)relaxin c) human placental lactogn(hpL) d) all
48. The germ cells contains 23 chromosomes (a) primary spermatocytes (b) spermatogonia (c) secondary spermatocyte (d) oognia
49. capacitation occurs (a) epididymis (b) male reproductive tract (c) female reproductive tract (d) ovary
50. select the incorrect statement a) LH triggers the leydig cells to produce androgens b) FSH stimulates the sertoli cells, which helps in spermiogenesis c) LH & FSH decrease gradually during the follicular phase d) LH triggers ovulation in ovary
51.Gonads derived from a) mesoderm b) ectoderm c) endoderm d) neuro-derm
52. Secretions from which one of the following are rich in fructose, calcium and some enzymes? (Mains 2010) (a) Male accessory glands b) Liver c) Pancreas d) Salivary glands
53. A human female has the maximum number of primary oocytes in her ovaries (a) at birth (b) at puberty (c) after menarche (d) after menopause
54. the structure formed after release of ova from graafian follicle and secretary in nature is a) corpus spongiosum b) corpus stratum c) corpus luteum d) corpus albicans
55. Fertilizing protein is found in a) acrosome b) sarcosome c) ovum d) middle piece of sperm
56.withdrawal of which hormone is the immediate causes of menstruation a) progesterone b) testosterone c) estrogen d) oxytocin
57. Fetal ejection reflex in human female is induced by a) release of oxytocin b) fully developed foetus and placenta c) menstrual cycle d) amniotic fluid
58. The region of the embryo that first develops a close connection with the uterus is called the a) chorion b) yolk sac c) amnion d) placenta
59. which of the following keeps to embryo attached to the wall of the uterus a) fallopian tube b) umbilical cord c) vas deferens d) meso ovarium
60. fallopian tube consists of a) infundibulum ; b) isthmus; c) ampulla; d) cervix Ans: a) a,b,c,d b) a, c c) a,b,d d) a,b,c
61. seminiferous tubules consists of a) sertoli cells; b) leydig cells; c) primary follicles; d) sperm cells Ans: a) a,d b) a,b,d c) a,c d)a,b,c,d
62. If one ovary is removed from a woman, she will a) not produce ovum b) produce ovum every month c) produce ovum in alternate month d) produce two ovum in alternate month
63. A 36 year old female have 2 child . if menses start at the age of 12 year then calculate the number of secondary oocyte and ova

a) 268 secondary oocyte and 2 ova c) 258 secondary oocyte and 2 ova	b) 248 secondary oocyte and 2 ova d) 278 secondary oocyte and 2 ova										
<p>64. Match the terms in column A with suitable terms in column B:</p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: center;">Column A</th> <th style="text-align: center;">Column B</th> </tr> </thead> <tbody> <tr> <td>A. Testes</td> <td>1. Endometrium</td> </tr> <tr> <td>B. Ovary</td> <td>2. Graffian follicle</td> </tr> <tr> <td>C. Scrotum</td> <td>3. Maintain temperature</td> </tr> <tr> <td>D. Uterus</td> <td>4. Sperm</td> </tr> </tbody> </table> <p>(a) A=1, B=2, C=3, D=4 (b) A=4, B=2, C=3, D=1 (c) A=2, B=2, C=3, D=1 (d) A=3, B=2, C=4, D=1</p>		Column A	Column B	A. Testes	1. Endometrium	B. Ovary	2. Graffian follicle	C. Scrotum	3. Maintain temperature	D. Uterus	4. Sperm
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A. Testes	1. Endometrium										
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D. Uterus	4. Sperm										
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<p>69. Hormones secreted by the placenta to maintain pregnancy are (NEET-2018)</p> <p>A. hCG, hPL, progestogens, estrogens, glucocorticoids B. hCG, hPL, progestogens, estrogens, C. hCG, hPL, progestogens, estrogens, relaxin, oxytocin D. hCG, hPL, progestogens, estrogens, prolactin</p>											

<p>70. The difference between spermiogenesis and spermiation is</p> <p>a) in spermiogenesis spermatids are formed while in spermiation spermatozoa are formed</p> <p>b) in spermmiogenesis spermatozoa are formed, while in spermiation spermatids are formed</p> <p>c) in spermiogenesis spermatozoa from Sertoli cells are released into the cavity of seminiferous tubules, while in spermiation spermatozoa are formed</p> <p>d) in spermiogenesis spermatozoa are formed, while in spermiation spermatozoa are released from Sertoli cells into the cavity</p>													
<p>71. The amnion of mammalian embryo is derived of</p> <p>a. ectoderm and mesoderm b. endoderm and mesoderm</p> <p>c.. mesoderm and trophoblast d. ectoderm and endoderm.</p>													
<p>72. Match the items given in column I with those in column II and select the correct option given below (NEET 2018)</p> <table style="width: 100%; border: none;"> <thead> <tr> <th style="text-align: left; width: 50%;">Column – I</th> <th style="text-align: left; width: 50%;">Column – II</th> </tr> </thead> <tbody> <tr> <td>a. Proliferative phase</td> <td>1. Breakdown of endometrial linings</td> </tr> <tr> <td>b. Secretory phase</td> <td>2. Follicular phase</td> </tr> <tr> <td>c. Menstruation</td> <td>3. Luteal Phase</td> </tr> </tbody> </table> <p>(a) A-(iii) B- (ii) C- (i)</p> <p>(b) A-(i) B- (iii) C- (ii)</p> <p>(c) A-(ii) B- (iii) C- (i)</p> <p>(d) A-(iii) B- (i) C- (ii)</p>		Column – I	Column – II	a. Proliferative phase	1. Breakdown of endometrial linings	b. Secretory phase	2. Follicular phase	c. Menstruation	3. Luteal Phase				
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<p>73. Capacitation occurs in (NEET 2018)</p> <p>a. Epididymis b. vas deferens c. female reproductive tract d. rete testis.</p>													
<p>74. Which of the following depicts the correct pathway of transport of sperms? (NEET 2017)</p> <p>a) Rete testis ---Efferent ductules--- Epididymis -----Vas deferens</p> <p>b) Rete testis---- Epididymis----- Efferent ductules --Vas deferens</p> <p>c) Rete testis ----Vas deferens---- Efferent ductules Vas deferens</p> <p>d) Efferent ductules--- Rete testis -----Vas deferens Epididymis</p>													
<p>75. Match column I with column II and select the correct option using the codes given below (NEET-II 2016)</p> <table style="width: 100%; border: none;"> <thead> <tr> <th style="text-align: left; width: 50%;">Column – I</th> <th style="text-align: left; width: 50%;">Column – II</th> </tr> </thead> <tbody> <tr> <td>a. Mons pubis</td> <td>1. Embryo formation</td> </tr> <tr> <td>b. Antrum</td> <td>2. Sperm</td> </tr> <tr> <td>c. Trophoctoderm</td> <td>3. Female External genitalia</td> </tr> <tr> <td>d. Nebenkern</td> <td>4. Graafian follicle</td> </tr> <tr> <td></td> <td>5.</td> </tr> </tbody> </table> <p>(a) A-(iii), B-(iv), C-(ii), D-(i) (b) A-(iii), B-(iv), C-(i), D-(ii)</p> <p>(c) A-(ii), B-0), C-(iv), D-(i) (d) A-(i), B-(iv), C-(iii), D-(i)</p>		Column – I	Column – II	a. Mons pubis	1. Embryo formation	b. Antrum	2. Sperm	c. Trophoctoderm	3. Female External genitalia	d. Nebenkern	4. Graafian follicle		5.
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<p>76. Changes in GnRH pulse frequency in females is controlled by circulating levels of (NEET-I 2016)</p> <p>a. progesterone only b. progesterone and inhibin</p> <p>c. estrogen and progesterone d. estrogen and inhibin.</p>													
<p>77.Fertilization in humans is practically feasible only if.(NEET-I 2016)</p> <p>(a) the ovum and sperms are transported simultaneously to ampullary isthmic junction of the cervix</p> <p>(b) the sperms are transported into cervix within 48 hrs of release of ovum in uterus</p> <p>(c) the sperms are transported into vagina just after the release of ovum in Fallopian tube</p>													

(d) the ovum and sperms are transported simultaneously to ampullary- isthmic junction of the Fallopian tube.
78. Select the incorrect statement (NEET-I 2016) (a) LH and FSH decrease gradually during the follicular phase (b) LH triggers secretion of androgens from the Leydig cells (c) FSH stimulates the Sertoli cells which help in spermiogenesis (d) LH triggers ovulation in ovary.
79. Identify the correct statement on inhibin'. (NEET-I 2016) (a) Is produced by granulosa cells in ovary and inhibits the secretion of LH (b) Is produced by nurse cells in testes and inhibits the secretion of FSH (c) Inhibits the secretion of LH, FSH and prolactin (d) Is produced by granulosa cells in ovary and inhibits the secretion of FSH
80. In human females, meiosis-II is not completed until. (2015) a. uterine implantation b. birth c. puberty d. fertilization
81. Which of the following layers in an antral-follicle is acellular? (2015) a. Stroma b. Zona pellucid c. Granulosa d. Theca interna
82. Which of the following events is not associated with ovulation human female(2015) a. Release of secondary oocyte b. LH surge c. Decrease in estradiol d. Full development of Graafian follicle
LEVEL – 3
83. Ectopic pregnancies are referred to as.(2015 NEET) a. Implantation of defective embryo in the uterus b. pregnancies terminated due to hormonal imbalance c. pregnancies with genetic abnormality d. implantation of embryo at site other than uterus.
84 Which of the following cells during gametogenesis is normally diploid (2015 –NEET) a. Spermatogonia b. Secondary polar body c.. Primary polar body d. Spermatid
85. Capacitation refers to changes in the (2015) (a) ovum after fertilization (b) sperm after fertilization (c) sperm before fertilization (d) ovum before fertilization
86. Hysterectomy is surgical removal of (2015) a. vas deferens b. uterus c. mammary glands d. prostate gland
87. Which of these is not an important component of initiation of parturition in humans? a. Release of oxytocin b. Release of prolactin c. Increase in estrogen and progesterone d. Synthesis of prostaglandins
88. The main function of mammalian corpus luteum is to produce (a) estrogen only b. progesterone c. human chorionic gonadotropin d. relaxin only.
89. Select the correct option describing gonadotropin activity in a normal pregnant female (a) High level of FSH and LH stimulates thickening of endometrium (b) High level of FSH and LH stimulates the of estrogen and progesterone (c) High level of FSH and LH facilitates implantation of the embryo (d) High level of hCG stimulates the thickening of endometrium.
90. What is the correct sequence of sperm formation? (NEET2013) (a) Spermatogonia, spermatozoa, spermatocytes, spermatids (b) Spermatogonia, spermatocytes, spermatids, spermatozoa (c) Spermatids, spermatocytes, spermatogonia, spermatozoa (d) Spermatogonia, spermatocytes, spermatozoa, spermatids

91. Which one of the following is not the function of placenta? (2013) (a) Facilitates removal of carbon dioxide and waste material from embryo (b) Secretes oxytocin during parturition (c) Facilitates supply of oxygen and nutrients to embryo (d) Secretes estrogen
92. Menstrual flow occurs due to lack of (a) oxytocin (b) progesterone (c) vasopressin (d) FSH.
93. The secretory phase in the human menstrual cycle is also called (a) luteal phase and lasts for about 6 days (b) follicular phase and lasts for about 6 days (c) luteal phase and lasts for about 13 days (d) follicular phase and lasts for about 13days.
94. If for some reason, the vasa efferentia in the human reproductive system get blocked, the gametes will not be transported from (a) testes to epididymis (b) epididymis to vas deferens (c) ovary to uterus (d) vagina to uterus.
95. The testes in humans are situated outside the abdominal cavity inside a pouch called scrotum. The purpose served is for (a) maintaining the scrotal temperature lower than the internal bodytemperature (b) escaping any possible compression by the visceral organs (c) providing more space for the growth of epididymis (d) providing a secondary sexual feature for exhibiting the male sex.
96. What happens during fertilization in humans after many sperms reach near to the ovum a) secretions of acrosome help one sperm enter cytoplasm of ovum through zona pellucida. (b) All sperms except the one nearest to the ovum lose their tails. (c) Cells of corona radiata trap all the sperms except one. (d) Only two sperms nearest the ovum penetrate zona pellucid.
97. About which day in a normal human menstrual cycle does rapid secretion of LH (popularly called LH surge) normally occurs? (a) 14th day (b) 20h day (c) 5th day (d) 11th day
98. Sertoli cells are found in (a) ovaries and secrete progesterone (b) adrenal cortex and secrete adrenaline (c) seminiferous tubules and provide nutrition to germ cells (d) pancreas and secrete cholecystokinin.
99. Vasa efferentia are the ductules leading from a). testicular lobules to rete testis (b). rete testis to vas deferens c). vas deferens to epididymis (d).epididymis to urethra.
100.Seminal plasma in human males is rich in a). fructose and calcium (b). glucose and calcium c). DNA and testosterone (d). ribose and potassium.
Answers at the end.

18. Assertion & Reasoning Questions

Sl.No.	<p>Instructions;</p> <p>(a) If both (A) and (R) are true and (R) is the correct explanation of (A)</p> <p>(b) If both (A) and (R) are true but (R) is not the correct explanation of (A)</p> <p>(c) If (A) is true, but (R) is false;</p>
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	(d) (d) If (A) and (R) are false.
1.	(A) In the testes spermatogenesis occurs in the seminiferous tubules and inhibin hormone secretion takes place from the Sertoli cells (R) Inhibin inhibits the secretion of FSH
2.	(A) Fimbriae are finger-like projections of infundibulum part of oviduct which is closest to ovary. (R) They are important for fertilization of ovum after ovulation from ovary.
3.	(A) Spermatogenesis starts at the age of puberty. (R) There is significant increase in level gonadotropin releasing hormone at puberty.
4.	(A) Human male ejaculate 300 million sperms during coitus. (R) all reach the isthmus an junction for process of fertilization.
5.	(A) The sperm head contains a cap-like structure called acrosome. (R) Acrosome is filled with enzymes that help in movement of the of the sperm
6.	(A) Ovum retains most of the contents of the primary oocyte and is much larger than a spermatozoon. (R) Ovum need not energy to go about in search of a spermatozoa for fertilization
7.	(A) Menstrual phase is also compared to shedding tears for the lost ovum. (R) In the menstrual phase loss of endometrial lining takes place due to reducing of progesterone,
8.	(A) Production of FSH increases, while that of LH decreases in the ovulation phase. (R) Due to increase in the level of LH ovulation (releasing of ova) takes place
9.	(A) Placenta is an exocrine gland. (R) It secretes many hormones which are not essential for pregnancy.
10.	(A) Breast feeding during initial period of infant growth is not recommended. (R) Colostrum contains fructose , essential to give energy in newborns.
11.	(A) Stem cells have the property of totipotency. (R) Stem cells can give rise to any type of cells
12.	(A) A woman passes out hCG in the urine during pregnancy. (R) The presence of hCG in urine is the basis for pregnancy test,
13.	(A) In humans, the gamete contributed by the male determines whether the child produced will be male or female. (R) the gamete contributed by female also determines the sex of baby.
14.	(A) Progesterone is essential for maintenance of the endometrium. (R) Endometrium is essential for sex of embryo.
15.	(A) Sertoli cells are being involved in the process of spermatogenesis. (R) Nutrition for developing sperms is provided by Sertoli cells.
16.	(A) Each primary spermatocyte cell gives rise to four secondary spermatocyte cells. (R) Secondary spermatocytes are formed through reduction division.
17.	(A) Scrotum is a pouch in which testes are held. (R) Out pocketed sac of the abdominal cavity or pelvic cavity holds testes.
18.	(A) Generally, sperm cells are larger than egg cells. (R) It is due to the presence of Acrosome and mitochondria.
19.	(A) First meiotic division in primary oocyte results in the formation of two equal sized cells.

	(R) Both of these cells are equally functional.
20.	(A) Only a single functional female gamete is formed from each primary oocyte cell. (R) Meiosis in each primary oocyte give rise to only one cell which functions as Ovum.

19. Assignment Questions to answer

VSAQ***	1	What are the functions of Sertoli cells of the seminiferous tubules and the Leidig Cells in Human beings?
**	2	Define Spermiogenesis and Spermiation.
***	3	Define Gestation period. What is the duration of the gestation period in Human beings?
*	4	What is Implantation with reference to embryo?
*	5	Distinguish between Epiblast and Hypopblast.
**	6	Draw a labelled diagram of a sperm.
***	7	What is menstrual Cycle? Which hormones regulate menstrual cycle?
**	8	What is Parturition? Which hormones are involved in inducing parturition?
*	9	What is capacitation of Sperms?
***	10.	What are the four extra Embryonic membranes?
*	11	What is Neurulation ?
*	12	What is compaction in Human Development?
SAQ*	1	Describe the Graffian follicle in Women.
*	2	Describe the placenta in women.
**	3	What is Oogenesis? Give a brief account of oogenesis in women.
*	4	What is Spermatogenesis? Briefly describe the process of spermatogenesis in man.
LAQ***	1	Describe female Reproductive system of a woman with the help of a neat labelled diagram
***	2	Describe male Reproductive system of a man with the help of a neat labelled diagram
*	3	Write an essay on different events that occur during development of a human.

20. Hands on Experiences for you – Try It!!!

1. Engaging Activity:

(Before starting activity ask student watch YouTube videos on Human Reproductive system)

To introduce the lesson, choose from the following questions to activate prior knowledge:

- • Males have both internal and external sex-organs. What are the major organs that make up the male reproductive system?
- • Females have internal sex-organs. What are the major organs that make up the Female reproductive system?
- • Males and Females are often said to be “opposite,” but physically speaking this isn’t entirely true. In what ways are the male and female reproductive systems similar?
- • How do they depend on each other to create a new individual?
- • Why would it be important for a person to know about the reproductive system?

2. Covid-19 – Child Care

DOES COVID-19 PASS FROM MOTHER TO CHILD

Breastfeeding advice during the COVID-19 outbreak

Breastfeeding protects newborns from getting sick and also helps protect them throughout their infancy and childhood. Breastfeeding is particularly effective against infectious diseases because it strengthens the immune system by directly transferring antibodies from the mother. As with all confirmed or suspected COVID-19 cases, mothers with any symptoms who are breastfeeding or practicing skin-to-skin contact should take precautions.

Actions for breastfeeding mothers

- Practice respiratory hygiene, including during feeding. If you have respiratory symptoms such as being short of breath, use a medical mask when near your child.
- Wash your hands thoroughly with soap or sanitizer before and after contact with your child.
- Routinely clean and disinfect any surfaces you touch.
- If you are severely ill with COVID-19 or suffer from other complications that prevent you from caring for your infant or continuing direct breastfeeding, express milk to safely provide breastmilk to your infant.
- If you are too unwell to breastfeed or express breastmilk, you should explore the possibility of relaxation (restarting breastfeeding after a gap), wet nursing (another woman breastfeeding or caring for your child), or using donor human milk. Which approach to use will depend on cultural context, acceptability to you, and service availability.

Actions for health facilities and their staff

- If you are providing maternity and newborn services, you should not promote breastmilk substitutes, feeding bottles, teats, pacifiers or dummies in any part of your facilities, or by any of your staff.
- Whether or not the mother or child has suspected, probable, or confirmed COVID-19, you should enable mothers and infants to:
 - remain together
 - practice skin-to-skin contact and
 - room-in throughout the day and night, especially straight after birth during establishment of breastfeeding.

Counselling and psychosocial support

If you, your infants, or young children have suspected or confirmed COVID-19, seek breastfeeding counselling, basic psychosocial support, or practical feeding support. You may get support from appropriately trained health care professionals and also community-based lay and peer breastfeeding counsellors.

Standard infant feeding guidelines

- Initiate breastfeeding within 1 hour of the birth.
- Continue exclusive breastfeeding for 6 months, then introduce adequate and safe complementary foods at age 6 months.
- Continue breastfeeding up to 2 years of age or beyond.



#COVID19
#CORONAVIRUS
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21. Medical and other careers related to Reproductive System

Gynecologists

They deal with the health of the female reproductive system. The term gynecology literally means the study of women. They can do anything from examine the vagina for vaginal cancer to give ultrasounds to help give birth. Gynecologists study at college for a minimum of 12 years because they must have all the basic medical classes as well as the specific gynecology classes. They can work in a hospital setting, have a private practice, or have a teaching position at a university hospital.

Andrologists

Andrology is the medical profession dealing with the health of the male reproductive system. It is the counterpart to gynecology and literally means the study of men. They perform the surgical procedures of a vasectomy and a vasovasostomy which is the reversal process of a vasectomy. They also handle any genital infections or infertility in males and often check for prostate cancer.

Reproductive Endocrinologists

Reproductive endocrinologists identify fertility issues in men and women and determine the best treatment methods for those conditions. They offer Assisted Reproductive Technologies, such as in vitro fertilization, which often include the surgical retrieval of eggs from a woman's ovaries. Reproductive endocrinologists also might preserve eggs or sperm for women and men who are about to undergo medical treatments like radiation therapy or chemotherapy.

Animal Breeders

Animal breeders create physical or genetic characteristics in the offspring of two sets of parent DNA. They manage animal genealogies or pedigrees and use the information to create new generations that preserve or enhance genetic lines. They can work with large or small animals intended for racing or show.

Embryologist

They are the fertility specialist that helps to create viable embryos to either be used in IVF right away or to be frozen for later use. Embryologists aren't MDs, but they are highly trained medical professionals, usually holding a Master's degree or a PhD due to the specialized nature of their work.

22. Answers to the activities and note making

15. Answers to fill in the blanks

1	Scrotum	11	Corpora cavernosa	21	Capacitation
2	Inguinal canal	12	Mons pubis	22	Hyaluronidase
3	Gubernaculum	13	Skene's glands	23	Acrosin
4	Tunica albugenia	14	Gonadotropin releasing	24	Decidua capsularis
5	Rete testis	15	Acrosome	25	Primitive knot/ Primitive node/ Hensen's node
6	Glans penis	16	Antrum	26	Splachnopleure
7	Bulbourethral	17	Corpus albicans	27	Chorioallantoic placenta
8	fimbriae	18	Menarche	28	Haemochorial
9	mesosalpinx	19	LH surge	29	Progesterone
10	Vulva or Pudendum	20	menopause	30	Parturition

16. TRUE or FALSE statements:

1	TRUE	11	FALSE	21	FALSE
2	TRUE	12	FALSE	22	TRUE
3	FALSE	13	TRUE	23	FALSE
4	TRUE	14	TRUE	24	TRUE
5	TRUE	15	FALSE	25	TRUE
6	TRUE	16	TRUE	26	TRUE
7	FALSE	17	TRUE	27	TRUE
8	TRUE	18	TRUE	28	FALSE
9	TRUE	19	FALSE	29	TRUE
10	FALSE	20	TRUE	30	TRUE

17. Activity- – MULTIPLE CHOICE QUESTIONS

Que. No	Ans.	Explanation/Notes
		<ul style="list-style-type: none"> • First one is an example. • The students should explore unknown options & make note as shown here.
LEVEL – 1		
1	d	
2	c	
3	D	
4	a	
5	C	
6	A	
7	B	

8	C	
9	d	
10	a	
11	a	
12	A	
13	B	
14	A	
15	B	
16	B	
17	B	
18	C	
19	A	
20	A	
21	C	
22	A	
23	A	
24	B	
25	B	
26	C	
27	C	
28	D	
29	A	
30	A	
31	C	
32	B	
33	D	
34	B	
35	C	
36	C	
37	C	
38	B	

39	A	
40	B	
LEVEL – 2		
41	A	
42	C	
43	D	
44	B	
45	C	
46	B	
47.	D	
48	C	
49	C	
50	C	
51	A	
52	A	
53	A	
54	c	
55	A	
56	A	
57	B	
58	A	
59	B	
60	D	
61	D	
62	B	
63	C	
64	B	
65	A	
66	D	
67	A	
68	C	

69	C	
70	D	
71	C	
72	C	
73	C	
74	D	
75	B	
76	C	
77	D	
78	A	
79	B	
80	D	
LEVEL – 3		
81	B	
82	C	
83	D	
84	A	
85	C	
86	B	
87	D	
88	B	
89	b	
90	B	
91	B	
92	C	
93	C	
94	A	
95	A	
96	C	
97	A	
98	A	

99	B	
100	A	

Activity 18. - ASSERTION AND REASON QUESTIONS

1	2	3	4	5	6	7	8	9	10
A	C	A	C	C	B	A	B	D	D
11	12	13	14	15	16	17	18	19	20
A	B	C	C	B	D	B	D	D	A

REPRODUCTIVE HEALTH



MAJOR LEARNING OBJECTIVE

- *Students will be able to recognize, identify, understand, appreciate and apply the knowledge of the Reproductive health.*
- *Students will be able to understand the importance of reproductive health in living organisms” (continuity of life and independent existence)*

LEARNING OUTCOMES:

- Be able to understand and apply the knowledge of need for Reproductive health and prevention of “Sexual Transmitted Diseases”.
- Be able to understand, describe, appreciate and apply the knowledge of need for different methods of birth control.
- Be able to apply the knowledge of Amniocentesis, Infertility and different techniques of Assisted Reproductive Technology.
- Be able to know the importance of legalizing the MTP
- Be able to appreciate the need of surrogacy

ADDITIONAL READING MATERIAL

- Sexual Health and Sexual Rights

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book
2. Defining key words
3. Expand the abbreviations
4. Name the STDs and Causative organisms
5. Name the appropriate method of contraception and describe briefly
6. Identify, label and describe the diagram
7. Observe and add brief note on Amniocentesis
8. Observe and Add brief note on Assisted Reproductive Techniques
9. Fill in the blanks
10. Answer “TRUE” or “FALSE”
11. Multiple Choice Questions for Competitive exams
12. Assertion & Reasoning Questions
13. Assignment Questions to answer
14. Hands on Experiences for you – Try It!!!
15. Medical and other careers related to Immune System
16. Answers to the activities and note making

INSTRUCTIONS TO LECTURER

- Ask the students to take aid of the textbook and to work with a partner
- Explain each part of the worksheet & Come up with some examples to help
- Clarify doubts of the students before starting the work book.

INSTRUCTIONS TO STUDENTS

- First read the text book thoroughly and logically with a friend cooperatively
- While attempting the activities analyze them carefully
- While attempting the multiple choice questions, make notes on the other options too

ADDITIONAL READING MATERIAL

➤ Sexual Health and Sexual Rights

The World Health Organization defines sexual health as: *"Sexual health is a state of physical, mental and social well-being in relation to sexuality. It requires a positive and respectful approach to sexuality and sexual relationships, as well as the possibility of having pleasurable and safe sexual experiences, free of coercion, discrimination and violence."*

Sexual Rights Are Human Rights

For women and girls, the right to control their own bodies and their sexuality without any form of discrimination, coercion, or violence is critical for their empowerment. Without sexual rights, they cannot realize their rights to self-determination and autonomy, nor can they control other aspects of their lives. Indeed, it is the attempts to control women's and girls' sexuality that result in many of the human rights abuses they face on a daily basis, including gender-based violence, forced marriage, female genital mutilation, and limitations on their mobility, dress, education, employment, and participation in public life. The same holds true for lesbians, gay men, bisexual people, transgender people, sex workers, and others who transgress sexual and gender norms and who face greater risk of violence, stigma, and discrimination as a result. It is clear: sexual rights underpin the enjoyment of all other human rights and are a prerequisite for equality and justice.

The World Association for Sexual Health (WAS) was founded in 1978 by a multidisciplinary, world-wide group of NGOs to promote the field of sexology.

The WAS Declaration of Sexual Rights :

- The right to equality and non-discrimination
- The right to life, liberty and security of the person
- The right to autonomy and bodily integrity
- The right to be free from torture and cruel, inhuman, or degrading treatment or punishment
- The right to be free from all forms of violence and coercion
- The right to privacy
- The right to the highest attainable standard of health, including sexual health; with the possibility of pleasurable, satisfying, and safe sexual experiences
- The right to enjoy the benefits of scientific progress and its application
- The right to information
- The right to education and the right to comprehensive sexuality education
- The right to enter, form, and dissolve marriage and similar types of relationships based on equality and full and free consent
- The right to decide whether to have children, the number and spacing of children, and to have the information and the means to do so
- The right to the freedom of thought, opinion, and expression
- The right to freedom of association and peaceful assembly
- The right to participation in public and political life
- The right to access to justice, remedies, and redress

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book

1	9	17
2	10	18
3	11	19
4	12	20
5	13	21
6	14	22
7	15	23
8	16	24

2. Defining key words

1. Contraception	
2. Periodic abstinence	
3. Coitus interruptus	
4. Lactational amenorrhea	
5. Oral contraceptive pills	
6. Vasectomy	
7. Tubectomy	
8. Amneocentesis	
9. Infertility	
10. Artificial insemination	
11. Surrogacy	
12. Female Feticide	
13. Maternal Mortality	
14. Infant Mortality	

3. Expand the abbreviations

1. RCH	
2. PID	
3. IUDs	
4. OCPs	
5. DMPA	
6. MTP	
7. ART	
8. IVF-ET	
9. ZIFT	
10. GIFT	
11. ICSI	
12. AI	
13. RTI	
14. VDs	

4. Name the STDs and Causative organisms

Sl.No.	Name of the disease	Causative Organism
1		
2		
3		
4		
5		
6		
7		
8		

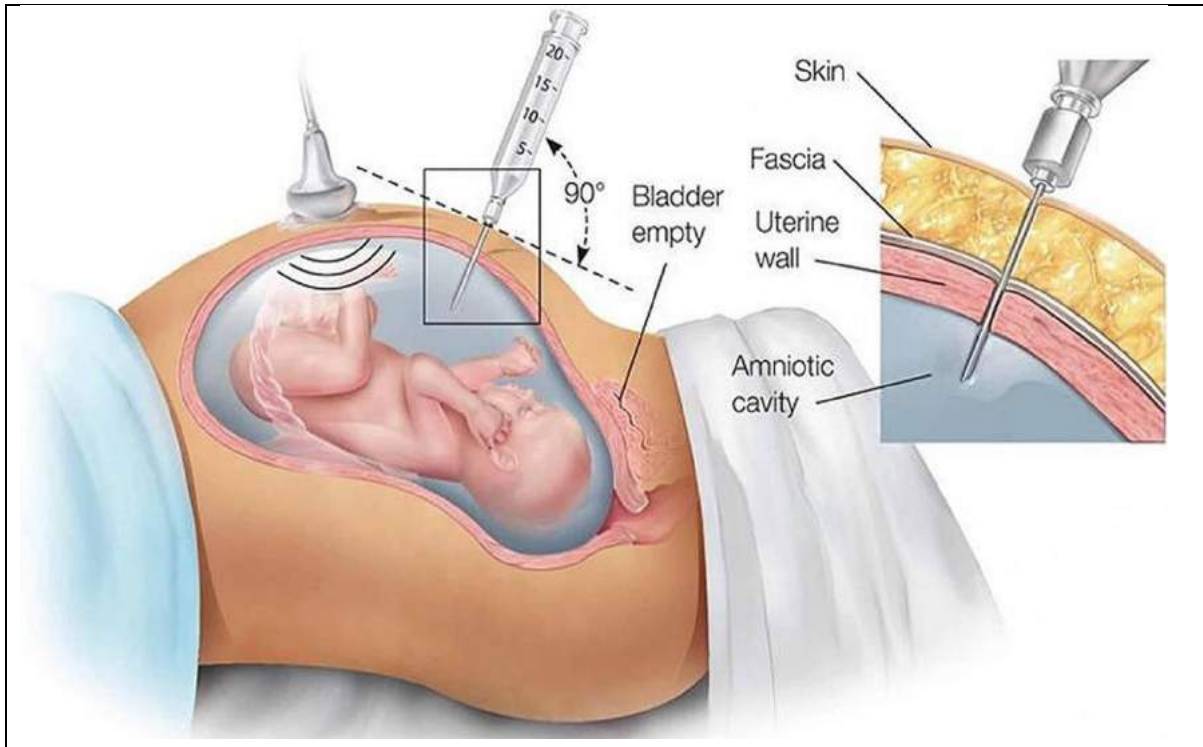
5. Name the category of contraception and describe briefly

Sl. NO.	Type of Contraception	Category of Contraception	Brief Note
1.	Periodic Abstinence	Example: Natural	
2.	Diaphragms		
3.	Lactational Amenorrhea		
4.	LNG-20		
5.	SAHELI		
6.	Spermicidal Creams		
7.	Cu – T		
8.	DMPA		
9.	Skin patches		
10.	Vaginal Rings		
11.	Coitus Interruption		
12.	Cervical Caps		
13.	Multi Load – 375		
14.	Implant		

6. Identify, label and describe the diagram

<p>Ovary Uterus Cervix Oral contraceptives Barrier devices Intrauterine devices GONDOM</p>	
<p>Types of clamping and IUDs</p>	
<p>Before After</p>	

7. Observe and add brief note on Amniocentesis



8. Observe and Add brief note on Assisted Reproductive Techniques

<p>In Vitro Fertilization (IVF)</p> <p>The diagram illustrates the IVF process. It starts with 'Egg pick up (aspiration)' where an egg is retrieved. Simultaneously, 'Washed sperms' are prepared. These are combined in a petri dish to show 'Embryo Development' through stages of 2 cells, 4 cells, and 8 cells. Finally, an 'Embryo Transfer' is performed using a 'Cannula' to place the embryo into the uterus.</p>	
<p>ZIFT</p> <p>This diagram shows 'IVF zygotes placed into the oviduct'. The zygotes are shown being introduced into the fallopian tube near the 'ovary'. Below the main diagram, there are smaller images showing the 'Zygote Intrafallopian Transfer' process at different stages: 2-cell stage, 4-cell stage, 8-cell stage, and morula stage.</p>	
<p>GIFT</p> <p>The diagram depicts 'Sperm and eggs are placed into a fallopian tube.' It shows a cross-section of the female reproductive system with a cannula inserted into the fallopian tube to deliver the gametes.</p>	
<p>ICSI</p> <p>The diagram outlines the six steps of the ICSI procedure: 1. Ovarian Stimulation (using a syringe), 2. Egg Retrieval (from a woman), 3. Sperm Preparation (from a man), 4. Fertilization (using a microscope), 5. Embryo Transfer (into the uterus), and 6. Cryopreservation (of the left embryos) (using a storage container).</p>	

9. Fill in the blanks

1	Embryo with 8 blastomeres formed due to in-vitro fertilization is transferred into---
2	----- is the detection of genetical disorders by taking amniotic fluid.
3	----- programmes created awareness among people about various reproduction related aspects
4	The technique used for determination of sex and condition of the foetus is known as --- -----
5	The apparent failure of a couple to conceive is known as -----
6	Syphillis is caused by -----
7	In ----- pregnancies implantation of embryo at site other than uterus
8	Administration of progesterone, progesterone-oestrogen combination and IUD are effective within----- hours
9	Days of periodic abstinence are -----
10	----- IUD increases the phagocytosis of the sperms within the uterus.
11	The method commonly used by Indian women for controlling the child birth is -----
12	The tying of oviducts of female is known as -----
13	A women who substitutes or takes the responsibility of the real mother to nurse the embryo in her uterus is called as -----
14	----- babies can be produced in surrogate mothers also.
15	The term----- is used for the women with no children.
16	The government of India enacted the----- Act, 1994 with stringent punishment rules.
17	Spermicidal Jellies and foams are -----type of contraceptives.
18	10 th to the 17 th day of the menstruation cycle is----- period.
19	Lippe's Loop is ----- kind of IUD.
20	Progestasert is a -----releasing IUD.
21	Skin patches release estrogen and progesterone into -----to prevent pregnancy.
22	Surgical procedure to prevent pregnancy is also known as -----
23	----- is sterilization procedure in males.
24	Tubectomy is the removal of small part of the -----in women sterilization process.
25	Vasectomy is the removal of small part of the -----in men sterilization process.
26	----- is carefully extracted from womb during amniocentesis for prenatal diagnosis of suspected genetic disorders.
27	----- abnormalities are detected by amniocentesis.
28	----- method is popularly known as Test Tube baby procedure.
29	In ----- technique semen is collected from husband/healthy donor and is introduced into the uterus for achieving fertilization.
30	The direct injection of sperm into the ovum with the help of microscopic needle to form an embryo in the laboratory is called as -----

10. Answer “TRUE” or “FALSE”

Sl. No.	Statement	True/ False
1.	Family Planning Programs were initiated as far back as in 1951.	
2.	Programs covering wider reproduction-related areas are currently in operation under the name Reproductive and Child Healthcare (RCH) Programs.	
3.	Female feticide (the act of aborting a female fetus) is a minor social problem in India	
4.	Sex determination of the fetus first became possible in India with the advent of amniocentesis in 1950s	
5.	As early as in 1976 the Government banned the use of amniocentesis tests for the purpose of sex determination of the foetus.	
6.	In 1947 3D ultra sound scanning technique was invented for detecting developmental abnormalities in fetuses.	
7.	As a measure to legally check increasing female feticides, the Government of India enacted the Pre-natal Diagnostic Techniques (Regulation and prevention of misuse) Act. 1994 with stringent punishment rules.	
8.	Diseases or infections which are transmitted through sexual contact (intercourse) are collectively called viral diseases	
9.	Persons in’ the age group of 15—24 years are more vulnerable to contract STDs.	
10.	Statutory raise of marriageable age of the females to 15 and that of males to 18 years and providing incentives to couples with smaller families Government to tackle this problem.	
11.	The intentional prevention of conception (fertilization of an egg by at the beginning of pregnancy) by natural or artificial means is called contraception.	
12.	Contraceptives do not prevent pregnancy by interfering with the normal process of Ovulation, fertilization and implantation.	
13.	An ideal contraceptive should have the following qualities. i) user friendly ii) easily available. iii) effective and reversible with no or less side and iv) do not affect the sexual life of the user.	
14.	Periodic abstinence: In this method couples avoid or abstain from coitus from the 13 to the 15 th day of the menstrual cycle	
15.	Withdrawal or Coitus interruptus means the male partner withdraws his penis from the vagina, just before ‘ejaculation ‘. so as to “avoid insemination.	
16.	Ovulation generally will not occur during the period of intense lactation by the mother following parturition	
17.	Condoms are used to cover the penis in the male and cervix (neck of the uterus) or vagina in the female to prevent ejaculated semen from entering into the uterus of the female	
18.	Nirodh is an easily Wearable popular brand of condoms for males. widely used in India	
19.	IUDs’ promote ‘phagocytosis’ of sperms by white blood corpuscles within	

	the uterus and the iron ions released suppress the motility, viability and fertilizing capacity of the spermatozoa	
20.	Oral administration of small doses of testosterone or testosterone-estrogen in the form of tablets or pills is another popular contraceptive method used by females	
21.	The contraceptive Pill inhibits ovulation, implantation and also alters the quality of cervical mucous and retards entry of sperms.	
22.	A Once a week pill by name Saheli developed by CSIR, DELHI is a non-steroidal oral contraceptive preparation with very few side effects and high contraceptive value.	
23.	An injection of depot medroxy progesterone acetate (DMPA) provides protection against pregnancy for one year	
24.	A small part of the Vas efferens on either side is removed or tied up through a small incision on the scrotum is called vasectomy.	
25.	A small part of the fallopian tube on both sides is removal or tied up through a small incision made in the abdomen or fallopian tubes through vagina is called tubectomy.	
26.	Intentional or voluntary termination of pregnancy before the full term of gestation is called Medical termination of pregnancy (MTP).	
27.	Amniocentesis is a diagnostic procedure to detect sex of the unborn baby.	
28.	The most common abnormalities that can be detected by amnio centesis are Down syndrome, Edwards syndrome and Turners Syndrome.	
29.	Infertility is biological inability of a person to contribute to conception.	
30.	Fertilization of ovum by sperm done inside the body of a woman is called in vitro fertilization	
31.	In Zygote Intra Fallopian Tube the ovum is extracted and fertilized in vitro (outside the body) and the zygote transferred to the woman's uterus to complete its further course of development	
32.	In GIFT an ovum collected from a donor is transferred to the fallopian tube of the recipient woman for fertilization	
33.	In Intra Cytoplasmic Sperm Injection (ICSI), a sperm is directly injected into the uterus with the help of a microscopic needle to form an embryo in the laboratory	
34.	In AI technique, semen is collected from the husband /healthy donor and is introduced into the uterus (Intrauterine insemination- IUI) for achieving fertilization	
35.	In surrogacy the ovum of the wife/donor and the sperm of the husband/male donor are fertilized and the zygote is transferred into the womb of a surrogate mother	
36.	In vitro fertilization technique was first devised by Patrick Steptoe and Robert Edwards.	
37.	Trichomoniasis is caused by a bacterium.	
38.	Pills comes under natural method of birth control.	
39.	Pills are made up of hormones estrogen and progesterone.	
40.	GIFT stands for "Gamete Intra Fallopian Transfer".	

11. Multiple Choice Questions for Competitive exams

LEVEL - 1

<p>1. Which one of the following correctly matches a sexually transmitted disease(STD) with its pathogen ?</p> <p>(1) AIDS- Bacillus anthracis (2) Urethritis - Entamoeba gingivalis (3) Gonorrhoea- Neisseria gonorrhoeae (4) Syphilis-Treponema vaginalis</p>
<p>2. morning after pills can prevent pregnancy if taken within _____ hours</p> <p>a. 50 b. 60 c. 30 d. 72</p>
<p>3. Depo-Provera are</p> <p>(1) growth hormones (2) oestrogen derivative injections (3) progesterone-derivative injections (4) glucocorticoids</p>
<p>4. Which of the following is a sexually transmitted disease ?</p> <p>(1) genital herpes 2. syphilis (3) Gonorrhoea (4) (1),(2) & (3)</p>
<p>5. Syphilis is a</p> <p>(1) Bacterial disease (2) Venereal disease (3) STD (4) All of these</p>
<p>6. Gonorrhoea and syphilis are common in</p> <p>(1) African countries (2) European countries (3) All over the world (4) Asia countries</p>
<p>7. Chlamydia trachomatis causes</p> <p>(1) trachoma (2) sexually transmitted disease (3) peri-natal infection (4) all of the above</p>
<p>8. The first test tube baby Louise Joy Brown was borne in Oldham, England on.</p> <p>(1) Jan 2, 1976 (2) March 28, 1977 (3) July 25, 1978 (4) August 6, 1986</p>
<p>9. Which one of the following not is sexually transmitted disease/s ?</p> <p>(1) chancroid (2) genital herpes (3) Hepatitis-B (4) Leprosy</p>
<p>10. Genital warts STD is a viral disease and is caused by</p> <p>(1) Chlamydia trachomatis (2) Trichomonas vaginalis (3) Trepanema pallidum (4) Human palloma virus</p>
<p>11. Which STDs are not completely curable</p> <p>(1) chlamydiasis, gonorrhoea, trichomoniasis (2) chancroid, syphilis, genital warts (3) AIDS, syphilis, hepatitis B (4) AIDS, genital herpes and Hepatitis B.</p>
<p>12. Which is not correct ?</p> <p>(1) Hormonal injections contain progestin a hormone, similar to progesterone (2) Permanent methods of birth control are vasectomy and tubectomy (3) i-pill, pill-72 and unwanted-72 are morning after pills (4) A spermicide nonoxynol -9 is less effective when used together with a barrier method of birth control</p>

13. The test which is misused for sex identification of an unborn baby is (1) clotting test (2) amniocentesis (3) erythroblastosis (4) angiogram										
14. The hormone releasing IUDs make the unstable for implantation. (1) fallopian tube (2) uterus (3) vagina 4. ovary										
15. Combined pills contain synthetic... check ovulation (1) LH and progesterone (2) FSH and oestrogen (3) progesterone and estrogen (4) LH and FSH										
16. Saheli an oral contraceptive for female contains a non-steroidal preparation called (1) interferon 2. centochroman 3. DMPA 4. Mala-D										
17. Which of the following is/are called morning after pills (1) i-pill (2) Pill-72 (3) unwanted 72 (4) all of these										
18. A permanent method of birth control is (1) vasectomy in males (2) tubal ligation in females (3) both (1)&(2) (4) none of these										
19. July 11 is (1) World Environment Day (2) World Population Day (3) World AIDS Day (4) World Education Day										
20. The fusion of ovum and sperm is done out- side the body of woman to form zygote. The zygote is allowed to divide forming 8 blastomeres. The early embryo with not more than 8 blastomeres is transferred into the (1) Uterus 2. Fallopian tube 3. cervix (4) Vagina										
LEVEL - 2										
21. Study the following question, choose the correct option <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Column-1</td> <td style="text-align: center;">Column-2</td> </tr> <tr> <td>A. Nirodh</td> <td>1. condom</td> </tr> <tr> <td>B. femidome</td> <td>2. Polyurethane foam</td> </tr> <tr> <td>C. spermicide</td> <td>3. Delfin foam</td> </tr> <tr> <td>D. Vaginal sponge</td> <td>4. Vaginal pouch</td> </tr> </table> (A). A=4,B=1, C=3,D=2 (b) A=1,B=4, C=,3 D=2 (c) A=2,B=3,C=1,D=4 (d) A=2,B=1,C=4,D=3	Column-1	Column-2	A. Nirodh	1. condom	B. femidome	2. Polyurethane foam	C. spermicide	3. Delfin foam	D. Vaginal sponge	4. Vaginal pouch
Column-1	Column-2									
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B. femidome	2. Polyurethane foam									
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D. Vaginal sponge	4. Vaginal pouch									
22. Study the following question, choose the correct Option <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Coloumn-I</td> <td style="text-align: center;">Coloumn-II</td> </tr> <tr> <td>A. Lippes loop</td> <td>1. Medicated IUDs</td> </tr> <tr> <td>B. Multi load-375</td> <td>2. Hormone releasing IUDs</td> </tr> <tr> <td>C. LNG-20</td> <td>3. Combined pill</td> </tr> <tr> <td>D. Mala-D</td> <td>4. non medicated IUDs</td> </tr> </table> (a) A=3,B=4,C=2,D=1 (b) A=4,B=3, C=2,D=1 (c) A=4,B=1,C=2,D=3 (d) A=3,B=1, C=2 ,D=4.	Coloumn-I	Coloumn-II	A. Lippes loop	1. Medicated IUDs	B. Multi load-375	2. Hormone releasing IUDs	C. LNG-20	3. Combined pill	D. Mala-D	4. non medicated IUDs
Coloumn-I	Coloumn-II									
A. Lippes loop	1. Medicated IUDs									
B. Multi load-375	2. Hormone releasing IUDs									
C. LNG-20	3. Combined pill									
D. Mala-D	4. non medicated IUDs									
23. Study the following question, choose the correctoption <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Column-I</td> <td style="text-align: center;">Column-II</td> </tr> <tr> <td>A. Mala-D</td> <td>1. Once in a week</td> </tr> <tr> <td>B. sahel</td> <td>2. daily without break</td> </tr> <tr> <td>C. Depo-provera</td> <td>3. With in 72 hours</td> </tr> <tr> <td>D. Pill-72</td> <td>4. Every 3 months</td> </tr> </table> (a) A=2,B=1,C=4,D=3 (b) A=3,B=2,C=1,D=4. (c) A=2,B=3, C=2,D=4 (d) A=4,B=3,C=1,D=2.	Column-I	Column-II	A. Mala-D	1. Once in a week	B. sahel	2. daily without break	C. Depo-provera	3. With in 72 hours	D. Pill-72	4. Every 3 months
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A. Mala-D	1. Once in a week									
B. sahel	2. daily without break									
C. Depo-provera	3. With in 72 hours									
D. Pill-72	4. Every 3 months									

<p>24. Study the following question, choose the correct option</p> <p>Column-I</p> <p>A. tubectomy B. vasectomy C. MTP D. STD</p> <p>(A) A=4 B=2 C=1 D: 3 (C) A=2 B=4 C=3 D: 1</p>	<p>Column-II</p> <p>1. Abortion,12 weeks 2. ELISA 3. Blocking the sperms 4. Cutting of oviduct</p> <p>(B) A=3 B= 2 C=1 D=4 (D) A=3 B=4 C=1 D=2</p>										
<p>25. Match the items given in column I with those in column II and select the correct option given below</p> <table border="0"> <tr> <td style="text-align: center;">Column-I</td> <td style="text-align: center;">Column I</td> </tr> <tr> <td>A. syphilis</td> <td>(i) Haemophilus ducreyi</td> </tr> <tr> <td>B. gonorrhoea</td> <td>(ii) trachomatis</td> </tr> <tr> <td>C. chancroid</td> <td>(iii) Trepanema</td> </tr> <tr> <td>D. chlamydiasis</td> <td>(iv) Neisseria</td> </tr> </table> <p>(a) A=4 B=2 C=1 D: 3 (c) A=2 B=4 C=3 D: 1</p> <p>(b) A=3 B= 2 C=1 D=4 (d) A=3 B=4 C=1 D=2</p>		Column-I	Column I	A. syphilis	(i) Haemophilus ducreyi	B. gonorrhoea	(ii) trachomatis	C. chancroid	(iii) Trepanema	D. chlamydiasis	(iv) Neisseria
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D. chlamydiasis	(iv) Neisseria										
<p>26. Match the items given in column I with those in column II and select the correct option given below</p> <table border="0"> <tr> <td style="text-align: center;">Column-I</td> <td style="text-align: center;">Column I</td> </tr> <tr> <td>A. AIDS</td> <td>(i) HBV</td> </tr> <tr> <td>B. hepatitis-B</td> <td>(ii) HIV</td> </tr> <tr> <td>C. genital herpis</td> <td>(iii) HSV</td> </tr> <tr> <td>D. genital warts</td> <td>(iv) HPV</td> </tr> </table> <p>(A) A=4 B=2 C=1 D: 3 (c) A=2 B=1 C=3 D: 4</p> <p>(B) A=3 B= 2 C=1 D=4 (D) A=3 B=4 C=1 D=2</p>		Column-I	Column I	A. AIDS	(i) HBV	B. hepatitis-B	(ii) HIV	C. genital herpis	(iii) HSV	D. genital warts	(iv) HPV
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A. AIDS	(i) HBV										
B. hepatitis-B	(ii) HIV										
C. genital herpis	(iii) HSV										
D. genital warts	(iv) HPV										
<p>27. Match column I with column II and select the correct option using the codes givenbelow</p> <table border="0"> <tr> <td style="text-align: center;">Column I.</td> <td style="text-align: center;">Column IIA.</td> </tr> <tr> <td>A. oligo spermia</td> <td>(i) absence of living sperms</td> </tr> <tr> <td>B. azo spermia</td> <td>(ii) less sperm count</td> </tr> <tr> <td>C. ADAM(androgen deficiency)</td> <td>(iii) inability of an erection of penis</td> </tr> <tr> <td>D. impotence</td> <td>(iv) male menopause</td> </tr> </table> <p>(A) A=4 B=2 C=1 D: 3 (B) A=3 B= 2 C=1 D=4 (C) A=2 B=1 C=4 D: 3 (D) A=3 B=4 C=1 D=2</p>		Column I.	Column IIA.	A. oligo spermia	(i) absence of living sperms	B. azo spermia	(ii) less sperm count	C. ADAM(androgen deficiency)	(iii) inability of an erection of penis	D. impotence	(iv) male menopause
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C. ADAM(androgen deficiency)	(iii) inability of an erection of penis										
D. impotence	(iv) male menopause										
<p>28. Match column I with column II and select the correct option using the codes given below:</p> <table border="0"> <tr> <td style="text-align: center;">Column I.</td> <td style="text-align: center;">Column IIA.</td> </tr> <tr> <td>A. IVF</td> <td>(i) . fertilization out side the body of women</td> </tr> <tr> <td>B. ZIFT</td> <td>(ii) . male and female gametes into fallopian tube</td> </tr> <tr> <td>C. GIFT</td> <td>(iii) .sperm directly injected into the ovum</td> </tr> <tr> <td>D. ICSI</td> <td>(iv) .zygote transferred to fallopian tube</td> </tr> </table> <p>a) A=1,B=4 C=2 D: 3 (b) A=3 B= 2 C=1 D=4 (c) A=2 B=1 C=4 D: 3 (d) A=3 B=4 C=1 D=2</p>		Column I.	Column IIA.	A. IVF	(i) . fertilization out side the body of women	B. ZIFT	(ii) . male and female gametes into fallopian tube	C. GIFT	(iii) .sperm directly injected into the ovum	D. ICSI	(iv) .zygote transferred to fallopian tube
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B. ZIFT	(ii) . male and female gametes into fallopian tube										
C. GIFT	(iii) .sperm directly injected into the ovum										
D. ICSI	(iv) .zygote transferred to fallopian tube										

LEVEL – 3

29. The population limited to a particular geo-graphic area is called as (1) pandemic(2) endemic (3) alien (4) natural
30. Copper releasing IUD is (1) Diaphragm (2) Multiload 375 (3) LNG – 20 (4) Saheli
31. In which of the following ART techniques the semen is artificially introduced into the fe-male (1) ET (2) GIFT (3) IUT (4) IUI
32. Artificial insemination means(neet-2013) (1) artificial introduction of sperms of a healthy donor into the vagina (2) introduction of sperms of a healthy do-nor directly into the ovary. (3) transfer of sperms of a healthy donor to a test tube containing ova (4) transfer of sperms of husband to a test-tube containing ova
33. Which one of the following is not the function of placenta? It .(NEET 2013) (1)Facilitates removal of carbon dioxide and waste material from embryo. (2)Secretes oxytocin during parturition. (3)Facilitates supply of oxygen and nutri-ents to embryo. (4)Secretes estrogen
34. Which of the following cannot be detected in a developing foetus by amniocentesis? (NEET 2013) (1) Down syndrome (2)Jaundice (3)Klinefelter syndrome (4)Sex of the foetus
35. One of the legal methods of birth control (NEET2013) (1) by having coitus at the time of day break (2)by a premature ejaculation during coitus (3)abortion by taking an appropriate medicine (4)by abstaining from coitus from day of the menstrual cycle
36. Assisted reproductive technology, IVF involves transfer of (1)Embryo with 16 blastomeres into the fallopian tube (2)Ovum into the fallopian tube. (3)Zygote into the fallopian tube (4) zygote into the uterus
37. The main function of mammalian corpus lu-teum is to produce (1)relaxin only (2)estrogen only (3)progesterone (4)human chorionic gonadotropin (AIPMT 2014)
38. Tubectomy is a method of sterilization in which (1)Uterus is removed surgically (2)Small part of the fallopian tube is re-moved or tied up. (3)Ovaries are removed surgically (4)Small part of vas deferens is removed or tied up(AIPMT 2014)
39. Which of the following is a hormone releasing intra Uterine Device (IUD)? (1) Vault (3) LNG-20 (2) Multiload 375 (4) Cervical cap
40 In-context of Amniocentesis, which of the following statements is incorrect? (1)it is used for prenatal sex determination (2)It can be used tor detection of Down syndrome (3)It can be used for detection of Cleft palate (4)It is usually done when a woman is between 14-16 weeks pregnant.

41. Which of the following is hormone IUD? (1) LNG-20 (2) Multiload 375 (4) Cu7 (3) Lippes loop (NEET-2-2016)															
42. Which of the following is incorrect regarding vasectomy? 1) No sperm occurs in seminal fluid 2) No sperm occurs in epididymis 3) Vasa deferentia is cut and tied 4) Irreversible sterility (NEET-2-2016)															
43. The function of copper ions in copper releasing IUD's is . (NEET 2017) (1) They suppress sperm motility and fertilizing capacity of sperms (2) They inhibit gametogenesis (3) They make uterus unsuitable for implantation (4) They inhibit ovulation															
44. Condom is a safe guard against infections of 1. AIDS 2. Gonorrhoea 3. Syphilis 4. All of these															
45. The main reasons of male infertility are 1. Disorders of spermatogenesis 2. Obstruction of the efferent ducts 3. Disorders of sperm motility 4. All the above															
45. Medical termination of pregnancy is permitted up to (CBSE-AIPMT 2010) 1. First trimester 2. Second Trimester 3. Third Trimester 4. Both (1) and (2)															
46. The birth control method which involve avoiding the sexual intercourse around the time of ovulation is known as 1. Rhythm method 2. Hormonal Method 3. Sterilization method 4. None of these															
47. Intra uterine devices are mainly made of 1. Copper 2. Silver 3. Plastic 4. Both (1) and (3)															
48. Menstruation irregularities lead to 1. Polycystic ovary 2. Monocystic ovary 3. Syphilis 4. Both (1) and (2)															
49. Which one of the following matches a sexually Transmitted Disease (STD) with its pathogen <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>Column – 1</th> <th>Column – 2</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>AIDS</td> <td>Bascillus anthracis</td> </tr> <tr> <td>2</td> <td>Syphilis</td> <td>Treponema pallidium</td> </tr> <tr> <td>3</td> <td>Urethsisitis</td> <td>Entamoeba gingivalis</td> </tr> <tr> <td>4</td> <td>Gonorrhoea</td> <td>Leishmania donovani</td> </tr> </tbody> </table>		Column – 1	Column – 2	1	AIDS	Bascillus anthracis	2	Syphilis	Treponema pallidium	3	Urethsisitis	Entamoeba gingivalis	4	Gonorrhoea	Leishmania donovani
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2	Syphilis	Treponema pallidium													
3	Urethsisitis	Entamoeba gingivalis													
4	Gonorrhoea	Leishmania donovani													
50. The fertilization takes place out side the body in 1. In-vitro Fertillization 2. Gamete Intra Fallopian Transfer 3. Zygote Intra Fallopian Transfer 4. All of the above															

12.Assertion & Reasoning Questions

	Instructions; (a) If both (A) and (R) are true and (R) is the correct explanation of (A) (b) If both (A) and (R) are true but (R) is not the correct explanation of (A) (c) If (A) is true, but (R) is false; (d) If (A) and (R) are false.
1.	(A) Reproductive health is a state of complete well being individuals in physical, functional, emotional, behavioural and social aspects of reproductive system (R) This statement about reproductive health was given by Ministry of Health and family welfare of India.
2.	(A) Reproductive and Child Health care Programme is for reproduction related areas. (R) It deals with creating awareness among various psychological related aspects.
3.	(A) Amniocentesis is often misused. (R) Amniocentesis is meant for determining the sex of the foetus so that female foetus may be aborted, but it is being used to determine the genetic disorders in the foetus.
4.	(A) Reusable contraceptives are not fair safe methods of contraception's. (R) Nirodh, condoms and diaphragms are barrier methods which prevent conceptions by blocking entry of sperms through cervix. They are reusable.
5.	(A) There is chance of fertilization during 10-17 days of menstrual cycle. (R) Ovulation occurs during these days.
6.	(A) Barrier methods prevent physical meeting of sperm and ova. (R) This does not prevent conception.
7.	(A) Sterilization is a surgical method of contraception. (R) It blocks gamete transport and thereby prevents conception.
8.	(A) STDs are transmitted through sexual intercourse. (R) STDs can be prevented by using barrier contraceptives like condom.
9.	(A) In zygote intra Fallopian transfer the zygote is transferred to the Fallopian tubes of the female (R) ZIFT is ART(assisted reproductive technology) method.
10.	(A) Artificial insemination is method of introduction of semen outside of the body of a female. (R) This technique is used in those cases where males have high sperm count.
11.	(A) Mother can pass on Syphilis bacteria to their developing foetus. (R) Placenta in the later part of pregnancy becomes permeable to some pathogens.
12.	(A) In humans' father is responsible for the sex of the child. (R) Father has Y - Chromosome.
13.	(A) ELISA is used to detect AIDS infection. (R) HIV is a viral disease.
14.	(A) over population has become a serious problem in the developing countries. (R) It may exhaust natural resources, cause unemployment and lead to pollution.
15.	(A) Zero population growth should be achieved as early as possible to control human population. (R) This requires not two children per couple but a little more.

13. Assignment Questions to answer

VSAQ**	1	What are the measures one has to take to prevent contracting sexually Transmitted Diseases (STDs)?
*	2	It is true that “MTP is not meant for population control”. Then why did the government of India legalize MTP ?
***	3	What is “Aminiocentesis”? Name any two disorders that can be detected by amniocentesis.
**	4	Mention the advantages of “Lactational Amenorrhea method”.
SAQ**	1	Briefly describe the common sexually transmitted diseases in human beings.
**	2	Describe the surgical methods of Contraception.
***	3	Write short notes on : 1. IVF; 2. ICSI ; 3. IUDs
*	4	Is sex education necessary in schools? Why?

14. Hands on Experiences for you – Try It!!!

1. Know your better action – One

How Well Does Birth Control Work?

<div style="display: flex; align-items: center; justify-content: center;"> <div style="font-size: 2em; margin-right: 5px;">↑</div> <div style="text-align: left; font-size: 0.8em;"> <p>Most Effective</p> <p>Less Effective</p> </div> </div>	 Sterilization	 Implant	 IUD	99% effective	
	 Shot	 Pill	 Ring	 Patch	92–97% effective depending on the method
	 Diaphragm	 Condoms (Internal/External)	 Sponge	 Cervical Cap	78–82% effective depending on the method
	 Spermicide	 Fertility Awareness	Withdrawal		71–76% effective depending on the method

2. Know your hazardous habit – Two

PRODUCTIVE HAZARDS OF SMOKING

Reproductive health problems

<p>Man</p> <ul style="list-style-type: none"> • Sexual potency decreases • Fertility is impaired • Sperm count decreases • Sperm movements decreases • Abnormal forms of sperm increases 	<p>Woman</p> <ul style="list-style-type: none"> • Egg production (oogenesis) decreases • Implantation failure increase • Early pregnancy losses (miscarriage) increase • Small-for-date babies increase • Premature/pre-term labour increase
--	--

3. Know that your motherhood is at risk – Three

Couples exposed to air **pollution** presented decreased **fertility** indices, decreased pregnancy success and delayed onset of **reproductive** maturity, as evidenced by extended times to mating (Veras et al. 2009). In humans, air **pollution** exposures seemed to decrease conception rates (Dejmek et al. 1998).

Pregnant Women + Air Pollution Don't Mix

- 40% increase in Volume of air inhaled/exhaled per minute
- 20% increase in Oxygen consumption
- 50% increase in Cardiac output

Physical changes in pregnancy make women **more susceptible to pollutants**

4. Know that you are also responsible – Four

National Infertility Awareness Month

KNOW THE FACTS?

About **1 in 8** Couples have trouble getting pregnant

It is equally likely to be caused by **male and female** factor

- Female cases
- Male cases
- Combination or unexplained

Healthy living can **boost your fertility** potential

Its never too early to **talk to your doctor** about your fertility

info@indianmedtrip.com www.indianmedtrip.com +91-8600855554

5. Know that COVID-19 too has its hand – Five

- Women’s choices and rights to sexual and reproductive health care, however, should be respected regardless of COVID-19 status.

Is contraception/ family planning safe to use during the COVID-19 pandemic?

Yes. All modern methods of contraception are safe to use, including during the COVID-19 pandemic.

If you have had a baby in the last six months or have a health condition, such as diabetes, high blood pressure, or breast cancer – or if you smoke – seek advice from a health care professional to ensure you are using a method of contraception which is suitable and safe for you.

I want to avoid getting pregnant during the COVID-19 pandemic. What can I do?

If you do not want to become pregnant, you should start or continue to use your contraceptive method of choice. You may be able to access information and contraceptive services from a healthcare provider by phone or online.

If you cannot access these services you may opt for a method that is available without a prescription (such as condoms, spermicides, pills, or emergency contraceptive pills) from a nearby pharmacy or drug shop.

What is the best contraceptive method to use during the COVID-19 pandemic?

All modern methods of contraception help to prevent pregnancy. Women and their partners can choose any modern contraceptive method that is acceptable to and safe for them. The best method of contraception is the one that works well for you.

There is a wide variety of modern methods, one of which may suit you best.

Condoms, when they are used consistently and correctly, are the only method of contraception that help to prevent unintended pregnancy and protect against sexually transmitted infections, including HIV. They can be used together with other methods of contraception to protect against both unintended pregnancy and sexually transmitted infections.

Emergency contraceptive pills can prevent up to 95% of pregnancies when taken within 5 days after intercourse, and they can be taken by anyone with or without a health condition.

I want to remove or replace my implant or IUD – can I do this during COVID-19 pandemic?

Removal of long acting methods such as implants or IUDs, after the recommended period of use (and routine follow up appointments) may not be prioritized by your country’s health system during this health emergency. Seek advice from your health provider. If you are experiencing side effects or desire urgent removal for other reasons, contact a provider to find out what options suit you best, and which are available and feasible.

If, due to restrictions on movement due to the COVID-19 pandemic you cannot have your long acting method removed straight away, it is important to use another method of contraception to avoid pregnancy at this time.

There are no medical problems caused by delaying removal of long acting methods such as implants or IUDs. Do not try to remove the contraception method yourself; wait until you are able to access health care from a trained provider.

Why is providing contraception/ family planning, as well as family planning services and information, important during the COVID-19 pandemic?

Contraception and family planning information and services are life-saving and important at all times. Sexual activity does not cease with the COVID-19 pandemic, it is therefore crucial to ensure that people are able to access rights-based services and information to initiate and / or continue use of contraception.

By preventing unintended pregnancies, contraception helps to protect girls and women from the negative health consequences of unintended pregnancies, which can save their lives.

15. Medical and other careers related to Immune System

Embryologist: An embryologist is a fertility specialist that helps to create viable embryos to either be used in IVF right away or to be frozen for later use. Embryologists aren't MDs, but they are highly trained medical professionals, usually holding a Masters degree or a PhD due to the specialized nature of their work.

The most important activities that the embryologist does are as follows:

1. *Maintenance of the embryology lab*

The embryologist maintains laboratory conditions most conducive for embryos to flourish. Strict regulation of conditions such as temperature, air quality, and humidity are prerequisites of any good IVF laboratory.

2. *Egg retrieval*

During egg retrieval, fluid is removed from the ovaries. This fluid contains the eggs. The embryologist examines this fluid under a microscope, identifies, and collects the eggs.

3. *Checking for fertilization*

The day after the sperms and eggs are combined, the embryologist checks the eggs for fertilization (activation of oocyte) by examining each of them under the microscope.

4. *Incubation and monitoring*

The embryologist places the fertilized eggs inside an incubator regulated to control temperature and pH that mimics the condition of the uterus. These optimal conditions enable the fertilized egg to become an embryo. The embryologist periodically checks the embryos and replaces the culture media.

5. *Genetic Testing – (PGT-A, PGT-M & PGT-SR)*

Embryologists also perform embryo biopsy in order to screen embryos for chromosomal abnormalities. A biopsy can be performed on either Day 3 or Day 5 of

embryo development. Biopsy is done by removing a single cell on Day 3 or a few cells from the Trophectoderm on Day 5 from an embryo while minimizing the risk of damage to it. Most embryos with an abnormal number of chromosomes fail to implant or lead to miscarriages. Genetic testing greatly increases the chances of a healthy pregnancy.

6. Assisted hatching

Assisted hatching is recommended in a few cases where the outer shell of the embryo known as zona pellucida is thinned with the help of laser in order to facilitate implantation.

7. Embryo Transfer

Embryologists select the best quality embryos and load them into the transfer catheter. This is then carefully handed over to the fertility specialist to deposit the embryos safely into the uterus.

8. Cryopreservation

The embryologist is responsible for the cryopreservation of extra embryos during the IVF procedure. Any good quality embryos that are not transferred are identified and frozen for later use.

The know-how of an expert [embryologist](#) is critical for the success of IVF treatments. The skills mentioned here are complex, delicate, and require years of experience. A proficient [embryologist](#) could mean the difference between the success and the failure of the [infertility treatments](#).

16. Answers to the activities and note making

9. FILL IN THE BLANKS:

1	uterus	2.	amniocentesis	3	RCH	4	amniocentesis	5	Infertility
6	Trypanema pallidium	7	ectopic	8	72 hours	9	10-17days	10	Copper releasing & non medicated IUDs
11	Pills	12	Tubectomy	13	Surrogate mother	14	Test tube	15	Nulliparas
16	Pre Natal Diagnostic Techniques	17	Barrier	18	fertile	19	Non-medicated	20	Hormone
21	Blood stream	22	Sterilization	23	Vasectomy	24	Fallopian tube	25	Vas deferens
26	Amniotic fluid	27	Downs /Edwards / Turner's syndromes	28	Intra Uterine Transfer/ Embryo Transfer	29	Artificial/Intra Uterine insemination	30	Intra cytoplasmic Sperm Injection

10. True or False statements:

Note: Correct Statements are given in the brackets.	
1	True
2.	True
3	False (major problem)
4	False (1970)
5	True
6	False (1987)
7	True
8	False (STDs)
9	True
10	False (18 to 21)
11	True
12	False (do prevent)
13	True
14	False (10-17 th day)
15	True
16	True
17	True
18	True
19	False (copper ions)
20	False (progestogen-progesteron-estrogen)
21	True
22	False (CDRI, LUCKNOW)
23	False (3 months)
24	False (vas defernse)
25	True
26	True
27	False (genetic disorders)
28	True
29	True
30	False (outside of the body)
31	False (women uterus)
32	True
33	False (ovum)
34	True
35	True
36	True
37	False
38	False
39	True
40	True

11. Multiple choice questions:

Que. No	Ans.	Explanation/Notes
LEVEL – 1		
1	3	
2	4	
3	3	
4	4	
5	4	
6	3	
7	4	
8	3	
9	4	
10	4	
11	4	
12	4	
13	2	
14	2	
15	3	
16	2	
17	4	
18	3	
19	2	
20	2	
LEVEL-2 MULTIPLE CHOICE		
21	B	
22	C	
23	A	
24	D	
25	D	

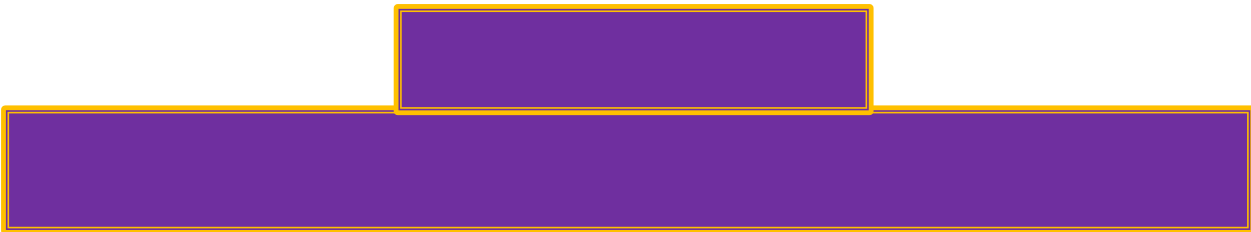
26	C	
27.	C	
28	A	

LEVEL – 3

29	2	
30	2	
31	4	
32	1	
33	2	
34	2	
35	4	
36	3	
37	3	
38	2	
39	3	
40	3	
41	1	
42	2	
43	1,3	
44	2	
45	4	
46	1	
47	4	
48	2	
49	2	
50	1	

Activity-12 - ASSERTION AND REASON QUESTIONS

1	2	3	4	5	6	7	8	9	10
C	C	C	C	A	C	A	A	A	D
11	12	13	14	15					
A	A	D	A	A					



MAJOR LEARNING OBJECTIVE

- *Students will be able to recognize, identify, understand, appreciate and apply the knowledge of the Genetics.*
- *Students will be able to understand the importance of knowledge of Genetics in designing a better society.*

LEARNING OUTCOMES:

- To create interest in students in Genetics as a science of heredity and variations.
- Students be able to know the key words and their description related to genetics
- Be able to understand multiple alleles and their inheritance patterns with the help of ABO blood groups.
- Be able to understand the mechanism of sex determination in various animals.
- Be able to distinguish between Sex linked inheritance, Sex limited inheritance and Sex-influenced inheritance and the reasons behind them.
- Be able to Understand the pedigree chart and identify the most likely mode of inheritance
- Be able to Interpret knowledge of genetics to explain reasons behind various disorders
- Be able to understand DNA fingerprinting protocol and its applications in medico legal cases and in forensic analysis.
- Be able to apply the Knowledge of genetics to understand different concepts of genetics and interpreting them to solve the problems in competitive exams.

ADDITIONAL READING MATERIAL

- Introduction to Genetics * Some basic concepts of Genetics

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book
2. Defining key words
3. Expand the abbreviations
4. Names the scientists as per their contributions
5. Fill up the table related to sex determination in Drosophila
6. Observe the following table and write your conclusions about blood group transfusion.
7. Identify, label and describe the diagram
8. Observe the following picture and fill up the blanks with suitable Karyotypes.
9. Identify and describe the Genetic disorders
10. Mention the Karyotype of the genetic disorders
11. Give Pedigree Chart of your Family
12. Make note on Human Genome Project
13. Interpret DNA Finger Printing from the diagram and Explain the Advantages:
14. Crossword puzzle
15. Pedigree based questions
16. Fill in the blanks
17. Answer “TRUE” or “FALSE”
18. Multiple Choice Questions for Competitive exams
19. Assignment Questions to answer
20. Hands on Experiences for you – Try It!!!
21. Medical and other careers related to Immune System
22. Answers to the activities and note making

INSTRUCTIONS TO LECTURER (Same as in Previous Chapters)

INSTRUCTIONS TO STUDENTS(Same as in Previous Chapters)

ADDITIONAL READING MATERIAL

1. INTRODUCTION TO GENETICS:

LIKE BEGETS LIKE is a common phrase and an important universal phenomenon of life which means that a strong similarity exists between the offspring and the parents. This is due to inheritance. The science that deals with heredity and variations is called GENETICS. Heredity is the study of transmission of characters from one generation to the next. Variations are the differences in characteristics shown by the individuals of a species and also by the offsprings of the same parents. Humans knew from early as 8000 - 1000 BC that one of the causes of variations was hidden in sexual reproduction. 5000-6000 BC there is archeological evidence that documents domestication of animals and cultivation of plants. Hindu's observed that certain diseases 'ran in the family' this led to the belief that children inherited all their parent traits. In fact the law of Manu says that a man of base descents can never escape his origins. Hippocrates thought that male semen carries the hereditary material and there was a similar fluid in females. Aristotle thought that only the male was responsible for contributing to heredity. The female's contribution was just to provide the raw material.

However the modern science of Genetics only began with the work of Gregor Mendel in the 19th century. Mendel conducted Monohybrid cross and Dihybrid cross in the Garden pea plant, *Pisum sativum* and observed that organisms inherit traits via distinct units of inheritance, which are now called genes. Chromosomal Theory of inheritance by Sutton and Boveri is a fundamental unifying theory of genetics which states that the chromosomes are the carriers of the genetic material. Experimental verification of Chromosomal theory of inheritance by Thomas Hunt Morgan in the fruit fly *Drosophila melanogaster* led to discovering the basis for variations in sexually reproducing organisms. Today humans have come to know of the **genetic roots** of various diseases which are evading cure. The Human Genome Project unveils the truth behind 22 autosomes and 1 pair of allosomes (X and Y chromosomes). Fruitful research is going on in the field of Gene therapy (replacing defective genes with healthy genes). Improving the human race by the application of the laws of Genetics is called **Eugenics**. The symptomatic treatment of genetic diseases in man is called **Euphenics**. This chapter includes Multiple alleles and Human blood groups, sex determination, Sex-linked inheritance, genetic disorders, Human Genome Project and DNA fingerprinting.

Why is the study of genetics important and interesting?

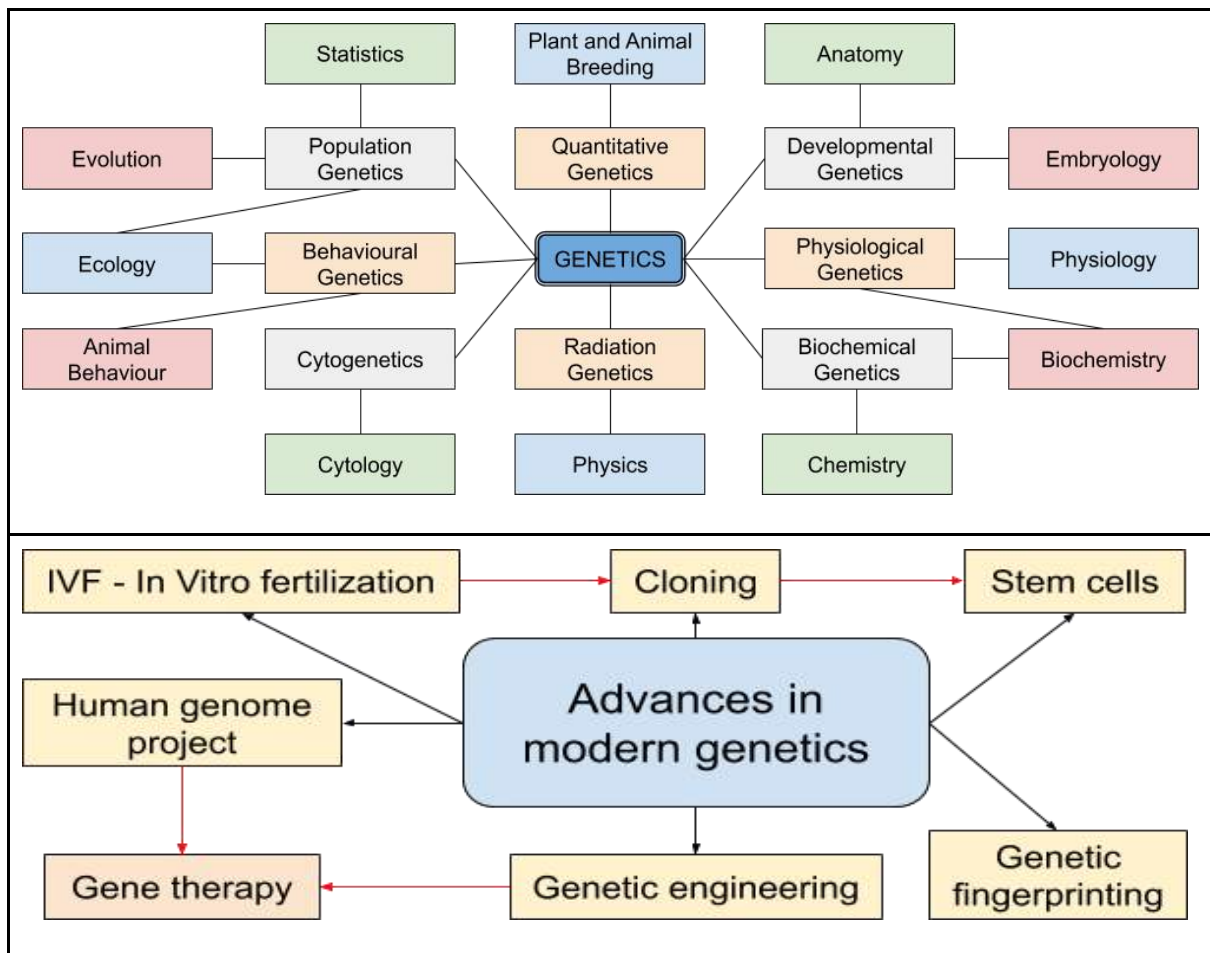
1. Transmission of genetic information serves as a link between generations in every species
2. Genetics is central to human affairs (food, health).
3. Genetic information is the basis for every process and structure in an organism.
4. Learning genetics can help you to understand your own health and make healthy choices.
5. Learning about your family health history can provide a lot of useful information.
You may notice that a certain disease is prevalent in your family, and this pattern may

point to genes as the cause. This information can help you learn about health risks in your family, The more you know, the easier it is to make the right decisions.

Why is genetics education so important?

Geneticist using all the technological advancements of different fields had reached the nucleotide sequence of the, many, genomes. However, the four letter language of DNA is still a puzzle for scientist working all over the world. In the entire genome, approximately 25,000 genes are identified by human genome project; how such a limited number of genes can make such a complex organism is still an enigma.

Moreover, the concept of gene, fundamental to genetics, is changing from Gregor Mendel's factors which encodes single trait to Down syndrome cell adhesion molecule (DSCAM) gene which encodes 38,016 isoforms. With all scientific advancements till now, we lack an exact definition for gene. Therefore, we need a new breed of geneticist who can think and imagine beyond the existing boundaries. The best source of this pool is undergraduate students enrolled in genetics across the world. In conclusion, genetics at undergraduate level is important as well as necessity for human's bright future in coming generations.



SOME BASIC CONCEPTS OF GENETICS

Gene: The fundamental unit of heredity. A segment of DNA that carries genetic information

Gene Locus: The location of a particular gene on a given chromosome is called gene locus.

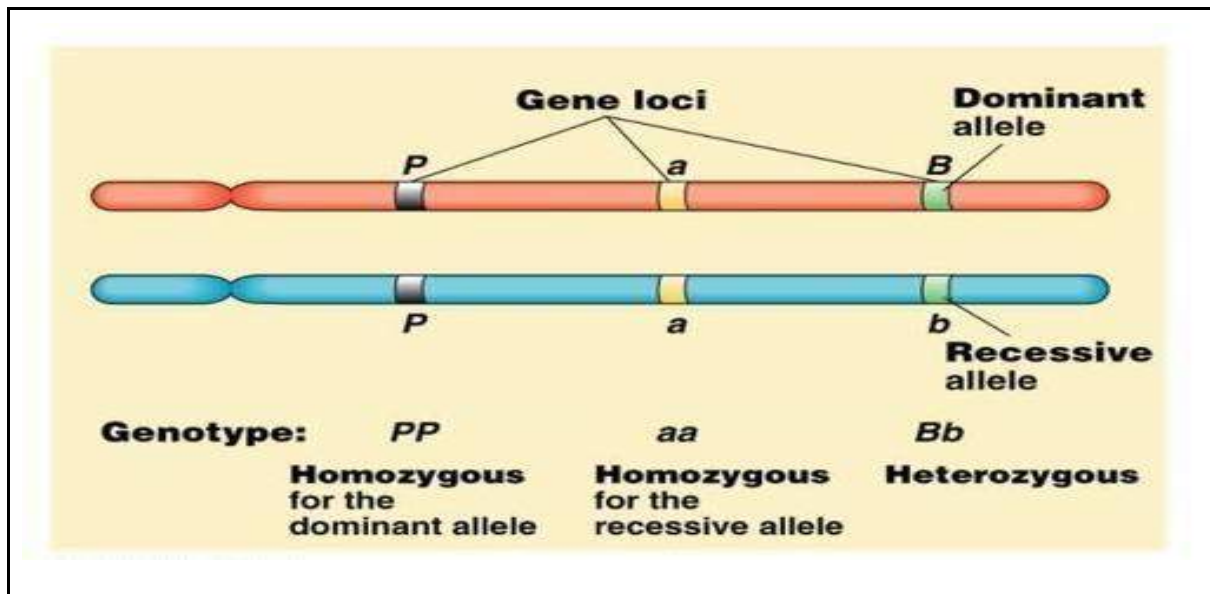
Alleles: The two alternative forms of a gene are called alleles.

Homozygous: It is the condition in which both the alleles are identical for a particular character .

Heterozygous: It is the condition in which both the alleles are different for a particular character.

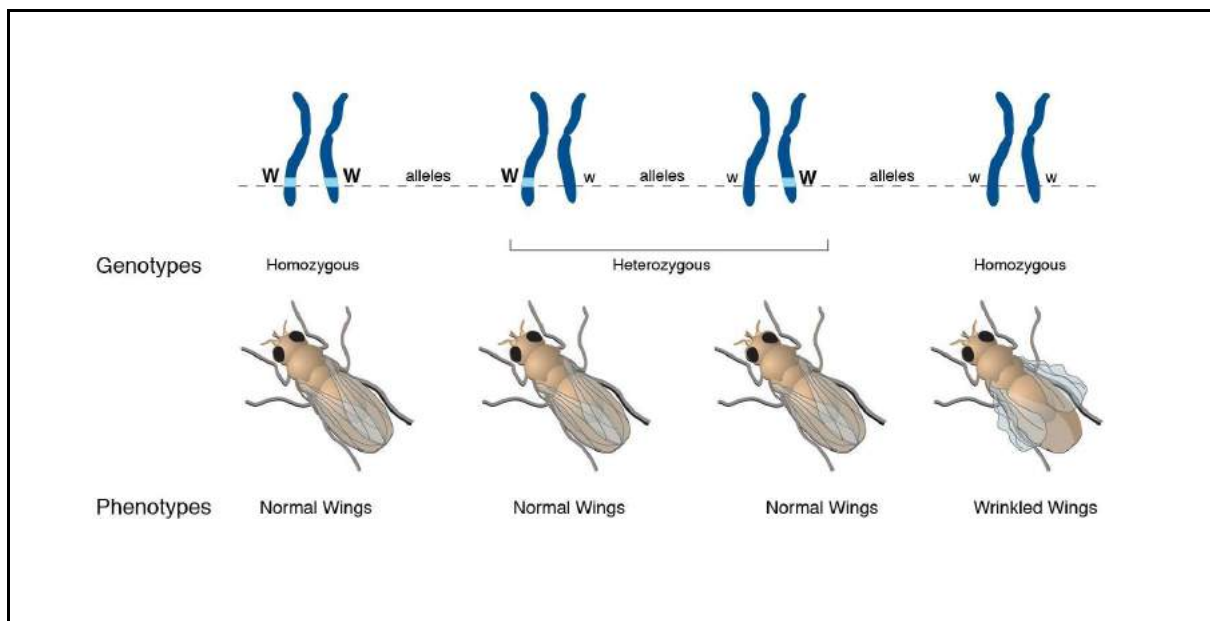
Dominant allele: It is out of a pair of alleles which is fully expressed either in heterozygous or homozygous form.

Recessive allele: It Is one out of a pair of alleles which is not expressed in heterozygous form and it is masked.

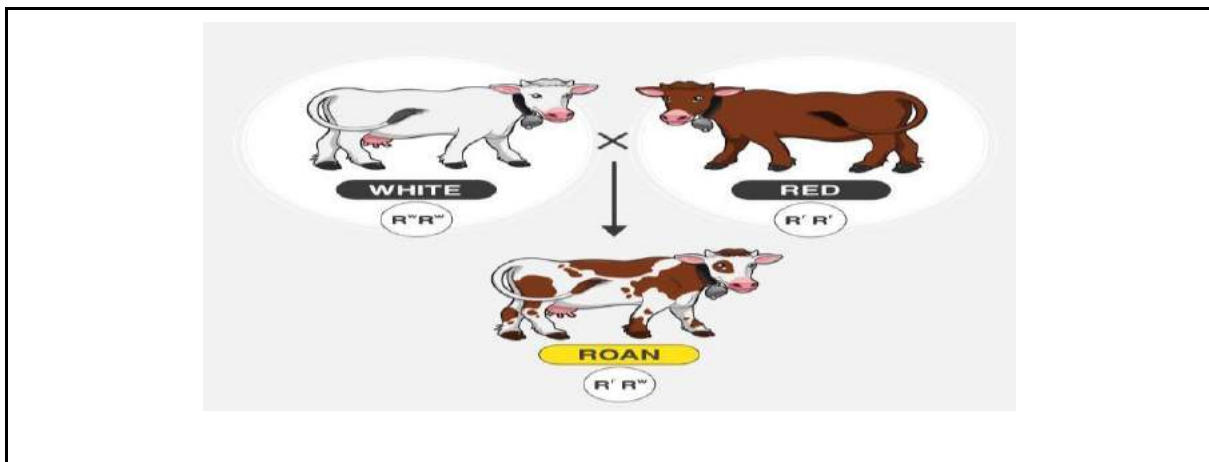


Genotype: The genetic constitution of an organism not visible from outside in an organism.

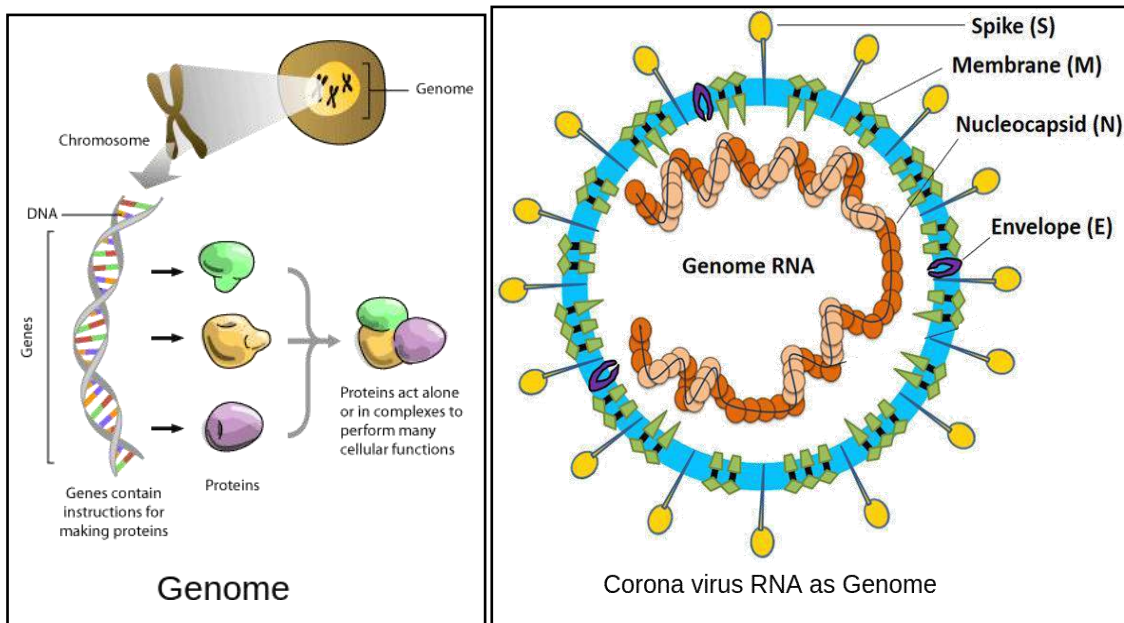
Phenotype: The characters which are visible from outside in an organism.



Codominance: The equal expression of both the alleles in heterozygous state is called codominance. As a result, the phenotype of the offspring is a combination of the phenotype of the parent.



Genome: The complete set of Deoxyribonucleic acid (DNA) in an Organism (Ribonucleic acid (RNA) as in CORONAVIRUS)



ACTIVITIES

1. Locate and rewrite the difficult key words from the text book

1.	11.
2.	12.
3.	13.
4.	14.
5.	15.
6.	16.
7.	17.
8.	18.
9.	19.
10.	20.

2. Defining key words

Term	Definition
1. Gene	
2. locus	
3. Allele	
4. Homozygous	
5. Heterozygous	
6. Dominant character	
7. Recessive character	
8. Test cross	
9. Back cross	
10. Pleiotropy	

11. Multiple alleles	
12. Codominance	
13. Polygenic inheritance	
14. Allosomes	
15. Autosomes	
16. Sex-linked genes	
17. Sex –Limited genes	
18. Sex-Influenced genes	
19. Genome	
20. Point Mutation	

3. Expand the abbreviations

PKU	
N-1 Rule	
DMD	
SCD	
HBA1 & HBA2	
CML	
HGP	
BAC	
RFLPs	
ESTs	
YAC	
VNTRs	
PCR	

4. Names the scientists as per their contributions

Contribution to Genetics	Name of the scientist
1.Chromosomal theory of inheritance	
2.Linkage and Inheritance	
3.ABO blood group system	
4.Rh-antigen	
5.Genic Balance theory	
6.x-Inactivation	
7.Phenylketonuria	
8.Automated DNA sequencers	
9.DNA fingerprinting	
10. X-Body	

5. Fill up the table related to sex determination in Drosophila

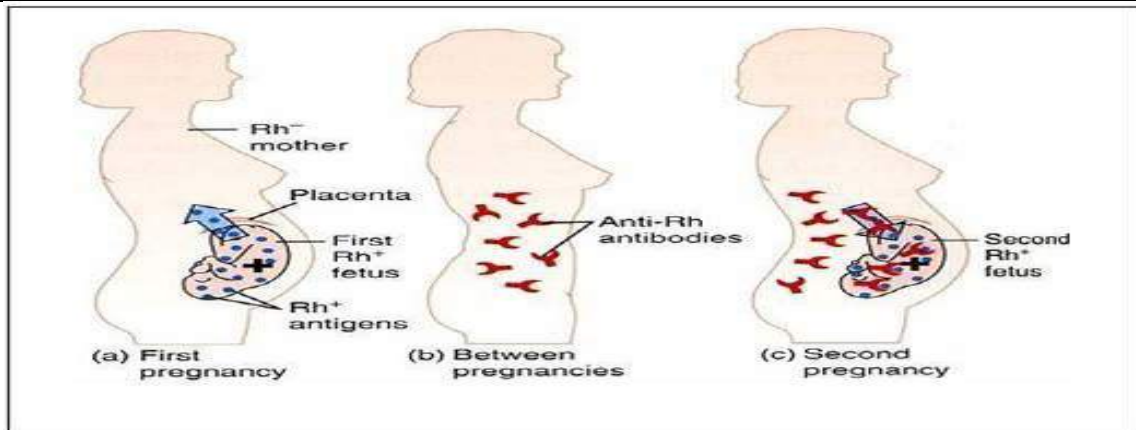
S.No	Number of X-chromosomes	Number of sets of autosomes	X/A ratio	Sex of the individual
1	3	2		
2	4	3		
3	4	4		
4	3	3		
5	1	3		
6	2	3		
7	1	2		
8	2	1		
9	1	2		
10	2	4		

6. Observe the following table and write your conclusions about blood group transfusion.

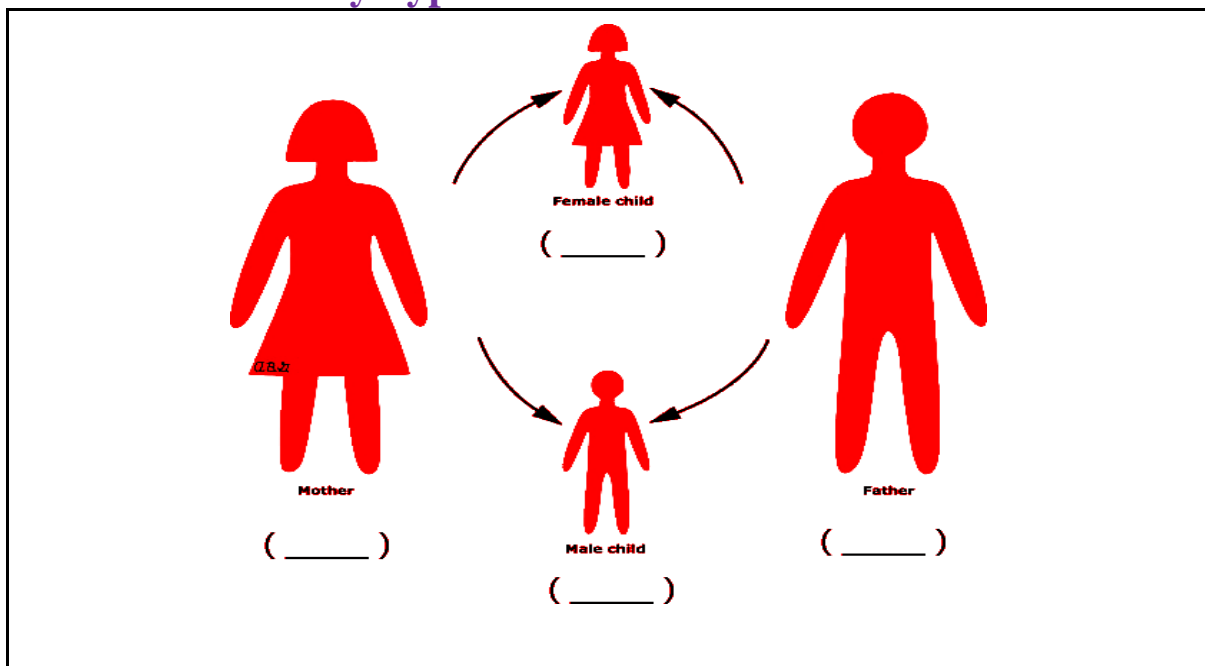
BLOOD GROUP COMPATIBILITY TABLE								
Recipient	Donor							
	O-	O+	A-	A+	B-	B+	AB-	AB+
O-	✓	✗	✗	✗	✗	✗	✗	✗
O+	✓	✓	✗	✗	✗	✗	✗	✗
A-	✓	✗	✓	✗	✗	✗	✗	✗
A+	✓	✓	✓	✓	✗	✗	✗	✗
B-	✓	✗	✗	✗	✓	✗	✗	✗
B+	✓	✓	✗	✗	✓	✓	✗	✗
AB-	✓	✗	✓	✗	✓	✗	✓	✗
AB+	✓	✓	✓	✓	✓	✓	✓	✓

7. Identify, label and describe the diagram

1. Title:



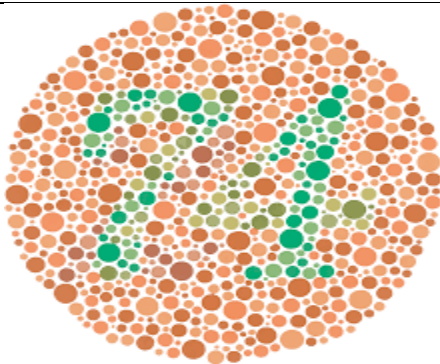
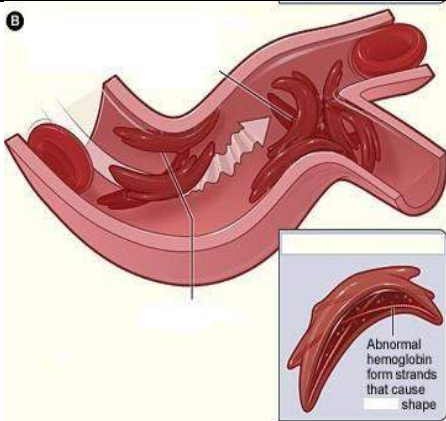
8. Observe the following picture and fill up the blanks with suitable Karyotypes.



9. Identify and describe the Genetic disorders



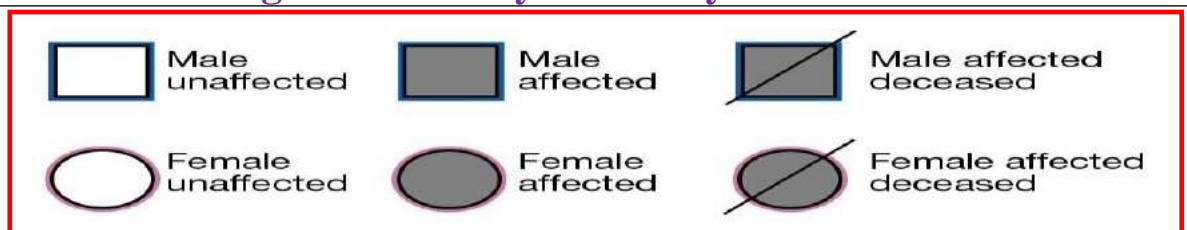
Boy with PKU



10. Mention the Karyotype of the following genetic disorders

1. Phenylketonuria	
2. Cystic Fibrosis	
3. Klinefelter syndrome	
4. Turner's Syndrome	
5. Down Syndrome	
6. Edward's Syndrome	
7. Patau Syndrome	
8. Cri-du-Chat Syndrome	
9. Chronic Myelogenous Leukemia	
10. Duchenne Muscular Dystrophy	

11. Give Pedigree Chart of your family:



12. Make note on Human Genome Project

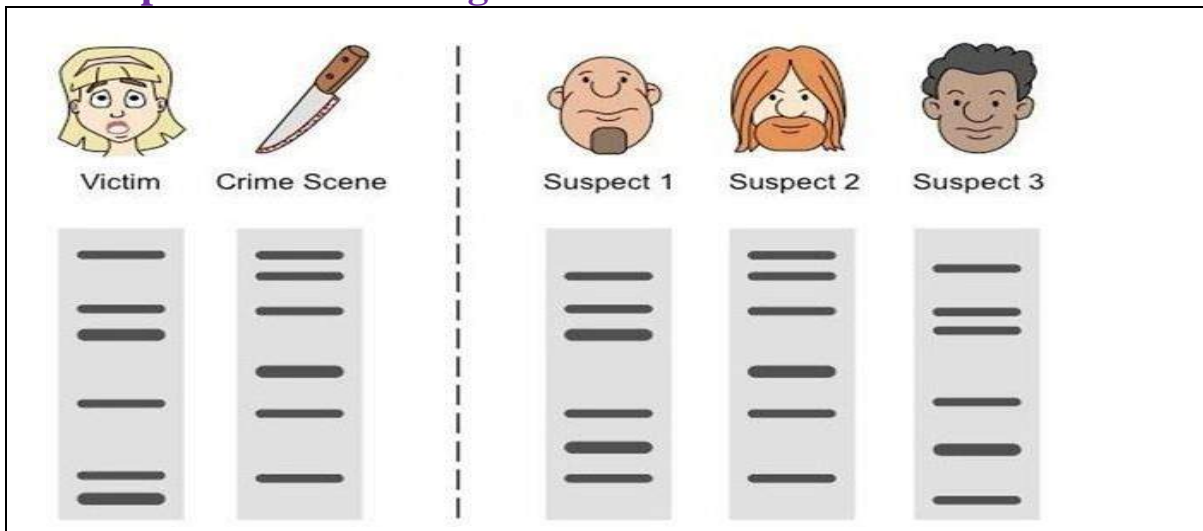
Define HGP:

Goals Of HGP:

Salient Features of HGP:

Advantages of HGP:

13. Interpret DNA Finger Printing from the diagram and Explain the Advantages



Interpretation:

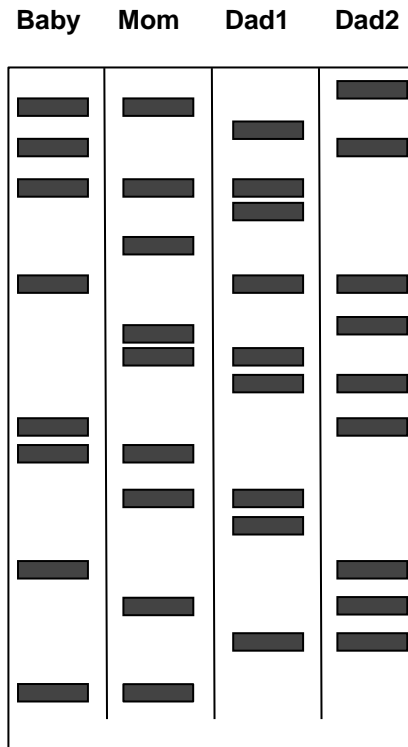
Applications of DNA Finger Printing:

1. Mrs. Jeevitha has a baby named Saira . She believes one of two men can be the father of her child. A paternity test is done and the results are shown below.

Which of the 2 men is baby Saira’s father?

a) Dad1

b) Dad2



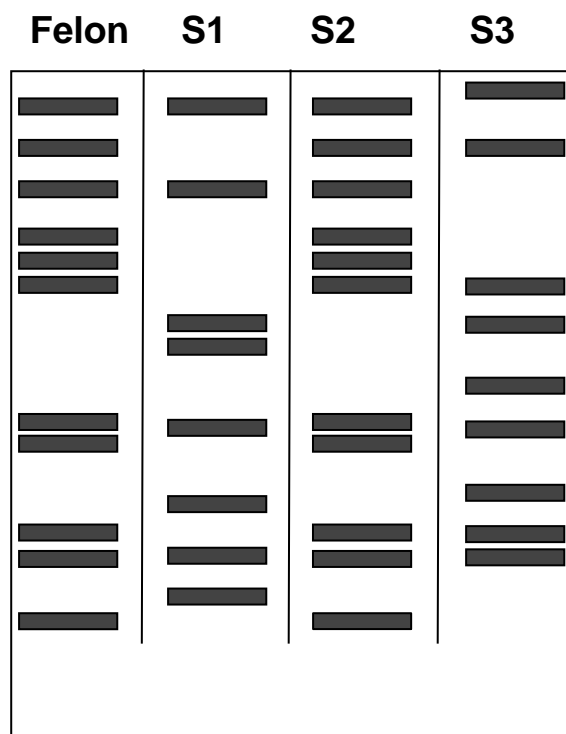
2. Mr. Rama is investigating a murder scene. The felon was scratched by his victim & some of his skin cells were found under the victim’s fingernails. A DNA test was performed.

Which of the suspects is the murderer?

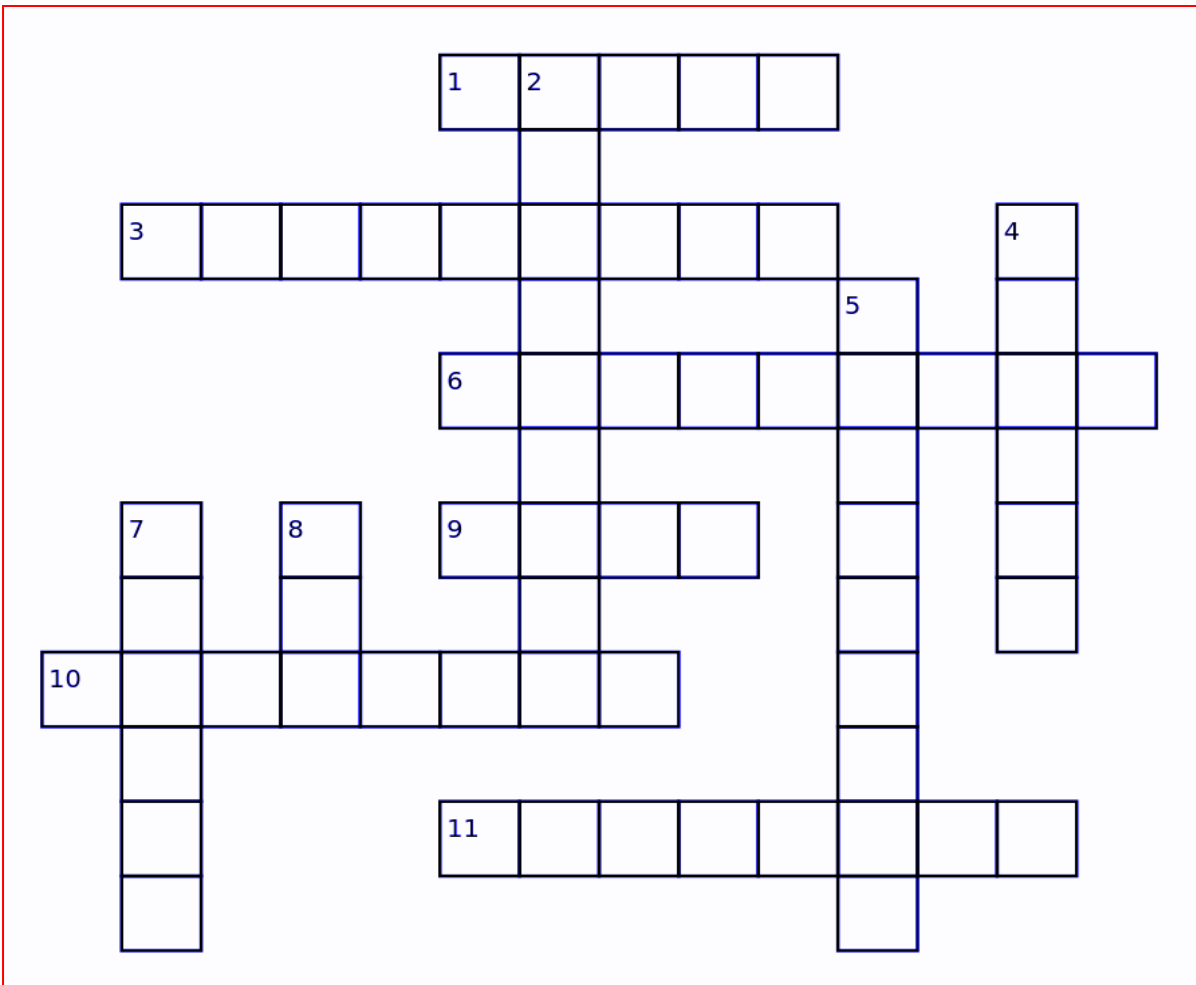
a) S1

b) S2

c) S3



14. Crossword puzzle



Down:

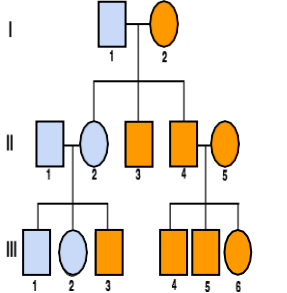
2. In DNA fingerprinting the first step is
4. In X-linked inheritance the affected F1 sons get their recessive alleles from the
5. Chromosomes responsible for sex determination are called
7. In sickle cell anaemia the glutamic acid is replaced by
8. Restriction endonucleases _____ the DNA

Across:

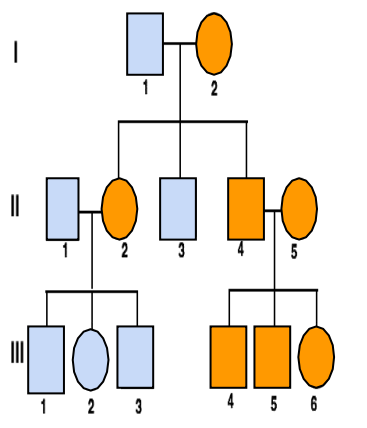
1. ZW-ZZ type of sex determination is observed in
3. Chromosomes other than sex chromosomes are called
6. Very high degree of DNA polymorphism is shown by _____ DNA
9. VNTR belongs to which class of satellite DNA
10. Transferring of DNA fragments to synthetic membranes like nylon or nitrocellulose is called
11. The blotting technique used for DNA fingerprinting is

15. Pedigree based questions:

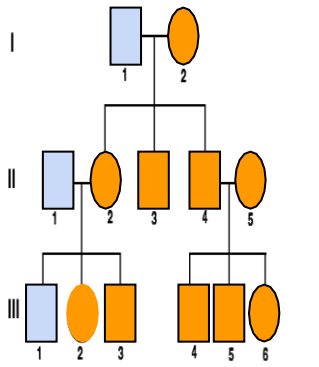
1. The pedigree below tracks Duchenne Muscular Dystrophy (DMD) through several generations. DMD is an X-linked recessive trait.

	<p>a. If individual II-3 has a child with a carrier woman, what is the percent chance that the child will be a daughter with DMD? A) 0% B) 25% C) 50% D) 100%</p> <p>b. In the above pedigree what is the genotype of individual II-2? A) X^dX^d B) X^dY C) X^DX^d D) X^DX^D</p> <p>c. If individuals I-1 and I-2 had another son, what is the chance that he would have DMD? A) 0% B) 25% C) 50% D) 100%</p>
---	---

2. The pedigree below tracks the presence of attached earlobes through a family's generation. Having attached earlobes is an autosomal recessive trait.

	<p>a. What is the genotype of the individual II-3? A) EE B) X^EY C) ee D) Ee E) X^eY</p> <p>b. If individual III-6 married a man who was homozygous for unattached earlobes, what is most likely to be true regarding their children? A) All of their children would have attached earlobes. B) All the female children will have unattached earlobes, and all the male children will have attached earlobes. C) All of their children would have unattached earlobes. D) The children would all have partially attached earlobes.</p> <p>c. If individuals I-1 and I-2 had a fourth child, what is the chance that the child would have attached earlobes? A) 0% B) 50% C) 75% D) 100%</p>
--	--

3. The pedigree below tracks the presence of dimples through a family's generation. Having dimples is an autosomal dominant trait.

	<p>a. Which of the following individuals is correctly matched with its genotype? (A) II-2 -> DD (B) I-1 -> Dd (C) II-3 -> dd (D) III-2 -> Dd</p> <p>b. In the above pedigree, if an individual III-3 married a woman who was heterozygous for dimples, what is the percent chance their children will have dimples? A) 0% B) 25% C) 75% D) 100%</p> <p>c. If individuals II-1 and II-2 have a fourth child, what is the probability that the child will have dimples? A) 0% B) 50% C) 75% D) 100%</p>
---	---

4. Observe the pedigree chart

	<p>Which one is correct regarding the above pedigree chart</p> <p>A) It is autosomal recessive trait B) It is autosomal dominant trait C) It is a sex linked recessive trait D) It is a sex linked dominant trait</p>
--	--

5. Observe the following pedigree chart

	<p>The above chart shows the inheritance pattern of the following disease</p> <p>A) Haemophilia B) Color Blindness C) Sickle Cell anaemia D) Duchenne muscular dystrophy</p>
--	---

6. In the following human pedigree the filled symbols represent the affected individuals. Identify the type of given pedigree

	<p>A) X – linked dominant B) Autosomal dominant C) Autosomal recessive D) X – linked recessive</p>
--	---

7. In the below human pedigree, the filled symbols represent the affected individuals. Identify the type of give pedigree

	<p>A) X –linked dominant trait B) X- linked recessive trait C) Y – linked trait D) Autosomal recessive</p>
--	---

8. Study the pedigree chart given below what does it show

	<p>A) The pedigree chart is wrong as this not possible B) Inheritance of a recessive sex – linked disease like haemophilia C) Inheritance of a sex – linked inborn error of metabolism like phenyl ketonuria D) Inheritance of a condition like phenylketonuria as an autosomal recessive treat</p>
--	--

16. Fill in the blanks

1. The study of heredity and hereditary variations in living organisms is known as _____.
2. The word genetics is derived from _____ word genesis.
3. Genesis means _____
4. The term Genetics was coined by _____.
5. The study of transmission of characters from one generation to the next generation is _____
6. The characters that are passed from one generation to the other generation are called as _____
7. The differences in characteristics shown by the individuals of a species and also by the progeny of the same parents are called _____
8. Humans knew from as early as _____ - _____ BC that one of the causes of variations was hidden in _____ reproduction.
9. Sahiwal cows of Punjab are developed due to artificial _____ and _____ of ancestral wild cows.
10. Female fruit flies have a pair of homologous x- chromosomes and males have one X- chromosome and one _____.
11. Morgan conducted _____ crosses in *Drosophila* to study the independent inheritance of two pairs of contrasting characters.
12. Morgan wanted to know the _____ and _____ of the body colour and wing size in *Drosophila*
13. Chromosomal theory of inheritance is also known as _____ theory
14. Multiple effects of a single gene is called _____
15. The most widely cited example for pleiotropy is _____.
16. Phenylketonuria is caused due to the deficiency of the enzyme _____.
17. Phenylalanine is converted into tyrosine by the enzyme _____
18. Generally a gene has two alternative forms called as _____.
19. Father of modern genetics is _____

20. DNA fingerprinting is perfected by _____
21. The commonly used hosts for DNA sequencing are _____ and _____
22. The largest known human gene that codes for the protein called _____
23. _____ has become the major partner of HGP apart from Japan, China, France, Germany and others.
24. The short 22nd chromosome is called _____ chromosome.
25. The Philadelphia chromosome results in the production of abnormal enzyme called _____

17. Answer “TRUE” or “FALSE”

Statement	True /False
1.Heredity is the study transmission of characters from one generation to the next.	
2.Multiple alleles are not observed in a population.	
3.Antigen A and antigen B are polypeptides	
4.Skin colour is a quantitative character and is not affected by the environmental factors.	
5.Female lizard is heterogametic	
6.The cheek cells of female human beings consist of two active X-chromosomes.	
7.Males always inherit the X-linked recessive traits from the female parents.	
8.Homologous segments of X and Y chromosomes are called Pseudo autosomal regions	
9.Haemophilia A is due to lack of clotting factor Thromboplastin.	
10.The human genome consists of 3164.7 million base sequences.	

18. Multiple Choice Questions for Competitive exams

<u>LEVEL 1</u>	
1.	The equal expression of both parental allelic characters in F ₁ generation is called as
	1) Incomplete dominance 2) Codominance 3) Epistasis 4) Pleiotropy
2	The common example for codominance in man is the inheritance of following
	1) AB Blood group 2) A blood group 3) B blood group 4) O blood group
3	Codominance means
	1) F ₁ generation resembles neither of the parents 2) F ₁ resembles both parents 3) F ₁ resembles the male parents only 4) F ₁ resembles the female parents only
4	ABO blood groups are controlled by the gene
	1) ABO 2) I 3) Both 4) None
5	The plasma membrane of red blood cells has sugar polymers, controlled by the gene 'i'. This gene has how many alleles.
	1) Only one allele 2) Two alleles 3) Three alleles 4) Four alleles
6	Which among the following are co-dominants?
	1) I ^A I ^O 2) I ^A I ^A 3) I ^A I ^B 4) I ^B I ^B
7	In 'AB' blood group person the red blood cells possess
	1) Only A type of sugar 2) B type of sugar 3) Both A and B types of sugars 4) No Sugar polymer
8	In 'O' blood group person the RBC plasma membrane possess
	1) Only A type of sugar polymers 2) A and B types of sugar polymer 3) No sugar polymer 4) ABO Sugar polymers
9	The codominance is expressed only in

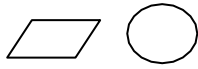








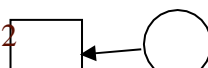
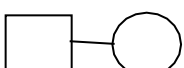

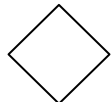

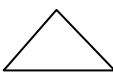

	1) Homozygous condition 3) Polyzygous condition	2) Heterozygous condition 4) Polygenic
10	In codominance phenotype and genotype ratios will be	
	1) Same	2) Half-genotype
	3) Different	4) Double of phenotype
11	There are three different alleles for 'ABO' blood groups. The possible number of genotypes is	
	1) 4	2) 5
	3) 6	4) 9
12	When a gene has more than two alleles they are called	
	1) Polygenes	2) Pleiotropic genes
	3) Epistatic genes	4) Multiple alleles
13	Multiple alleles are found only in	
	1) Individual studies	2) Population studies
	3) Phenotypic studies	4) Genotypic studies
14	ABO alleles are shown as $I^A=I^B>I^O$. In this type of relation	
	1) I^A is recessive	2) I^B is recessive
	3) I^O is recessive	4) I^O Dominant
15	Inheritance of skin colour in humans is an example of	
	1) Point mutation	2) Polygenic inheritance
	3) Codominance	4) Chromosomal aberration
16	Preliminary cytological experiments on sex determination was carried by	
	1) Morgan	2) Sutton and Boveri
	3) Henking	4)Collens
17	The name given by Henking to sex determining structure	
	1) X body	2) X Chromosome
	3) Y Chromosome	4) X-ray
18	Detection of hybridization DNA fragments is done by	

	1) Electrophoresis 2) Autoradiography 3) Blotting 4) Electrolysis
19	Labelled VNTR probes are used in DNA fingerprinting for
	1) Digestion of DNA 2) Isolation 3) Blotting 4) Hybridization
20	XX-XO type of sex determination is present in
	1) Grasshopper 2) Human beings 3) Drosophila 4) Birds
21	XX – XY type of sex determination is present in
	1) Grasshopper 2) Human beings 3) Drosophila 4) Both 2&3
22	ZO-ZZ type of sex determination is observed in
	1) Grasshopper 2) Butterfly 3) Drosophila 4) Birds
23	In DNA fingerprinting technique the DNA fragments are separated by
	1) Digestion 2) Electrophoresis 3) Electrolysis 4) Blotting
24	The number of chromosomes in human beings
	1) 23 2) 23pairs 3) 46pairs 4) 48
25	The number of X-chromosomes in human female is
	1) Two 2) Two pairs 3) Three pairs 4) 6
26	The number of autosomes in human sperm is
	1) 22 2) 22pairs 3) 2 4) 1
27	The number of autosomes in human egg
	1) 22 2) 21 3) 22pairs 4) 1
28	What is the probability of male & female child during each pregnancy in human beings?

	1) 100%	2) 50%	3) 75%	4) 45%
29	Which of the following conditions of the zygotic cell would lead to the birth of a normal human female child			
	1) Two X chromosomes	2) Only one Y chromosome	3) Only one X chromosome	
	3) Only one X chromosome		4) One X and Y chromosome	
30	Genetic disorders are grouped into two categories. They are			
	1) Nutritional disorders and chromosomal disorders			
	2) Morgan's disorders and chromosomal disorders			
	3) Mendelian disorders and chromosomal disorders			
	4) Cytological disorders and Mendelian disorders			
31	Alteration or mutation in the single gene leads to			
	1) Mendelian disorder		2) Chromosomal disorder	
	3) Dominant disorder		4) Recessive disorder	
32	Mendelian disorders are			
	1) Haemophilia and cystic fibrosis			
	2) Sickle cell anaemia and color blindness			
	3) Phenylketonuria and Thalassemia			
	4) All the above			
33	Which among the following is 'X' linked recessive trait			
	1) Sickle cell anaemia	2) Haemophilia	3) Phenylketonuria	4) 1 & 3
34	Which among the following is autosomes linked recessive trait			
	1) Sickle cell anaemia	2) Phenylketonuria	3) 1 & 2	4) Down's syndrome
35	Among the following which one is transmitted from carrier female to male progeny			
	1) Phenylketonuria	2) Sickle cell anaemia	3) Alkaptonuria	4) Haemophilia
36	The carrier female for haemophilia			

43	Sickle cell anaemia is due to point mutation. The substitution of single base at the sixth codon of the beta globin gene from _____ to _____ cause mutant haemoglobin molecule
	1) GUG to GAG 2) GAG to GUG 3) GCG to GTG 4)AUG to GUG
44	In sickle cell haemoglobin persons the shape of RBC changes from biconcave disc to elongated sickle like structure due to
	1) Polymerisation of haemoglobin under low O ₂ tension 2) Constriction of haemoglobin under high O ₂ tension 3) Polymerisation of haemoglobin under high O ₂ tension 4) Break down of hemoglobin under high O ₂ tension
45	Among the following which one is an inborn error of metabolism caused due to
	1) Haemophilia, X recessive gene 2) Down's syndrome trisomy of 21 3) Phenylketonuria, autosomal recessive gene 4) Turner's syndrome – absence of one X chromosome
46	Phenylketonuria affected person lack an enzyme, which converts
	1) Phenylalanine into pyruvic acid 2) Phenylalanine into tyrosine 3) Tyrosine into phenylalanine 4) Tyrosine into phenyl pyruvic acid
47	Accumulation of phenyl pyruvic acid in brain leads to
	1) Kidney disorders 2) Change in hair colour 3) Mental retardation 4) Hyper activity
48	Chromosomal disorders are caused due to
	1) Absence of a chromosome 2) Excess of chromosome 3) Abnormal arrangement of chromosome 4) All the above
49	Gain or loss of a chromosome is called
	1) Aneuploidy 2) Polyploidy 3) Diploid 4) Haploid

50	Identify the examples for Aneuploidy
	<ul style="list-style-type: none"> 1) Down's syndrome and phenylketonuria 2) Down's syndrome and Sickle cell anaemia 3) Down's syndrome and color blindness 4) Down's syndrome and Turner's syndrome
51	Failure to cytokinesis after telophase stage of cell division results in an increase in a whole set of chromosomes in an organism this is called
	<ul style="list-style-type: none"> 1) Aneuploidy 2) Polyploidy 3) Haploid 4) Diploid
52	Trisomy and monosomy are
	<ul style="list-style-type: none"> 1) Addition copy of chromosome and lack of any one pair of chromosome 2) Triploid condition and diploid condition 3) Addition of three chromosomes and deletion one chromosome 4) Triploid and haploid
53	Trisomy of 21 chromosome leads to
	<ul style="list-style-type: none"> 1) Down's syndrome 2) Edwards syndrome 3) Klinefelter's syndrome 4) Patau syndrome
54	Small round head, furrowed tongue and partially opened mouth is observed in
	<ul style="list-style-type: none"> 1) Turner's syndrome 2) Klinefelter's syndrome 3) Down's syndrome 4) Edwards syndrome
55	Which one is correct karyotype for klinefelter's syndrome is
	<ul style="list-style-type: none"> 1)47,XY 2)47,XXY 3)45,XY 4)46,XY
56	Gynecomastia is observed in
	<ul style="list-style-type: none"> 1) Klinefelter's syndrome 2) Turners syndrome 3) Phenylketonuria 4) Down's syndrome
57	Turner's syndrome persons are with
	<ul style="list-style-type: none"> 1) 45, XO 2) 46,XX 3) 47,XXY 4) 46,XY

58	Both klinefelter's and turner syndrome people are
	1) Fertile 2) Sterile 3) Can reproduce 4) Externally males
59	Pedigree analysis is
	1) Identification of genes in a population 2) Tracing the inheritance of a particular trait in the family tree over generations 3) Classification of animals and plants 4) Classification of genes over generations
60	Which one is useful as a 'strong tool' in human genetics to study the inheritance of a specific trait or abnormality or a disease
	1) Pedigree analysis 2) Mendel experiments 3) Morgan's experiments 4) Biotechnology
61	In pedigree chart the male and females are represented respectively
	1.  2.   
62	In a pedigree chart affected individuals are shown as
	1.    
63	In a pedigree chart mating is represented as
	1.  2.   4. 
64	In a pedigree chart sex unspecified is represented as
	1.  2.  3.  4. 

65	In a pedigree chart mating between relatives is represented as
	<p>1. 2. 3. 4. </p>
66	Human genome project was started in the year
	1) 1990 2) 1998 3) 2000 4) 2014
67	Human genome project lead to new branch of biology called
	1) Cytogenetics 2) Bioinformatics 3) Biotechnology 4) Eugenics
68	Approximately number of base pairs present in human genome
	1) 3×10^{10} 2) 3×10^9 3) 3×10^{11} 4) 30×10^9
69	The total estimated cost of the human genome project would be approximately
	1) 9 billion US dollars 2) 20 billion US dollars 3) 3.2 billion US dollars 4) 10 billion US dollars
70	The project was completed in the year
	1) 2014 2) 2016 3) 2004 4) 2003
71	Identify the non-human organism in which the DNA is sequenced
	1) Yeast & Bacteria 2) <i>Caenorhabditis elegans</i> 3) <i>Drosophila</i> 4) All the above
72	The plants in which the DNA is sequenced are
	1) Rice and Arabidopsis 2) Mango and Arabidopsis 3) <i>Clostridium</i> and Arabidopsis 4) Aloe Vera and Pea plant
73	<i>Caenorhabditis elegans</i> is a

	<ul style="list-style-type: none"> 1) A free living pathogenic nematode 2) A free living non-pathogenic nematode 3) Parasitic nematode 4) Earth worm
74	The method of approach that focused on identifying all the genes that are expressed as RNA is referred as
	<ul style="list-style-type: none"> <li style="width: 50%;">1) Sequence Annotation <li style="width: 50%;">2) Expressed RNA tags <li style="width: 50%;">3) Expressed sequence tags <li style="width: 50%;">4) Yeast artificial chromosome
75	he method of approach in which simply sequencing the whole set of genomes that contain coding and non coding regions and later assigning functions is called
	<ul style="list-style-type: none"> <li style="width: 50%;">1) Expressed sequence tags <li style="width: 50%;">2) Expressed RNA tags <li style="width: 50%;">3) Sequential fragmentation <li style="width: 50%;">4) Sequence Annotation
76	DNA cloning is done in
	<ul style="list-style-type: none"> <li style="width: 25%;">1) Vector <li style="width: 25%;">2) Host <li style="width: 25%;">3) Inducer <li style="width: 25%;">4) Regulator
77	The commonly used hosts for cloning
	<ul style="list-style-type: none"> <li style="width: 50%;">1) Bacteria & Drosophila <li style="width: 50%;">2) Bacteria & Yeast <li style="width: 50%;">3) Bacterial artificial Chromosome (BAC) <li style="width: 50%;">4) Yeast artificial chromosome (YAC)
78	The commonly used vector for cloning
	<ul style="list-style-type: none"> <li style="width: 50%;">1) Bacteria & Yeast <li style="width: 50%;">2) Arabidopsis <li style="width: 50%;">3) YAC & BAC <li style="width: 50%;">4) Drosophila & Caenorhabditis
79	In HGP the cloning of DNA resulted
	<ul style="list-style-type: none"> <li style="width: 50%;">1) The fragmentation of DNA <li style="width: 50%;">2) Amplification of DNA <li style="width: 50%;">3) Sequencing the DNA <li style="width: 50%;">4) Mutation of DNA
80	DNA sequencing by using automated DNA sequencers is a method development by
	<ul style="list-style-type: none"> <li style="width: 25%;">1) Frederick Wilson <li style="width: 25%;">2) Frederick Sanger <li style="width: 25%;">3) Ion Wilmot <li style="width: 25%;">4) Crick

81	Frederick Sanger, who developed ‘automated DNA sequencers also developed a method for the determination of			
	1) Sugar sequences in polysaccharides	2) Lipid sequences	3) Amino acid sequences in proteins	4) None of the above
82	Human genome contains			
	1) 3020.8 million nucleotides bases	2) 3014.7 million nucleotide bases	3) 3164.7 million nucleotide bases	4) 3000 million nucleotides
83	The average gene consist of			
	1) 3000 bases	2)4000 bases	3)30000 bases	4) 40000 bases
84	The largest human gene is			
	1) Dystrophin	2) Actin	3) Myosin	4) Globulin
85	Dystrophin consist of about			
	1) 3.4 million bases	2) 2.4 million bases	3) 3.5 million bases	4) 4.5 million bases
86	The chromosome that contain most genes			
	1) Chromosome2	2) Chromosome Y	3) Chromosome X	4) Chromosome 1
87	The number of genes are present in			
	1) 3400	2) 2968	3) 3500	4) 2800
88	Fewest number of genes are present in			
	1)X Chromosome	2)Chromosome–1	3)Chromosome 12	4)Chromosome–Y
89	How much percent of base sequence among humans is the same			
	1) 90%	2) 99%	3) 99.9%	4) 100

90	The very quick way to compare the DNA sequences of any two individuals
	1) Recombinant DNA Technology 2) DNA Fingerprinting 3) Polymerization 4) Pedigree analysis
91	DNA fingerprinting technique was initially developed by
	1) Jacob and Monod 2) Alec Jeffreys 3) E.M Southern 4) Western

LEVEL 2

1	ABO blood group system is an example of										
	1) Dominant – recessive relationship 2) Polygenes 3) Codominance 4) Codominant and dominant – recessive relationship										
2	Which is not related to codominance										
	1) F ₁ generation individuals resemble both the parents 2) Codominance express in heterozygous condition 3) Codominance express in homozygous condition 4) AB blood group is due to codominance										
3	Match the following correctly										
	<table style="width: 100%; border: none;"> <thead> <tr> <th style="text-align: left;">Genotype</th> <th style="text-align: left;">Phenotype</th> </tr> </thead> <tbody> <tr> <td>A. I^A i</td> <td>i) AB blood group</td> </tr> <tr> <td>B. I^B I^B</td> <td>ii) O blood group</td> </tr> <tr> <td>C. I^A I^B</td> <td>iii) B blood group</td> </tr> <tr> <td>D. ii</td> <td>iv) A blood group</td> </tr> </tbody> </table>	Genotype	Phenotype	A. I ^A i	i) AB blood group	B. I ^B I ^B	ii) O blood group	C. I ^A I ^B	iii) B blood group	D. ii	iv) A blood group
Genotype	Phenotype										
A. I ^A i	i) AB blood group										
B. I ^B I ^B	ii) O blood group										
C. I ^A I ^B	iii) B blood group										
D. ii	iv) A blood group										
	<p style="text-align: center;">a b c d</p> <p>1) iv ii i iii 2) iv iii I ii 3) iv ii I iii</p>										
4	Genetics of blood groups in human illustrates										
	1) Multiple allelism and codominance 2) Pseudoallelism and codominance										

	3) Incomplete dominance and codominance 4) Pleiotropy and polygenic inheritance
5	ABO blood groups in humans are controlled by gene I. It has three alleles I^A, I^B and i . due to this six different genotypes are possible. The number of possible phenotypes are
	1)6 2) 12 3)4 4)8
6	The possible phenotype for the genotype ($I^A I^A$) with reference to human beings blood groups is
	1) O group 2) A group 3) AB group 4) B group
7	In human beings 'B' group phenotype is expressed with the following genotype
	1) $I^A I^A$ 2) $I^A I^O$ 3) $I^B I^B$ & $I^B I^O$ 4) $I^B I^A$
8	Male heterogamy is observed in which pair of animal
	1) Grasshopper & Butterfly 2) Grasshopper & Human beings 3) Butterfly & Drosophila 4) Human beings & Birds
9	Female heterogamy is observed in
	1) Birds 2)Grasshopper 3)Human beings 4)Drosophila
10	In pea plant round seeds produce large starch grains whereas wrinkled seeds (bb) produce smaller starch grains. But the heterozygotes (Bb) are round but produce intermediate starch grains if we take starch grain size as the phenotype then what is the expression of alleles.
	1) Codominance 2) Incomplete dominance 3) Dominance 4) Pleiotropy
11	Study the following statement regarding dominance and identify the incorrect one.
	1) Dominance is not an autonomous feature of a gene or the product that it has information for. 2) Dominance depends as much on the gene product and the production of particular phenotype from this product.

	<p>3) F₁ Generation individuals resembled either of the two parents. 4) F₁ generation individuals resemble both parents.</p>
12	<p>Mother and father of a person with 'O' blood group have 'A' and 'B' blood groups respectively. What would be the genotype of both mother and father.</p>
	<p>1) Mother is homozygous for A blood group 2) Mother is heterozygous for A blood group and father is homozygous for B 3) Both mother and father are heterozygous for 'A' and 'B' blood groups respectively 4) Both mother and father are homozygous for 'A' 'B' blood group</p>
13	<p>Male and female grasshopper has following set of chromosomes</p>
	<p>1) XO and XX 2) XX and XO 3) XX and XY 4) ZW and ZZ</p>
14	<p>Which one of the following conditions correctly describes the manner of determining sex in given example.</p>
	<p>1) Homozygous sex chromosomes (ZZ) determine female sex in birds 2) XO type of sex chromosomes determine male sex in grass hopper 3) XY type of sex chromosomes determine female sex in Drosophila 4) Homozygous sex chromosomes (XX) determine female sex in human being</p>
15	<p>The sex is determined in human beings</p>
	<p>1) Based on the type of sperm that fertilizes the ovum 2) Based on the type of ovum that is fertilized 3) Based on the sets of autosomes 4) Based on the total number of chromosomes</p>
16	<p>In XY and XO type of sex determination</p>
	<p>1) Females are heterogametic 2) Males are heterogametic 3) Males are homogametic 4) Both males and females are homogametic</p>
17	<p>In ZW and ZO type of sex determination</p>
	<p>1) Females are heterogametic 2) Males are heterogametic 3) Females are homogametic 4) None of the above</p>

18	<p>Match the following</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center; width: 50%;">Set – I</td> <td style="text-align: center; width: 50%;">Set -II</td> </tr> <tr> <td>a) XX – XY</td> <td>i) Grasshopper</td> </tr> <tr> <td>b) XX – XO</td> <td>ii) Human being</td> </tr> <tr> <td>c) ZW –ZZ</td> <td>iii) Fowls</td> </tr> <tr> <td>d) ZO – ZZ</td> <td>iv) Fumea</td> </tr> </table> <p>Identify the correct one</p>	Set – I	Set -II	a) XX – XY	i) Grasshopper	b) XX – XO	ii) Human being	c) ZW –ZZ	iii) Fowls	d) ZO – ZZ	iv) Fumea
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	<p style="text-align: center;">a b c d</p> <p>1) ii iii iv i</p> <p>2) ii i iii iv</p> <p>3) I ii iii iv</p> <p>4) ii iii iv i</p>										
19	<p>The total number of chromosomes in the karyotype of one of the following pair of organisms is the same in both males and females. Identify the correct one</p>										
	<p>1) Human beings and Grasshopper 2) Human beings and peacock 3) Insects and Birds 4) Drosophila and Grasshopper</p>										
20	<p>In X-linked recessive inheritance, the affected males are</p> <p>1) Homozygous for affected allele 2) Hemizygous for affected allele 3) Both 1 and 2 4) None of the above</p>										
21	<p>In X-linked recessive inheritance all affected females have</p> <p>1) An unaffected father and a affected mother 2) Unaffected father and unaffected mother 3) An unaffected grandfather and an affected mother 4) An affected father and a carrier or affected mother</p>										
22	<p>The X-linked recessive traits pass on from an affected father to his grandsons through</p>										

	1) Carrier daughter 2) Carrier mother 3) Affected son 4) Unaffected father										
23	Haemophilia is more commonly seen in human males than in human females because										
	1) This is due to an X-linked dominant mutation 2) A greater proportion of girls die in infancy 3) This disease is due to an X-linked recessive mutation 4) This disease is due to a Y-linked recessive mutation										
24	Which of the following is not a hereditary disease										
	1) Cystic fibrosis 2) Thalassemia 3) Haemophilia 4) Cretinism										
25	Which one is not correct regarding Down's syndrome										
	1) It is first described by Langdon Down (1866) 2) It is due to the trisomy of 21 chromosome 3) Physical, psychomotor and mental retardation in affected persons 4) It is due to polyploidy										
26	Which one is correct regarding Klinefelter's syndrome										
	1) 45, X ₀ is the karyotype 2) Small round head, furrowed tongue and partially open mouth 3) Gynecomastia (breast development) is expressed 4) Rudimentary ovaries are present										
27	Match the following										
	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">SET –A</td> <td style="text-align: center;">SET-B</td> </tr> <tr> <td>a) Haemophilia</td> <td>i) 45, X₀</td> </tr> <tr> <td>b) Down's syndrome</td> <td>ii) 47, XXY</td> </tr> <tr> <td>c) Turner's syndrome</td> <td>iii) 21 trisomy</td> </tr> <tr> <td>d) Klinefelter's syndrome</td> <td>iv) X recessive trait</td> </tr> </table>	SET –A	SET-B	a) Haemophilia	i) 45, X ₀	b) Down's syndrome	ii) 47, XXY	c) Turner's syndrome	iii) 21 trisomy	d) Klinefelter's syndrome	iv) X recessive trait
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a b c d											
1) iv iii ii i											
2) iv ii iii i											
3) iv iii i ii											

	4) iii iv ii I
28	The inheritance pattern of a gene over generations among humans is studied by pedigree analysis. Character studied in the pedigree analysis is equivalent to
	1) Quantitative trait 2) Mendilian trait 3) Polygenic trait 4) Maternal trait
29	Which among the following is incorrect regarding human genome project
	1. Human genome project is a mega project launched in the year 1990 for sequencing human genome 2) Human genome consisting of approximately 3×10^9 bp 3) The total estimated cost of the project is approximately 9billion dollars 4) HGP was closely associated with the rapid development of a new area of biology called biotechnology
30	What is it that forms the bases of DNA fingerprinting
	1) The relative amount of DNA in the finger prints. 2) Satellite DNA occurring as highly repeated short DNA segments 3) The relative proportions of purines and pyrimidines in DNA

LEVEL 3

1	The possible blood groups of children born to parents having A × AB group are
	1) A, O 2) O, A, B 3) O, A, B, AB 4) A, B, AB
2	When a homozygous A blood group man marries homozygous 'B' blood group women in F ₁ -generation AB-group children are born. When these F ₁ individuals marry AB blood group people. What are the blood groups of their children?
	1) A, AB, B 2) A, B, O 3) AB only 4) A & B
3	Study the following and select correct statement i) In codominance recessive character is absent ii)'AB' blood group is due to the expression of I ^A & I ^B genes together iii) In AB blood group persons the plasma membrane of RBC has no sugar polymers. Identify the correct one

	1) II & III are correct 2) Only III is correct 3) All are correct 4) I & II are correct
4	A man with blood group 'A' marries a woman with blood group 'B'. What are all the possible blood groups of their offsprings?
	1) A and B only 2) A,B and AB only 3)A,B,AB,O 4)O only
5	Which of the following genotypes does not produce a sugar polymer on the surface of the RBC
	1) $I^A I^B$ 2) $I^A I^A$ 3) $I^A i$ 4) ii
6	If two persons with AB blood group marry and have sufficiently large numbers of children, these children could be classified as 'A' blood group, AB blood group, 'B' blood group in 1:2:1 ratio. Modern technique of protein electrophoresis reveals presence of both A and B type in AB blood group individuals. This is an example of (NEET 2013)
	1) Codominance 2) Incomplete dominance 3) Partial dominance 4) Complete dominance
7	Match the terms in column I with their description in column II and choose the correct option <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Column – I</p> <p>a) Dominance</p> <p>b) Codominance</p> <p>c) Pleiotropy</p> <p>d) Polygene</p> </div> <div style="text-align: center;"> <p>Column - II</p> <p>i) Many genes govern a single character</p> <p>ii) In a heterozygous organism only one allele expresses itself</p> <p>iii) In a heterozygous organism both alleles express themselves</p> <p>iv) single gene influences many characters</p> </div> </div>
	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>a b c d</p> <p>1) ii i iv iii</p> <p>2) ii iii iv i</p> <p>3) iv i ii iii</p> <p>4) iv iii i ii</p> </div> <div style="text-align: center;"> <p>(NEET 2016)</p> </div> </div>
8	Assertion: In grass hopper the sex of the off spring depend on the fertilizing sperm Reason: Grasshopper females are heterogametic with XO chromosomes.

	<p>1) Both (A) and (R) are true and (R) is the correct explanation of (A) 2) Both (A) and (R) are true and (R) is not the correct explanation of (A) 3) (A) is true but (R) is false 4) Both (A) and (R) are false</p>															
9	<p>Assertion: In fowls the sex of the off spring depends on the fertilizing sperm Reason: In fowls females are heterogametic with ZW chromosomes and males are Homogametic with ZZ chromosomes</p>															
	<p>1) Both (A) and (R) are true and (R) is the correct explanation of (A) 2) Both (A) and (R) are true and (R) is not the correct explanation of (A) 3) (A) is true but (R) is false 4) Both (A) and (R) are false</p>															
10	In grasshoppers and moths there are/is															
	<p>1) X only 2)X and Y 3)Y only 4)None of these</p>															
11	<p>Study the following and select the correct combination of the embryo</p> <table border="1"> <thead> <tr> <th>Organism</th> <th>Type</th> <th>Sex</th> </tr> </thead> <tbody> <tr> <td>I) Fumea</td> <td>Female heterogametic</td> <td>Depends on fertilizing sperm</td> </tr> <tr> <td>II) Grasshopper</td> <td>Male heterogametic</td> <td>Depends on fertilizing sperm</td> </tr> <tr> <td>III) Humans</td> <td>Male heterogametic</td> <td>Depends on fertilizing sperm</td> </tr> <tr> <td>IV) Hen</td> <td>Female heterogametic</td> <td>Depends on fertilizing ovum</td> </tr> </tbody> </table>	Organism	Type	Sex	I) Fumea	Female heterogametic	Depends on fertilizing sperm	II) Grasshopper	Male heterogametic	Depends on fertilizing sperm	III) Humans	Male heterogametic	Depends on fertilizing sperm	IV) Hen	Female heterogametic	Depends on fertilizing ovum
Organism	Type	Sex														
I) Fumea	Female heterogametic	Depends on fertilizing sperm														
II) Grasshopper	Male heterogametic	Depends on fertilizing sperm														
III) Humans	Male heterogametic	Depends on fertilizing sperm														
IV) Hen	Female heterogametic	Depends on fertilizing ovum														
	<p>1) I, II & III only 2) II, III & IV only 3) I & III only 4) All are correct</p>															
12	Sickle cell anaemia has not been eliminated from the African population because it is															
	<p>1) Controlled by dominant gene 2) Controlled by recessive gene 3) not a fetal disease 4) Provides immunity against malaria</p>															
13	In a certain taxon of insects some have 17 chromosomes and the others have 18 chromosomes. The 17 and 18 chromosome bearing organisms are															
	<p>1) Males and females respectively 2) Females and males respectively 3) All males 4) All females</p>															

14	In sickle cell anemia glutamic acid is replaced by valine. Which one of the following triplets codes for valine.
	1) GGG 2) AGA 3) GAA 4) GUG
15	Pick out the correct statement I) Haemophilia is a sex-linked recessive disease II) Down's syndrome is due to aneuploidy III) Phenylketonuria is an autosomal recessive gene disorder IV) Sickle cell anaemia is an X-linked recessive gene disorder
	1) I and II are correct 2) I, III and IV are correct 3) II and IV are correct 4) I, II and III are correct
16	The DNA fragments separated on an agarose gel can be visualised after staining with(NEET 2017)
	(1) Bromophenol blue (2) Acetocarmine (3) Aniline blue (4) Ethidium bromide
17	Thalassemia and sickle cell anemia are caused due to a problem in globin molecule synthesis. Select the correct statement. (NEET 2017)
	(1) Both are due to a qualitative defect in globin chain synthesis (2) Both are due to a quantitative defect in globin chain synthesis (3) Thalassemia is due to less synthesis of globin molecules (4) Sickle cell anemia is due to a quantitative problem of globin molecules
18	Which of the following pairs is wrongly matched? (NEET 2018)
	(1) XO type sex : Grasshopper determination (2) T.H. Morgan : Linkage (3) ABO blood grouping : Codominance

	(4) Starch synthesis in pea : Multiple alleles
19	Which of the following is commonly used as a vector for introducing a DNA fragment in human lymphocytes? (NEET 2018)
	(1) λ phage (2) pBR 322 (3) Ti plasmid (4) Retrovirus
20	Which of the following characteristics represent 'Inheritance of blood groups' in humans? (NEET 2018) a. Dominance b. Codominance c. Multiple allele d. Incomplete dominance e. Polygenic inheritance
	(1) b, d and e (2) a, c and e (3) a, b and c (4) b, c and e
21	Sickle cell anaemia is example of
	1) Sex linked inheritance 2) Deficiency disease 3) Autosomal inheritance disease 4) infectious disease
22	If both parents are carriers for Thalassemia which is an autosomal recessive disorder, what are the chances of pregnancy resulting in an affected child
	1) 50% 2) 25% 3) 100% 4) No chance
23	The incorrect statement with regard to haemophilia is

	<ol style="list-style-type: none"> 1) It is a recessive disease 2) It is dominant disease 3) A single protein involved in the clotting of blood is affected 4) 4) It is a sex – linked disease
24	<p>Assertion (A): X – linked genes are hemizygous in men</p> <p>Reason (R): Only one X – chromosome present in men</p>
	<ol style="list-style-type: none"> 1) Both (A) and (R) are true and (R) is the correct explanation of (A) 2) Both (A) and (R) are true and (R) is not the correct explanation of (A) 3) (A) is true but (R) is false 4) Both (A) and (R) are false
25	<p>Assertion (A): sickle cell anemia is caused by replacement of glutamic acid in the sixth position by valine in the beta globin chain</p> <p>Reason (R): It involves chromosomal translocation</p>
	<ol style="list-style-type: none"> 1. Both (A) and (R) are true and (R) is the correct explanation of (A) 2. Both (A) and (R) are true and (R) is not the correct explanation of (A) 3. (A) is true but (R) is false 4) Both (A) and (R) are false
26	<p>A man whose father was haemophilic marries a woman who had a haemophilic mother and normal father. what percentage of male children of this couple will be colour blind.</p>
	<p>1) 25% 2)0% 3) 50% 4) 75%</p>
27	<p>Assertion (A): DNA fragments were sequenced using automated DNA sequencers.</p> <p>Reason (R): Alignment of DNA sequences was humanly not possible</p>
	<ol style="list-style-type: none"> 1) Both (A) and (R) are true and (R) is the correct explanation of (A) 2) Both (A) and (R) are true and (R) is not the correct explanation of (A) 3) (A) is true but (R) is false 4) Both (A) and (R) are false
28	<p>Study the following and identify correct statements.</p> <p>I. Human genome contains about 3.2 billion nucleotides.</p> <p>II. The largest gene is dystrophin gene</p> <p>III. In an average a human gene consists of 3000base pairs</p> <p>The correct combination is:</p>

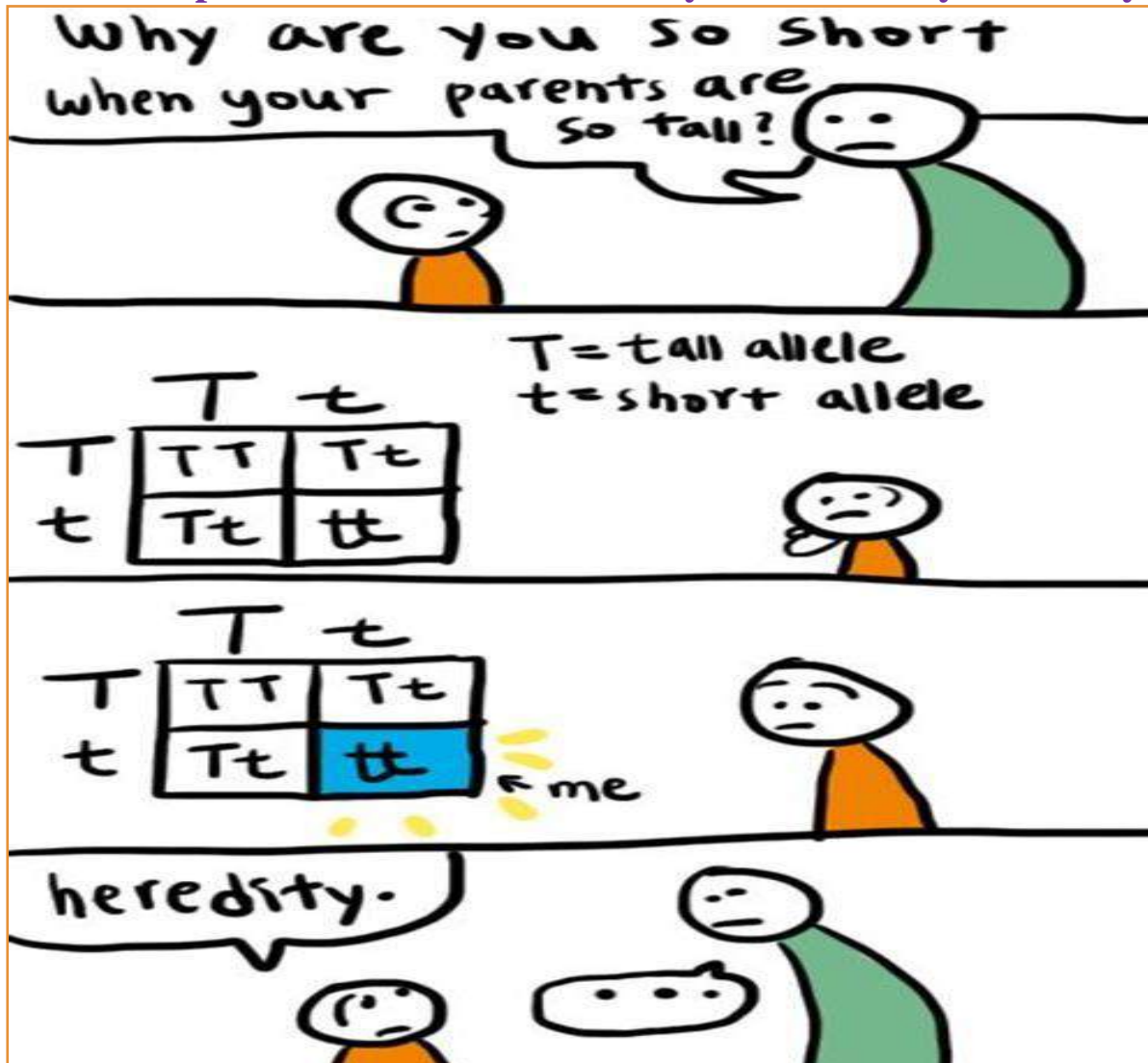
	1) I	2) I and II	3) I and III	4) I,II and III
29	An analysis of chromosomal DNA using southern hybridization technique does not use			
	1) .PCR	2) Electrophoresis	3) Blotting	4) Autoradio biography (AIPMT 2014)
30	Satellite DNA is useful tool in			
	1) Forensic science		2) Genetic engineering	
	3) Organ transplantation		4) Sex determination	
31	What is the criterion for DNA fragments movement on agarose gel during gel electrophoresis? (NEET 2017)			
	(1) The larger the fragment size, the farther it moves (2) The smaller the fragment size, the farther it moves (3) Positively charged fragments move to farther end (4) Negatively charged fragments do not move			
32	The final proof according to their size through sieving effect provided by agarose or DNA as the genetic material came from the experiments of (NEET 2017)			
	(1) Griffith		(2) Hershey and Chase	
	(3) Avery, Mcleod and McCarty		(4) Hargobind Khorana	
33	DNA fragments are (NEET 2017)			
	(1) Positively charged	(2) Negatively charged	(3) Neutral	
	(4) Either positively or negatively charged depending on their size			
34	A disease caused by an autosomal primary nondisjunction is			
	(1) Down's syndrome		(2) Klinefelter's syndrome	
	(3) Turner's syndrome		(4) Sickle cell anemia	
35	The genotypes of a Husband and Wife are IAIB and IAi. Among the blood types of their children, how many different genotypes and phenotypes are possible? (NEET 2017)			
	(1) 3 genotypes ; 3 phenotypes		(2) 3 genotypes ; 4 phenotypes	
	(3) 4 genotypes ; 3 phenotypes		(4) 4 genotypes ; 4 phenotypes	
36	A woman has an X-linked condition on one of her X chromosomes. This chromosome can be inherited by (NEET 2018)			
	(1) Only grandchildren		(2) Both sons and daughters	
	(3) Only sons		(4) Only daughters	

19. Assignment Questions to answer

UNIT – 6 GENETICS		
VSAQ***	1	What is Pleiotropy?
***	2	What is Erythroblastosis foetalis?
***	3	What is Polygenic Inheritance?
**	4	What is Haplo-Diploidy?
***	5	What are Barr Bodies?
***	6	What is “Klinefelter’s Syndrome”?
***	7	What is “Turner’s Syndrome”?
***	8	What is “Downs Syndromew”?
**	9	What is “Lyomisation”?
*	10	Define “Hemizygous condition”.
*	11	What are Sex limited Characters?
**	12	What is “Junk DNA”?
*	13	What are “VNTRs”?
**	14	List out any two applications of DNA Finger printing technology.
	15	Why are sex-linked dominant characters are more common in the female human beings?
	16	What are the antigens causing ‘ABO’ blood grouping? Where are they present?
SAQ*	1	What is pedigree analysis? Suggest how such an analysis, can be useful.
***	2	Describe Erythroblastosis foetalis.
**	3	Describe Male heterogamety.
**	4	Describe female heterogamety.
***	5	Describe the Genic Balance theory of Sex determination.
**	6	Describe the salient features of Human Genome project (HGP)?
***	7	Describe the steps involved in DNA Finger printing technology.
LAQ***	1	What are Multiple Alleles? Describe multiple alleles with the help of ABO blood groups in man.
***	2	Describe chromosomal theory of sex determination.
***	3	What is Criss-Cross inheritance? Explain the inheritance of one sex linked recessive character in human beings.
**	4	What is DNA finger printing? Mention its applications.

20. Hands on Experiences for you – Try It!!!

A. Prepare similar cartoons for any character in your family.



B. Did you know?

1. Why Haemophilia is called as Royal disease?

Hemophilia is referred to as “the royal disease,” because it affected the royal families of England, Germany, Russia and Spain in the 19th and 20th centuries. Queen Victoria of England, who ruled from 1837-1901, is believed to have been the carrier of hemophilia B, or factor IX deficiency. She passed the trait on to three of her nine children. Her son Leopold died of a hemorrhage after a fall when he was 30. Her daughters Alice and Beatrice passed it on to several of their children. Alice’s daughter Alix married Tsar Nicholas of Russia, whose son Alexei had hemophilia. Their family’s entanglement with Rasputin, the Russian mystic, and their deaths during the Bolshevik Revolution have been chronicled in several books and films. Hemophilia was carried through various royal family members for three generations after Victoria, then disappeared

2. Why does the Hollywood icon, Elizabeth Taylor have two rows of eyelashes?

A mutation of the aptly named FOXC2 gene gave Hollywood icon Elizabeth Taylor two rows of eyelashes. The technical term for this rare disorder is distichiasis, and while it may seem like a desirable problem to have, there can be complications. According to the American Academy of Ophthalmology, this extra set of lashes is sometimes “fine and well tolerated,” but in other cases they should be removed to prevent eye damage.

3. Why can't human beings live for more than 125 years?

Biologists believe that there's a limit to how long we can live. Every species, including humans, has a predetermined lifespan and we can't outlive it no matter how good our living conditions are. While leading a healthy lifestyle in combination with access to quality medical care can significantly improve life expectancy, aging itself might be connected to the DNA damage that can't be reversed. The oldest living person we know of, Jeanne Calment, died at the age of 122. OUR GENES MIGHT PREVENT US FROM LIVING MORE THAN 125 YEARS.

4. Why Identical twins also look different even though they are with the same genetic code?

Identical twins have the same DNA when they're conceived, but there are other factors that may influence their development in the womb and then later in life. For example, the fetuses may receive a different amount of nutrients so the twins may end up being with very different heights and other body features.

C. Project Work

I) Collect, observe and identify whether there is a link between the type of blood group and corona virus infection and its effects in Human population.

- 1) Collect the blood groups of corona affected symptomatic, asymptomatic and the people who are not affected with COVID19 even though they are in contact with corona positive people, from a reliable source. (Better from a COVID testing center)
- 2) Enter the data in a table.
- 3) Draw histograms for each blood group for Symptomatic, asymptomatic and the persons who are not infected with COVID19 even though they are in contact with corona positive people.
- 4) Observe and draw conclusions.

II) Collect the pictures of each genetic disorder from the net and paste them in your project work and write down the major points associated with the disorder and show it to your lecturer.

D. DNA from Fruit

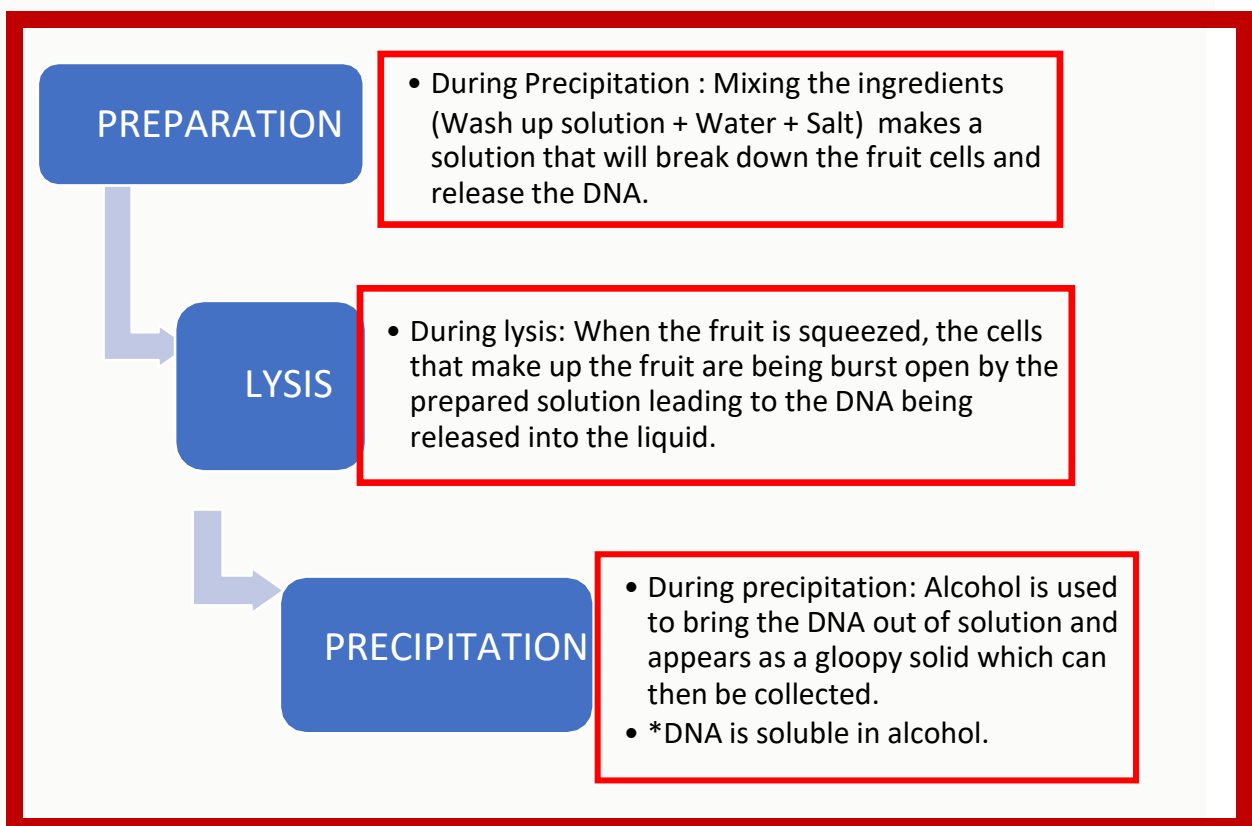
All living things have DNA. This hands-on activity will enable you to extract DNA from fruit, such as strawberries, using everyday household items.

BACKGROUND A bit like a recipe book, all the biological instructions for making an organism are contained in a long molecule called DNA (deoxyribonucleic acid). All living things, from humans and mice to plants and bacteria, have a unique set of instructions written in the four chemical letters of DNA: A, C, G, and T. Although it's not visible to the naked eye, we know that DNA has a unique shape. It is a double helix that looks a bit like a twisted ladder. DNA is found inside the cells of all living things. In animals, plants and fungi most of the DNA is found inside the nucleus – the information centre of the cell.

As it is such a long molecule (the DNA in one human cell is 2 metres long!) it is packaged into bundles, known as chromosomes. This makes sure it all fits inside the nucleus. This activity will enable participants to extract DNA from fruit using basic household ingredients. They will be using essentially the same chemicals and processes that are used when DNA is extracted in the lab.

Watch: <http://www.yourgenome.org/activities/extracting-dna-from-fruit>

A short summary of these processes is given below: -



21. Medical and other careers related to Genetics:

Genetic Counsellors

Genetic counselors must have a master's degree and certification to work in their field. They are healthcare professionals who focus on genetics; their work involves determining if a patient or family is at risk of having or passing on a genetic condition. They evaluate the patient's DNA and family history to identify genetic risk factors and produce reports for other medical professionals. They also provide information to the patient about any genetic health risks identified. A Genetic counsellor is an expert who counsels families, community and individuals about the genetic diseases and discussed with them the disease management options. They explain to them about the risks associated with a disease.

Medical Scientists

Medical scientists are required to have a doctoral or medical degree. Their focus is on scientific research related to medical issues. They perform studies to learn more about diseases, and those that focus on hereditary conditions would be involved in studying genetics to determine how genetic disorders can be passed on and may try to identify how to treat genetic conditions.

Plant Breeder/ Geneticist

A plant breeder is a person who studies characteristics of seed and works to improve the characteristics of plants. They implement their knowledge of genetics for the crossing of plants. They ensure to keep the plants and crops disease-free and help them protect from pests and insects.

Research Scientist (Life Sciences)

They are the professionals who are responsible to collect scientific data and set up experiments to conduct scientific investigations in controlled environments. There are specializations in various disciplines like cancer studies, neurosciences, stem cell research, genomics, microbiology etc.

Clinical Scientist, Genomics

A scientist working in genomics examines samples of patients' nucleic acid (DNA or RNA) to identify genetic and genomic disorders. They are responsible to deal with hereditary diseases or conditions. They are responsible to treat cancer or Cystic fibrosis patients.

Cytogeneticist:

A Cytogeneticist prepares biological specimens such as blood, amniotic fluids, bone marrow and tumours for chromosome analysis.

Crime Investigation:

Geneticists also work in the crime investigation branches of government and non-government organizations analysing biological samples submitted to them for the presence or absence of certain DNA strains.

Clinical Geneticist:

They are physicians who specialize in the diagnosis and treatment of genetic diseases. Their job may also include laboratory-based tasks related to such diseases.

Genetic Educators:

Genetics teachers in schools and universities are in high demand. They work at various levels, depending on their qualifications.

Biomedical Engineers

Biomedical engineers are responsible for the medical equipment healthcare professionals use. They must have a bachelor's degree in biomedical engineering or a comparable discipline. Their work involves designing medical equipment and repairing existing equipment. Those who are working on equipment that's used for genetic testing may also consult with medical scientists to ensure that the equipment is designed as effectively as possible and performs as intended.

Biochemists and Biophysicists

Biochemists and biophysicists are highly trained professionals with a doctoral degree in their field. Their work involves a lot of research, and it includes exploring hereditary conditions that affect people. Since hereditary illnesses are genetic, biochemists and biophysicists study DNA and work to determine how to identify genetic disorders.

Forensic Science Technicians

Forensic science technicians are scientists who apply their skills in the field of law enforcement. They need a bachelor's degree and they use their knowledge of forensic science to identify and analyze potential evidence from a crime scene. They may use specialized equipment to identify DNA from crime scenes. Through processing relevant genetic data, forensic science technicians help identify suspects.

Agricultural and Food Scientists

A Genetically Modified Organism (GMO) is a term used when a plant or animal has been changed through genetic engineering. Agricultural and food scientists may be involved in determining how to improve food production. Animal scientists may determine genetic factors affecting livestock, while food scientists and technologists apply genetic research to plants.

Bioethicist

May be consulted in cases where there is uncertainty about the right course of action for a patient due to conflicting values. Usually has an advanced degree in a field such as philosophy, medicine, nursing, social work, genetics, or law, and may also pursue specific advanced degrees or certification courses in bioethics.

In health care settings, reports to whomever oversees the work of the ethics committee or ethics consult service. Becomes involved in a patient's care at the request of another member of the health care team, the patient, or family members.

22. Answers to the activities and note making

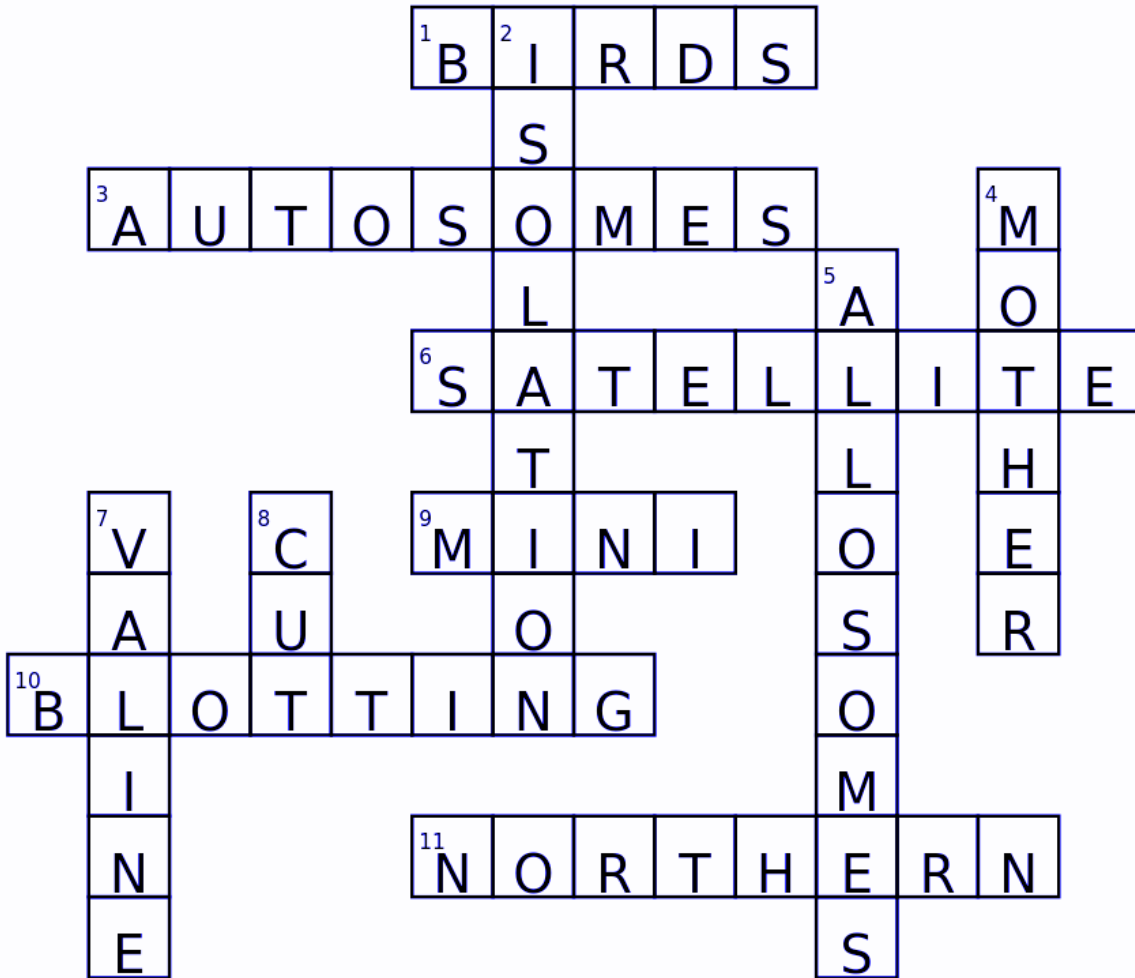
Key for Activity 2 (Defining Words):

1. A segment of DNA that carries genetic information.
2. A specific, fixed position on a chromosome where a particular gene is located
3. the two alternative forms of a gene.
4. It is the condition in which both the alleles are identical.
5. It is the condition in which both the alleles are different.
6. The character which is fully expressed either in homozygous or heterozygous form.
7. the character which remains masked in an offspring during heterozygous form and expressed only in homozygous form
8. Crossing an individual with a phenotypically recessive individual.
9. Crossing a hybrid one with one of its parents
10. Multiple effects of a single gene.
11. more than two alternative forms are present for a single gene
12. Equal expression of both genes.
13. Cumulative effect of two or more genes for a single phenotype
14. Sex chromosomes are called allosomes (X and Y Chromosomes)
15. Somatic chromosomes are called autosomes (other than sex chromosomes)
16. The genes that are present on X or Y chromosomes are called Sex linked genes.
17. Autosomal genes present both males and females but their phenotypic expression is limited to only one sex. Ex: beard in man, Breast in women.
18. Autosomal genes present both male and female but they behave differently in the two sexes. Ex: Bald head genes
19. The complete set of DNA in an organism.
20. A point mutation or single base substitution, is a type of mutation that causes the replacement of a single base nucleotide with another nucleotide of the genetic material, DNA or RNA.

Key for Activity 4 (Scientists and their contributions):

1. Sutton and Boveri	2. T.H.Morgan
3.Karl Landsteiner	4.Karl Landsteiner and Alexander S.Wiener
5.Bridges	6.Mary Lyon and Liane
7.A.Folling	8.Frederick Sanger
9.Jeffreys	10. Henking

Key for activity 14:



Key for Activity 16 (Fill in the blanks):

1. Genetics	2. Greek	3. Origin of any thing or the beginning	4. W.Bateson
5. Heredity	6. Hereditary characters	7. Variations	8. 800-1000 BC, sexual
9. Selection and domestication	10. Y-Chromosome	11. Dihybrid	12. Linkage and inheritance
13. Sutton and Boveri theory	14. Pleiotropy	15. Phenylketonuria	16. Phenylalanine hydroxylase
17. Phenylalanine hydroxylase	18. Allele	19. T.H. Morgan	20. Jeffreys
21. Bacteria and Yeasts	22. Dystrophin	23. Wellcome Trust (UK)	24. Philadelphia
25. Tyrosine Kinase	26.	27.	28.

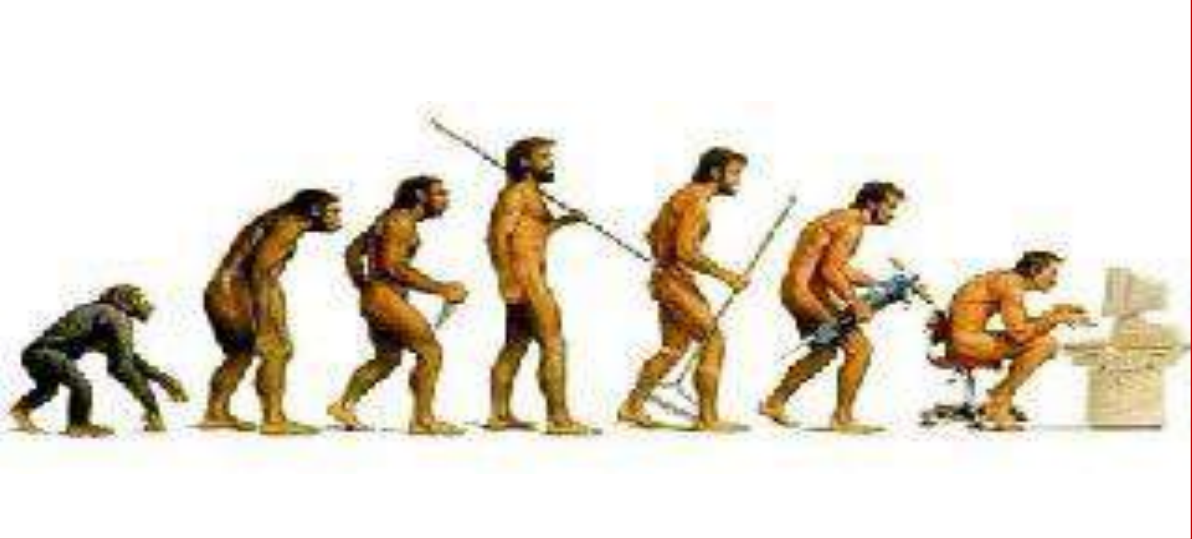
Key for Activity 17 (True or False):

1. True	
2. False	Can be observed in a population
3. False	Sugar polymers
4. False	Affected by environmental factors
5. True	
6. False	One active X-chromosomes
7. True	
8. True	
9. False	Antihemophilic factor
10. True	

Key to activity 18

LEVEL 1									
1	2	2	1	3	2	4	2	5	3
6	3	7	3	8	3	9	2	10	1
11	3	12	4	13	2	14	3	15	2
16	3	17	1	18	2	19	4	20	1
21	4	22	2	23	2	24	2	25	1
26	4	27	1	28	2	29	1	30	3
31	1	32	4	33	1	34	3	35	4
36	4	37	2	38	4	39	2	40	3
41	2	42	2	43	2	44	1	45	3
46	2	47	3	48	4	49	1	50	4
51	2	52	1	53	1	54	3	55	2
56	1	57	1	58	2	59	2	60	1
61	3	62	2	63	3	64	1	65	3
66	1	67	2	68	2	69	3	70	4
71	4	72	1	73	2	74	3	75	4

76	2	77	2	78	3	79	2	80	2
81	3	82	3	83	1	84	1	85	2
86	4	87	2	88	4	89	3	90	2
91	2								
LEVEL 2									
1	4	2	3	3	2	4	1	5	3
6	3	7	3	8	2	9	1	10	2
11	4	12	3	13	1	14	4	15	1
16	2	17	1	18	2	19	2	20	2
21	4	22	2	23	3	24	4	25	4
26	3	27	3	28	2	29	4	30	2
LEVEL 3									
1	4	2	1	3	4	4	3	5	4
6	1	7	2	8	3	9	4	10	1
11	2	12	2	13	1	14	4	15	4
16	4	17	3	18	4	19	4	20	3
21	3	22	2	23	2	24	1	25	3
26	3	27	2	28	4	29	1	30	1
31	2	32	2	33	2	34	1	35	3
36	4	37	3	38	4	39	4	40	3
36	2								



Evolution according to Darwin (Described in Origin of Species)



Chordates Living in Water (Fish)	Tetrapodes Living in both Water and Land (Amphibian)	Mammals Living on Land (Boar)	Partially Bipedalled Primates (Half man-Half Animal)	Hominidae Dwarf (Physically Less-Developed; Mentally very wise)	Homo Erectus (Living in Jungle) Man with Axe weapon	Homo Sapiens (The Perfect Man)
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Evolution according to Dashavatara (Described in Vishnu Puraan)

Matsya Avtar

Kurma Avtar

Varah Avtar

Narsimha Avtar

Vaman Avtar

Parshuram Avtar

Ram Avatar

MAJOR LEARNING OBJECTIVE

- *Students will be able to comprehend the primary processes of evolution.*
- *To comprehend how evolutionary biology informs and guides other biological fields*
- *To comprehend how evolutionary biologists work*

LEARNING OUTCOMES:

- Understand that by biological evolution we mean that many of the organisms that inhabit the Earth today are different from those that inhabited it in the past.
- Understand that natural selection is one of several processes that can bring about evolution, although it can also promote stability rather than change
- Understand Darwin's theory of evolution through natural selection.
- Interpret phylogenetic trees and understand how they are reconstructed.
- Use perturbations of Hardy-Weinberg equilibrium to infer activity of specific evolutionary processes.
- Can read and comprehend evolutionary biology advances described in contemporary literature.

ADDITIONAL READING MATERIAL

1. **A BRIEF ACCOUNT OF EVOLUTION**
2. **TYPES OF ORGANIC EVOLUTION**
3. **HUMAN EVOLUTION**
4. **CULTURAL EVOLUTION OF HUMAN**
5. **FUTURE MAN (*Homo futuris*)**

ACTIVITIES

1. Locating in and rewriting the difficult key words from the text book
2. Defining key words
3. Matching the scientists and their contributions
4. Prepare the concept map for “Biological Evolution” (page 238)
5. Relating, Exploring and Verifying “The Urey –Miller Experiment”
6. Look at the pictures – Identify the related concept and add a brief note.
7. Note making on Theory of Natural Selection
8. Understanding Hardy-Weinberg Equilibrium and Solving problems
9. Identifying the type of speciation and adding brief note
10. Identifying and Defining the Evolutionary Forces
11. Fill in the blanks
12. Answer “TRUE” or “FALSE”
13. Multiple Choice Questions for Competitive exams
14. Assertion & Reasoning Questions
15. Assignment Questions to answer
16. Hands on Experiences for you – Try It!!!
17. Careers in Evolution Studies
18. Answers to the activities and note making

INSTRUCTIONS TO LECTURER

- Ask the students to take aid of the textbook and to work with a partner
- Explain each part of the worksheet & Come up with some examples to help
- Clarify doubts of the students before starting the work book

INSTRUCTIONS TO STUDENTS

- First read the text book thoroughly and logically with a friend cooperatively
- While attempting the activities analyze them carefully
- While attempting the multiple choice questions, make notes on the other options too

1. A BRIEF ACCOUNT OF EVOLUTION:

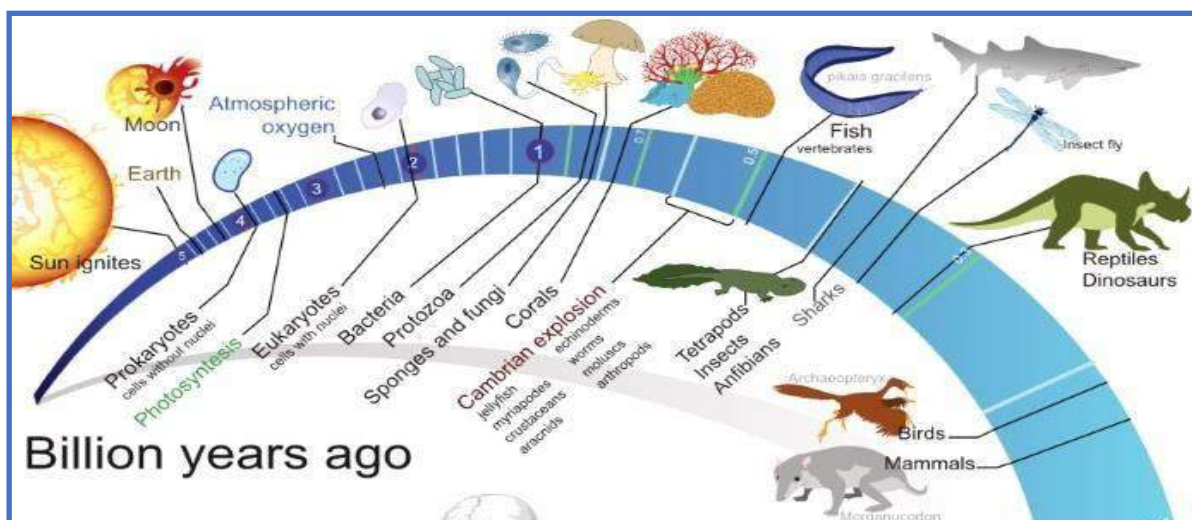
About 2000 million years ago (mya) the first cellular forms of life appeared on earth. The mechanism of how non-cellular aggregates of giant macromolecules could evolve into cells with membranous envelop is not known. Some of these cells had the ability to release O₂. The reaction could have been similar to the light reaction in photosynthesis where water is split with the help of solar energy captured and channelized by appropriate light harvesting pigments. Slowly single-celled organisms became multi-cellular life forms. By the time of 500 mya, invertebrates were formed and active. Jawless fish probably evolved around 350 mya.

We are told that the first organisms that invaded land were plants. They were wide spread on land when animals invaded land. Fish with stout and strong fins could move on land and go back to water. This was about 350 mya. In 1938, a fish caught in South Africa happened to be a Coelacanth which was thought to be extinct. These animals called lobefins evolved into the first amphibians that lived on both land and water. There are no specimens of these left with us. However, these were ancestors of modern day frogs and salamanders. The amphibians evolved into reptiles. They lay thickshelled eggs which do not dry up in sun unlike those of amphibians.

Again we only see their modern day descendents, the turtles, tortoises and crocodiles. In the next 200 millions years or so, reptiles of different shapes and sizes dominated on earth. Some of these land reptiles went back into water to evolve into fish like reptiles probably 200 mya (e.g. *Ichthyosaurs*). The land reptiles were, of course, the dinosaurs. The biggest of them, i.e., *Tyrannosaurus rex* was about 20 feet in height and had huge fearsome dagger like teeth. About 65 mya, the dinosaurs suddenly disappeared from the earth. We do not know the true reason. Some say climatic changes killed them. Some say most of them evolved into birds. The truth may live in between. Small sized reptiles of that era still exist today.

The first mammals were like shrews. Their fossils are small sized. Mammals were viviparous and protected their unborn young inside the mother's body. Mammals were more intelligent in sensing and avoiding danger at least. When reptiles came down mammals took over this earth. There were in South America mammals resembling horse, hippopotamus, bear, rabbit, etc. Due to continental drift, when South America joined North America, these animals were overridden by North American fauna. Due to the same continental drift pouched mammals of Australia survived because of lack of competition from any other mammal.

Lest we forget, some mammals live wholly in water. Whales, dolphins, seals and sea cows are some examples. Evolution of horse, elephant, dog, etc., is special stories of evolution. The most successful story is the evolution of man with language skills and self-consciousness.



2. TYPES OF ORGANIC EVOLUTION:

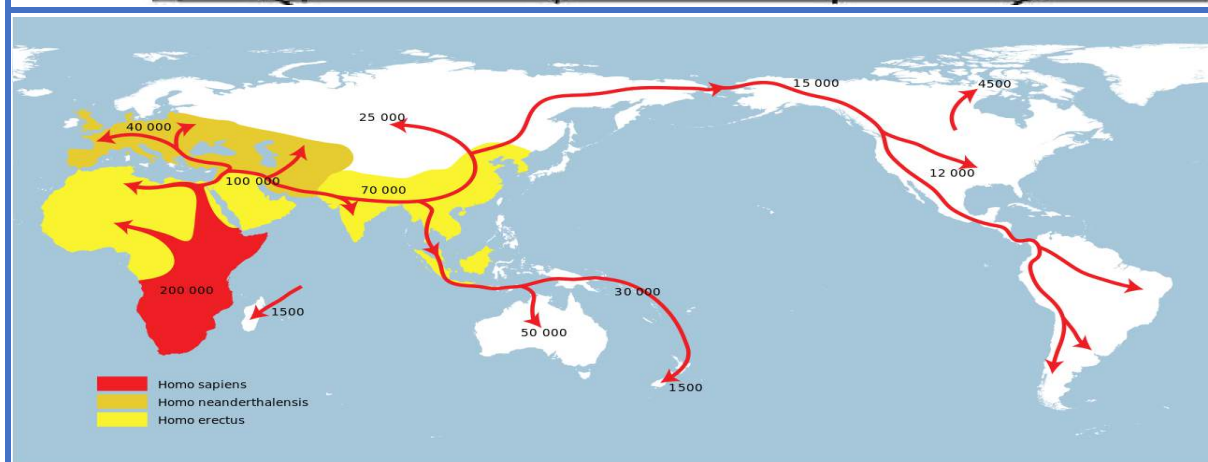
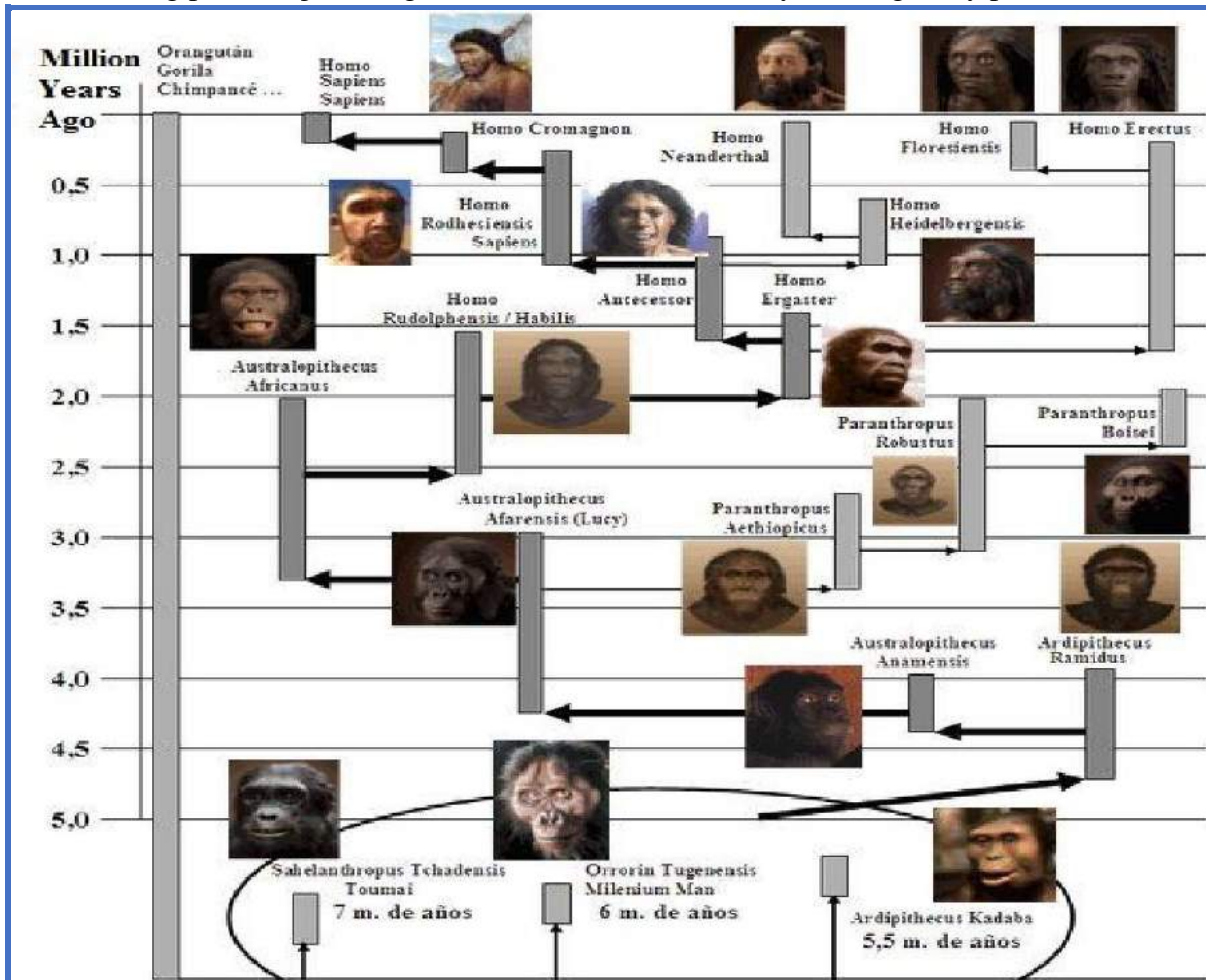
Organic evolution is the formation of new (more complex) types of organisms from the pre-existing (simpler) ones through the modification. Evolution may be of following several kinds:

- A. **Progressive Evolution:** (also known as *orthogenetic evolution*) The formation of more complex, elaborate and specialized structures from the simple structures is termed as "*Progressive Evolution*". Here the organisms have an innate tendency to *evolve* in a definite direction towards some goal (teleology) due to some internal mechanism or "driving force".
- B. **Retrogressive evolution** is a process where complex form of organism develop towards simpler form. For example: Monocot plants belong to a more advanced group of plants with herbaceous and simple structure.
- C. **Divergent evolution:** It is commonly defined as what occurs when two groups of the same species evolve different traits within those groups in order to accommodate for differing environmental and social pressures. Through divergent evolution, organisms may develop homologous structures. These are anatomically similar structures, which are present in the common ancestor and persist within the diverged organisms, although have evolved dissimilar functions.
- D. **Convergent evolution:** It occurs is when different organisms independently evolve similar traits. An example of convergent evolution is the similar nature of the flight/wings of insects, birds, pterosaurs, and bats. All four serve the same function and are similar in structure, but each evolved independently.
- E. **Microevolution:** It is the change in allele frequencies that occurs over time within a population. This change is due to four different processes: mutation, selection (natural and artificial), gene flow and genetic drift. This change happens over a relatively short (in evolutionary terms) amount of time. Microevolution may lead to speciation, which provides the raw material for macroevolution.
- F. **Macroevolution:** In the modern sense is evolution that is guided by selection among interspecific variation, as opposed to selection among intraspecific variation in microevolution. Macroevolution refers to the evolution of taxa above the species level (genera, families, orders etc.). It is a large scale evolutionary change, occurring over a long period of time and involving the origin of major taxa, like new species and genera due to mutations.
- G. **Megaevolution:** It involves large changes giving rise to new families, orders, classes etc.,
- H. **Coevolution:** Coevolution occurs when two or more species reciprocally affect each other's evolution through the process of natural selection. The term sometimes is used for two traits in the same species affecting each other's evolution, as well as gene-culture coevolution. An example is the coevolution of flowering plants and associated pollinators (e.g., bees, birds, and other insect species).
- I. **Parallel Evolution:** Parallel evolution is the independent evolution of similar traits, starting from a similar ancestral condition. Frequently this is the situation in more closely related lineages, where several species respond to similar challenges in a similar way. A notable example is the similarity shown by the marsupial mammals of Australia to the placental mammals elsewhere.
- J. **Iterative Evolution:** Iterative evolution means the repeated evolution of similar or parallel structures from the same ancestor but at different times. The white-throated rail is the only flightless bird known in the Indian Ocean area. New research has found that it had once gone extinct, but rose from the dead thanks to a rare process called "iterative evolution".

3. HUMAN EVOLUTION

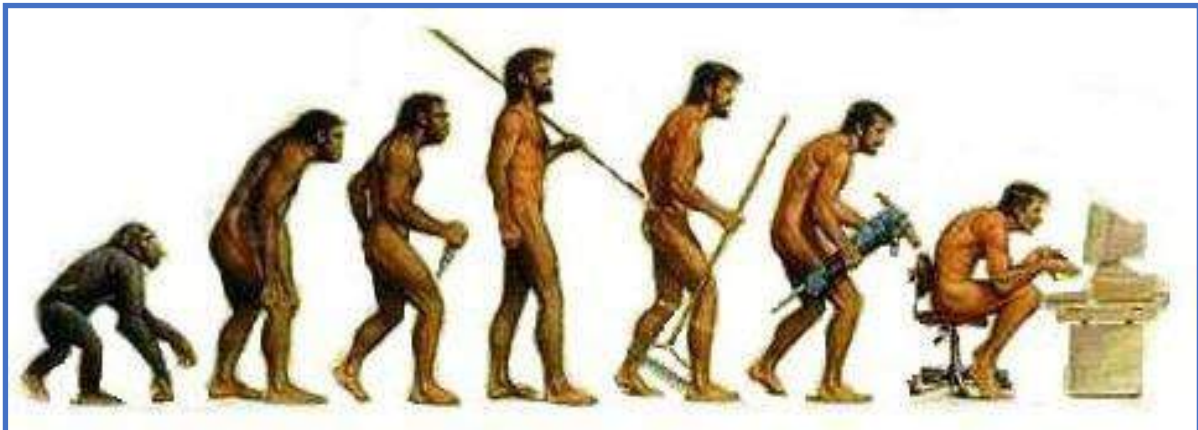
Human evolution is the lengthy process of change by which people originated from apelike ancestors. Genetic studies show that primates diverged from other mammals about 85 million years ago, in the Late Cretaceous period, and the earliest fossils appear in the Paleocene, around 5.5 million years ago. Scientific evidence shows that the physical and behavioral traits shared by all people originated from apelike ancestors and evolved over a period of approximately six million years.

Following pictures give rough idea of human evolutionary and migratory patterns:



4. CULTURAL EVOLUTION OF HUMAN:

Cultural evolution of *Homo sapiens* in the upper Pleistocene period taken place through by “**Cultural Revolution**” (Living in groups with protected life), “**Tool making Revolution**” (the use of fine tools for hunting about 2000 years ago), “**Agricultural Revolution**” (use of agricultural practices, settled life and domestication about 6000 years ago), and “**Scientific Industrial Revolution**” (use of improved techniques of food production, industrialization and medicine about 300 years ago). The first population explosion occurred during “**Tool making revolution**” and **second** and **third** during **agricultural and scientific industrial evolution** respectively.



5. FUTURE MAN (*Homo futuris*):

The organic evolution is a continuous process of nature, which is still continued at present and probably will remain in future too. It is believed that in future, human could be changed as a result of the factors like “**Gene mutation, gene recombination and natural selection**”.

According to the forecasting of H.L. Shapiro, an American anthropologist, the future man named *Homo futuris* will contain following characters

 <p>10,000 YEARS FROM NOW...</p>		<ul style="list-style-type: none">a. Height will be higherb. Hair will reduce and skull may become dome-shapedc. Body and cranium will be more developedd. The fifth finger may probably reducee. The age will increasef. Enlarged eyes
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Just Ponder: Advanced artificial intelligence could encapsulate the various components of human cognition and reassemble those components into something that is no longer human. Bostrom predicted the following course of events: “Some human individuals upload and make many copies of themselves”. Meanwhile there is gradual progress in neuroscience and artificial intelligence, and eventually it becomes possible to isolate individual cognitive modules and connect them up to modules from other uploaded minds.

ACTIVITIES:

2. Locate and rewrite the difficult key words from text book:

1	11	21
2	12	22
3	13	23
4	14	24
5	15	25
6	16	26
7	17	27
8	18	28
9	19	29
10	20	30

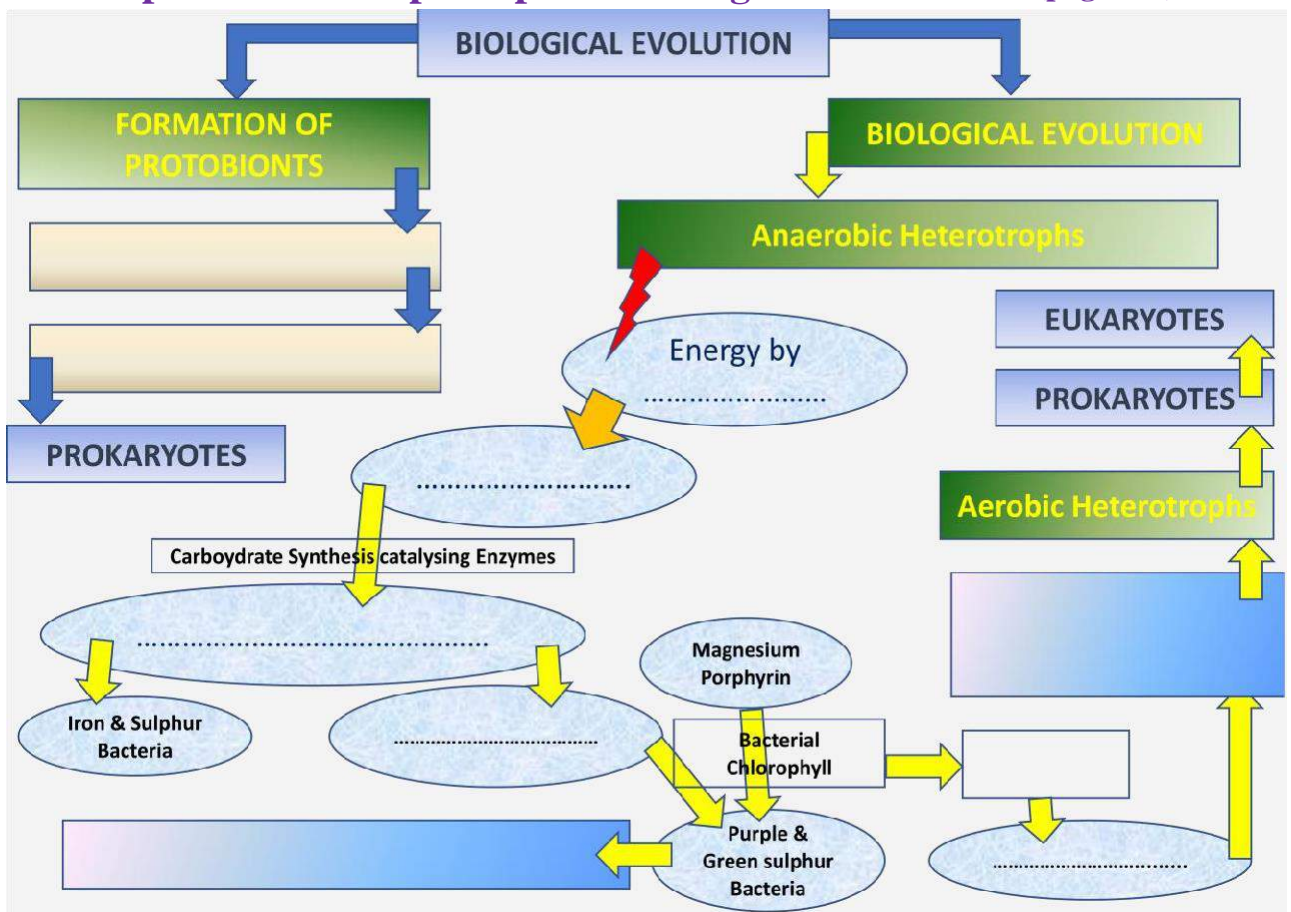
2. Define key words: (Search through the Text and write)

1. REDUCING ATMOSPHERE	
2. COASERVATES	
3. ANAEROBIC HETEROTROPHS	
4. ANOXYGENIC PHOTO- AUTOTROPHS	
5. RADIO CARBON DATING	
6. GEOLOGICAL TIME SCALE	
7. DIVERGENT EVOLUTION	
8. SPORTS OF NATURE	
9. ANAGENESIS	
10. CRO-MAGNAN MAN	

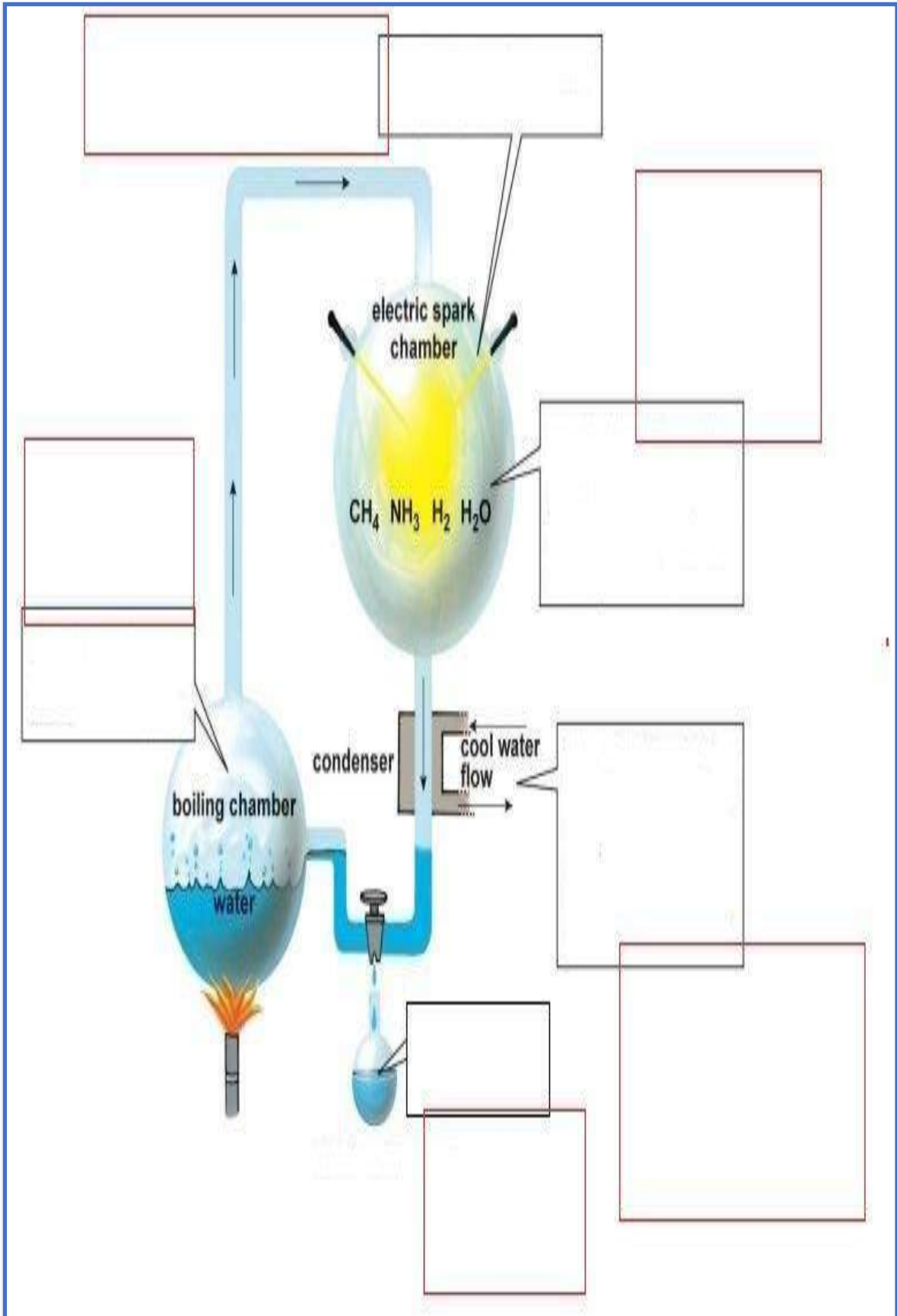
3. Match the scientists and their contributions (Rewrite in your notes)

A. Herbert Spencer	1. Theory of Biogenesis
B. Dobzhansky	2. Prebiotic Soup
C. Von Helmont	3. Ontogeny repeats Phylogeny
D. George Cuvier	4. Serological Tests – Anti Human Serum
E. Louis Pasteur	5. Philosophie Zoologique
F. Oparin & Haldane	6. Neo-Lamarck
G. J.B.S. Haldane	7. Theory of Catastrophism
H. Ernst Haeckel	8. Theory of spontaneous generation
I. H.F.Nuttal	9. Nothing in biology makes sense, but in the light of Evolution
J. Lamarck	10. The Principles of Populations
K. Osborn	11. Principles of Geology
L. Paul Kammarrer	12. Modern Synthetic Theory of evolution
M. Thomas Malthus	13. Industrial Melanism
N. Sir Charles Lyell	14. Coacervate Theory
O. Bernard Kettlewell	15. Proteus – Anguinus (Neo-Lamarckian)
P. Wright, Fisher & Mayr	16. Coined the term “Organic Evolution”
Q. Von Baer	17. Father of Modern Embryology

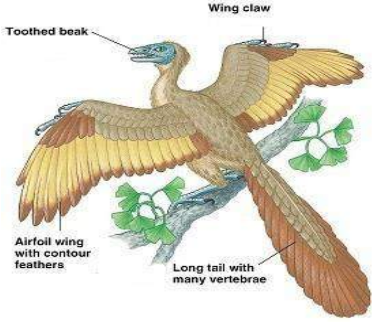
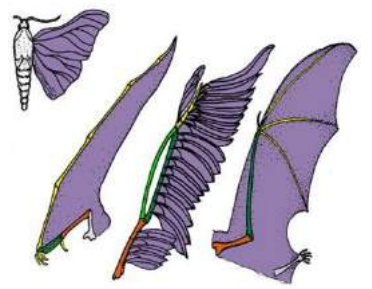
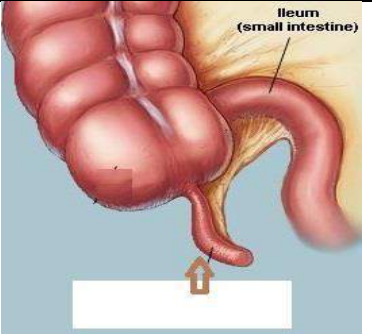

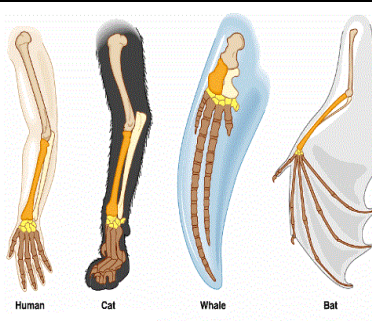
4. Complete the concept map for “Biological Evolution” (page 238)



5. **Relate, and Explore to Verify “The Urey –Miller Experiment”:**
(Label actual parts in **BLACK** boxes and simulations in **RED** boxes)



6. Look at the pictures– Identify the related concept and add a brief note:

PICTURE	Brief note
	a.
	b.
	c.
	d.
	e.


7. Note making on Theory of Natural Selection:



8. Understand Hardy – Weinberg equilibrium and solve:


The Hardy-Weinberg Principle

frequency of
homozygous dominant
genotype




p^2

frequency of
heterozygous
genotype



$2pq$



frequency of
homozygous recessive
genotype







q^2

$$p^2 + 2pq + q^2 = 1$$


Hardy-Weinberg Principle

Parent generation		
Phenotype	 YY	 Yy
Genotypic frequency	.49	.42
Number of individuals (total = 500)	245	210
Number of alleles in gene pool (total = 1000)	Y: 490 + 210 = 700	y: 210 + 90 = 300
Allelic frequency	$\frac{700 Y}{1000 \text{ total}} = .7 = p$	$\frac{300 y}{1000 \text{ total}} = .3 = q$

Hardy-Weinberg analysis

	p (.7)	q (.3)	
p (.7)	 YY $p^2 = .49$	 Yy $pq = .21$	
q (.3)	 Yy $pq = .21$	 yy $q^2 = .09$	
	p^2	$2pq$	q^2
	.49	.42	.09
	+	+	+
	.49	.42	.09
	=	=	=
	.98	.42	.09
	=	=	=
	.98	.42	.09
	=	=	=
	.98	.42	.09

\downarrow Predicted frequency of YY offspring
 \downarrow Predicted frequency of Yy offspring
 \downarrow Predicted frequency of yy offspring



$$p^2 + 2pq + q^2$$

Que: State the five conditions that are used when testing Hardy-Weinberg Principle.

Ans:

1

2

3

4

5

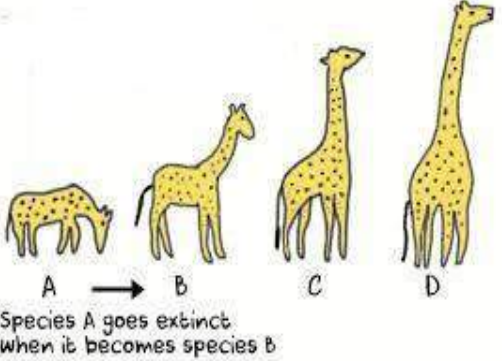
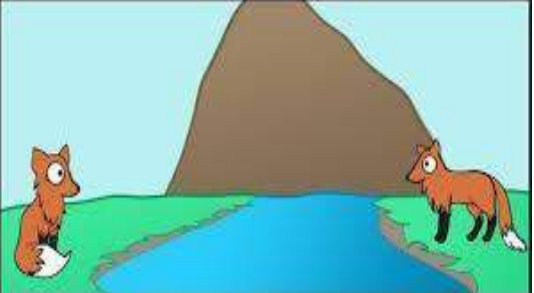
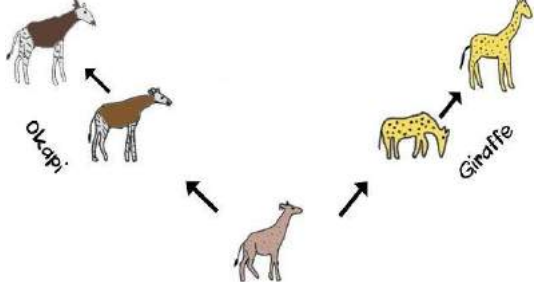
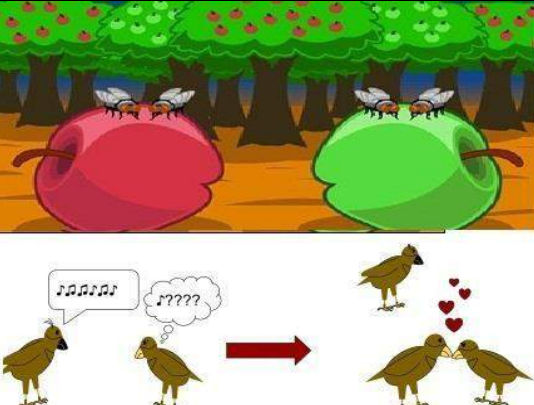
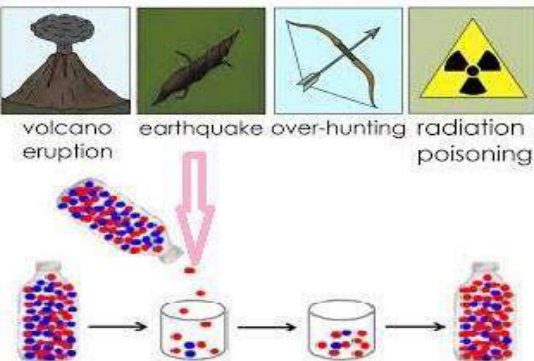
Solve :1. An investigator determined by the inspection that 16% of a human population has a recessive trait. Using this information, calculate all the genotypes and allele frequencies for the population, provided the conditions for Hardy-Weinberg equilibrium are met.

Solve:2. A population of animals found to be in Hardy-Weinberg equilibrium shows that 64% of them possess a dark brown coat. Assume the trait for coat color is inherited through simple dominance, and that dark brown is the dominant trait. What is the frequency of the recessive **allele** in this population?

Solve:3 The frequency of two alleles in a gene pool is 0.19 (A) and 0.81(a). Assume that the population is in Hardy-Weinberg equilibrium.

Solve:4. In a population that is in Hardy-Weinberg equilibrium, the frequency of the recessive homozygote genotype of a certain trait is 0.09. Calculate the percentage of individuals homozygous for the dominant allele.

9. Identify the type of “Speciation” and add brief note

 <p>A → B C D</p> <p>Species A goes extinct when it becomes species B</p>	<p>1</p>
	<p>2</p>
 <p>Okapi Giraffe</p>	<p>3</p>
	<p>4</p>
 <p>volcano eruption earthquake over-hunting radiation poisoning</p>	<p>5</p>

10. Identify and Define the Evolutionary forces:

	<p>Robins typically lay four eggs, an example of _____ selection. Larger clutches may result in malnourished chicks, while smaller clutches may result in no viable offspring.</p>	<p>1.</p>
	<p>Light-colored peppered moths are better camouflaged against a pristine environment; likewise, dark-colored peppered moths are better camouflaged against a sooty environment. Thus, as the Industrial Revolution progressed in nineteenth-century England, the color of the moth population shifted from light to dark, an example of _____ selection.</p>	<p>2.</p>
	<p>In a hypothetical population, gray and Himalayan (gray and white) rabbits are better able to blend with a rocky environment than white rabbits, resulting in _____ selection.</p>	<p>3.</p>
	<p>4.</p>	
	<p>5.</p>	

11. Fill in the blanks

1.	The early atmosphere of the earth was a chemically environment, whereas the present atmosphere is chemically Environment. The event's atmosphere from the first to the second type was the evolution of
2.	The category of molecules produced by Urey – Miller experiment was
3.	The first cells were almost certainly obtaining energy and nutrients from the organic molecules in their environment.
4.	The earliest form of cellular respiration must have been
5.	Much of the evidence in support of evolution is in the form of studied by Paleontologists.
6.	Evolved features that make organisms better suited to live and reproduce in their environment are called
7.	Darwin's observations of Galapagos island finches provided the evidences for, but not the inspiration.
8.	In natural selection, are selected for or against and evolve.
9.	A gene pool consists of all at all gene loci in all Of the population.
10.	An individual who survives to old age but leaves no offspring has a fitness of ...
11.	When co - adapted genes are located close together on the same chromosome, they form a
12.	Unusually large and small newborns have higher mortality rates than new borns of average weight. This is an example of .....selection.
13.	All successful organisms have a high biotic potential or
14.	..... Is the ultimate source of variations.
15.	Pterosporgia is a between Protozoa and Porifera.
16.	The appendix of man is thought to be remnant of the The storage organ for cellulose digestion in herbivorous mammals.
17.	In humans many indicate a relationship with other mammals , including the primates.
18.	Oparin's Also exhibit a simple form of metabolism.
19.	Evolution on the grand scale of geological time is called
20.	The unit of evolution is and the unit of natural selection is
21.	Mating between stallion (male horse) and female donkey results in a hybrid called
22.	Both mule and hinny are
23.	Humans belong to the family In which <i>Homo sapiens</i> is the only living species.
24.	Mammals evolved from primitive reptiles in early period, about 210 million years ago (MYA).
25.	The fossils of the “java man” and “Pecking man” belong to replaced by <i>Homo sapiens</i> .
26.	Seymouria (extinct reptile) is a between Amphibia and Reptilia.
27.	..... is the branch of science, deals with the improvement of human race genetically.
28.	..... is a living animal of ancient origin with many primitive characters.
29.	Species that morphologically look similar, but are reproductively isolated are called
30.	..... is the formation of one or more new species from an existing species.

12. Answer “TRUE” or “FALSE”

Sl.No	Statement	True/ False
1	Prebiotic evolution was controlled by the early atmosphere and climate.	
2	Ozone layer was present in Primitive atmosphere.	
3.	Primitive atmosphere was Oxidizing.	
4	Pasteur is famous for Germ theory of disease.	
5	C ¹⁴ radioactive carbon dating method is used for dating not only for fossils but also of archaeological remains.	
6	There was complete absence of living organisms in “Azoic Era”.	
7	Homologous structure have the same embryonic origin.	
8	Virus is a connecting link between plants and animals	
9	Ichthyosaurus were extinct fish like reptiles, which lived in ocean.	
10	The composition and physiological role of blood, lymph and tissue fluid are different in all vertebrates.	
11	Natural selection acts on phenotype, which reflects the underlying genotype.	
12	All genotypes are equally adaptive.	
13	Sexual selection favors traits that help an organism mate.	
14	Struggle for existence may be intra-specific but never inter-specific.	
15	The most accepted and recent theory of organic evolution is the “Mutation theory”	
16	The sum total of genes present in the reproductive individuals of a population constitute its “Gene Pool”	
17	Emigration is the migration of individuals in to the area.	
18	Bottle neck effect and Founder effect are two specific cases of “Genetic Drift”.	
19	The proportions of different alleles of gene present in a Mendelian population are known as “Gene Frequency”.	
20	Stabilizing selection favours average or normal individuals and eliminates overspecialized as well as less specialized individuals.	
21	Directional selection brings about progressive selection.	
22	Population genetics is the study of properties of genes in a single cell.	
23	Humans and apes are commonly called “Hominids”.	
24	The study of human evolution and culture is called “Phrenology”.	
25	Mitochondrial DNA is used to study of evolution because the DNA within mitochondria is transmitted only by females.	
26	Gibbons and Orangutans are closest relatives of humans.	
27	Competition for scarce resources favours the best adapted individuals.	
28	One major criticism against Darwin’s theory was his failure to give a satisfactory explanation for variations.	
29	Birbal Sahni is called “Father of Indian Palaeobotany”.	
30	Precambrian period comprises about 87% of the Geological time Scale.	
31	Age of man or epoch of human civilization is Pleistocene.	
32	Atavism is the sudden reappearance of some ancestral organs.	
33	Biogenetic Law states that, “Ontogeny is recapitulation of Phylogeny”.	
34	The process of destroying all living organisms is called “Sterilization”.	
35	Louis Pasteur experimented with swan necked flask, which provided access to air but not to micro organisms.	

Multiple Choice Questions for Competitive exams

1.	The origin of life on earth can be traced to A. Micro organisms from the other planets B. Some compounds formed on primitive earth C. God's Will D. Protista
2.	The oldest eukaryotic fossil is about A. 3.5 Billion years old B. 2.5 Billion years old C. 1.5 Billion years old D. 0.5 BYO
3.	Biogenetic law of Von Baer & Ernst haeckel is A. Phylogeny repeats ontogeny B. Ontogeny repeats phylogeny C. Ontogeny never repeats phylogeny D. Ontogeny and phylogeny are cyclic
4.	Evidence from fossils records are obtained by calculating age of fossil found in– A. Metamorphic rock B. Sedimentary rocks C. Igneous rocks D. Earth crust
5.	Which of the following gases was not present in free form at the time life originated on the earth? A. Ammonia B. oxygen C. Hydrogen D. Metane
6.	Which type of respiration probably arose first? A. Aerobic as it releases more energy B. Anaerobic as it releases more energy C. Aerobic as it is a more complex process D. Anaerobic as early atmosphere contained little or no Oxygen.
7.	Origin of life as a result of chemical evolution has been properly explained by or the most logical biochemical theory of origin of life has been given by A. Stanely Miller B. Darwin C. AI Oparin D. S.fox
8.	Darwin's theory of pangensis was refuted by- A. Recapitulation theory B. Theory of Germplasm C. Chromosome theory D. Theory of biogenesis
9.	Coacervates belong to category of A. Cyanobacteria B. Protozoans C. Molecular Aggregates D. Molecular aggregates surrounded by lipid membrane.
10.	In the early earth , organic acids were produced by the combination of H₂ with A. Ammonia and methane B. Hydrogen C. Organic matter D. Hydrogen sulphide
11.	Which one of the following is incorrect about the characteristics of protobionts (Coacervates and microspheres) as envisaged in the abiogenic origin of life? A. They were able to reproduce B. They could separate combinations of molecules from the surroundings C. They were partially isolated from the surroundings D. They could maintain an external environment
12.	The concept of chemical evolution is based on A. Crystallization of chemicals B. Interaction of water, air and clay under intense heat C. Effect of solar radiation on chemicals D. Possible origin of life by combination of chemicals under suitable environmental conditions
13.	Mutation theory of Hugo de vries was put forward while working on- A. Drosophila B. Ancon sheep C. Oenothera amarckiana D. Antirrhinum
14.	Evolution at genetic level is termed as- A. Microevolution B. Macroevolution C. Gene Evolution D. Point mutation

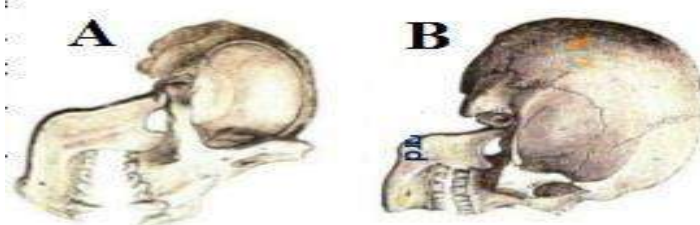
15.	The oldest microfossil so far of age 3.5 billion year ago was- A. Coacervates B. Eobionts C. Microspheres D. Cyanobacteria
16.	There is no life on moon because of the absence of A. Water B. Oxygen C. Nitrogen D. Hydrogen
17.	Which one of the following amino acid was not found to be synthesized in Urey - Miller's experiment? A. Glycine B. Aspartic Acid C. Glutamic acid D. Alanine
18.	The possible early source of energy was A. Chlorophyll B. carbon dioxide C. UV radiation and lightning D. Green plants
19.	Experimental evidence for molecular evolution of life was provided by- A. Oparin B. Haldane * C. Urey and Miller D. Sydney fox
20.	During pre-biotic origin of life which chemical played important role in formation of nucleotide specially guanosine? A. CH ₄ B. CO ₂ C. NH ₃ D. HCN
21.	Your arm is homologous with A. A seal flipper B. An octopus tentacle C. A bird wing D. Both A & C
22.	Which of the following are fossils ? A. Pollen grains buried in the bottom of peat bogs B. The petrified cast of clam's burrow C. The impression, a clam shell made in mud, preserved in mud stones D. All the above
23.	Among the following which molecule till now not synthesized by mimicking the environment of pre-biotic environment- A. Ribose B. Pyrimidines C. Purine D. L-aminoacids
24.	Among the following the evidence of evolution from biogeography is- A. Embryo development B. Plate tectonics C. Darwin finches D. Darwin turtles
25.	Thorns of Bougenwalia plant and tendril of cucurbits are- A. Homologous organs B. Paralougous organ C. Analogous organ D. Orthologous organ
26.	Placental mammals such as mouse, wolf, Australian marsupials such as marsupial mouse, Tasmanian wolf shows- A. Parallel evolution B. Convergent evolution C. Divergent evolution D. Phyletic evolution
27.	Which of the following is not an vestigial organ in humans- A. Ear muscles B. Tail vertebra C. Premolar D. Appendix
28.	Which of the following was earliest form with lipid bilayer and can reproduce by budding- A. Coacervates B. Micro spheres C. Protobionts D. Monospheres
29.	Which of them do not cause variation at genetic level- A. Mutation and recombination B. Gene migration and drift C. Natural selection and artificial selection D. Panmictic population
30.	The raw material for evolution is variability of gene or allele at/in- A. individual level B. population C. gene pool D. community
31.	All organisms share the common genetic code. This commonality is in evidence that A. The evolution is occurring now B. The convergent evolution has occurred C. The evolution occurs gradually D. All the organisms are descended from a common ancestor

32.	Founder effect is concerned with- A. Gene migration B. Genetic drift C. Natural selection D. Mutation
33.	If the individual at one extreme of the size distribution (eg., larger one) contribute more offspring to next generation then such selection is called as- A. Directional B. Disruptive C. Cyclic D. Stabilizing
34.	Examples of polymorphism in human is- A. ABO blood group B. Sickle cell anaemia C. height and Intelligence D. All of the above
35.	When the preservation of genetic variability is through heterozygote superiority is termed as- A. Heteropolymorphism B. Balanced polymorphism C. Stabilizing polymorphism D. Directional polymorphism
36.	Type of speciation due to polyploidy is- A. Allopathic B. Parapatric C. Peripatric D. Sympatric
37.	When the two species are morphologically almost identical but reproductively isolated, are termed as- A. Taxonomic species B. Ecotypes C. Sibling species D. Morphospecies
38.	Which of the following is not a prerequisite for natural selection's operation? A. More offspring than can possibly survive B. Differential reproduction C. An innate desire to change resources D. Competition for resources
39.	During the evolution of man, the first human like being was A. Homo sapiens B. Homo habilis C. Ramapithecus D. Dryopithecus
40.	Random evolutionary changes in a small breeding population is known as: A. Gene flow. B. Genetic drift C. Disruptive selection. D. Natural selection
LEVEL – 2 (and Medical Entrance Archives)	
41.	Prodigality of reproduction in Darwinism refers to (MHT –CET 2004) A. Every organism produces numerous offsprings B. Successful organisms produces numerous offsprings C. Only a few organisms are able to reproduce D. Only a few organisms are able to survive
42.	Darwinism explains all the following except (KCET 2009) A. Within each species there are variations B. Organisms tend to produce more number of offspring than can survive C. Offspring with better traits that overcome competition, one best suited for the environment. D. Variations are inherited from parents to offspring through genes
43.	“Every cell of the body contributes gemmulae to the germ cells and so shares in the transmission of inherited characters”. This theory is known as (KCET 2003) A. Theory of inheritance of acquired characters B. Theory of germ plasm C. Theory of Pangenesis D. Theory of Mutations
44.	Marine mammals have many structural characteristics in common with fishes. The explanation that evolutionary theory would give for this similarity is: A. Fish and mammals are closely related B. Fish evolved structures similar to those already existing in mammals C. Marine mammals evolved directly from the fishes D. Marine mammals adapted to an environment similar to that of the fishes

45.	A sudden major climatic change would most likely initially result in: A. A rapid increase in adaptive radiation rates B. A rapid increase in extinction rates C.. A sharp increase in numbers of species D. An increase in mutation rates
46.	Which of the following best represents Lamarck's ideas on the evolutionary process? A. Survival of the fittest B. Inheritance of acquired characteristics C. Neutral drift D. Punctuated equilibrium
47.	With respect to the alleles for sickle cell anemia, which genotype(s) is (are) at a disadvantage to persons residing in tropical areas of Africa? A. Homozygous recessive B. homozygous dominant C.. Heterozygous D. both heterozygous and homozygous dominant
48.	Individual species will continually evolve as a result of: A. coevolution. B. convergent evolution. C. punctuated equilibrium. D. natural selection.
49.	According to Lamarckism long necked Giraffes evolved because (KCET 2002) A. Nature selected only long necked ones B. Short necks suddenly changed into long necks C.. Human preferred only long necked Giraffes D.. Of stretching of necks over many generations by short necked ones
50.	“Descent with modification” is the main theme of (PbCET-2007) A. Genetics and Interpretation B. Biogenesis C. Recapitulation D. Evolution
51.	Darwin proposed that the new species evolve from ancestral forms by (PMET 2005) A. The gradual accumulation of adaptations to changing environment B. The inheritance of acquired adaptations to changing environment C. The struggle for limited resources D. The accumulation of mutations
52.	“Human Population grows in geometric ratio, while food materials increase in arthmatic proportions”. It is a statement from A. Darwin B. bateson C. Malthus D. Amritya sen
53.	Darwin finches refers to (UPCPMT – 2009) A. Fossils of birds collected by Darwin at Galapagos islands B. A type of birds present on Galapagos islands C. Migratory birds collected by Darwin at Galapagos islands D. Fossils of reptiles collected by Darwin at Galapagos islands
54.	Evolutionary modifications that improve the survival and reproductive success of an organism are called: A. Mutations. B. Vestigial structures. C. Homoplastic traits. D. Adaptations
55.	When populations with separate ancestors adapt in similar ways to similar environmental constraints, it is referred to a A. Biogeography. B. Coevolution. C. Convergent evolution D. Homologous evolution.
56.	If a population of 1000 individuals has 160 aa genotypes, the genotype frequency of the aa genotype is: A. 0.016. B. 0.08. C. 0.16 D. 0.8.

57.	If a population of 1000 individuals has 160 aa genotypes, assuming simple dominance by the A allele, the phenotype frequency of the dominant phenotype is: A. 0.08. B. 0.16. C. 0.42. D. 0.84
58.	What is the correct equation for the Hardy-Weinberg principle? A. $p^2 + 2pq + q^2 = 100$ B. $p^2 + 2p + 2q + q^2 = 1$ C. $p^2 - 2pq + q^2 = 1$ D. $p^2 + 2pq + q^2 = 1$
59.	In the Hardy-Weinberg equation, the term q^2 refers to the frequency of: A. the recessive allele at a given locus. B. the homozygous recessive genotype at a given locus C. the recessive alleles in a given population. D. the heterozygotes in a population.
60.	Which of the following causes changes in allele frequencies? A. genetic drift B. natural selection C. gene flow from migration D. All of these.
61.	Due to a rapid change in the environment, a population of ants was reduced from 1 million to 1 thousand. What type of genetic drift will occur in the gene pool of this population when it expands again? A. The founder effect B. Migration C. A genetic bottleneck effect D. Gene flow
62.	The wing of the bat and the fore-limb of the dog are said to be homologous structures. This indicates that: A. They have the same function B. Bats evolved from a lineage of dogs C. They are structures which are similar due to common ancestry D. The limb bones of each are anatomically identical
63.	Theory of abiogenesis or spontaneous generation was finally disapproved by A. Louis Pasteur B. A.I.Oparin C. A.R.Wallace D.Sydney Fox
64.	Chronological sequence of evolution of the genus Homo are A. Homo habilis – H.erectus -- H.neander -- H.sapiens sapiens B. Homo habilis – H.sapiens neanderthalensis -- H.sapiens sapiens C. Homo erectus – H.habilis -- H.sapiens sapiens -- H.sapiens neanderthalensis D. Homo neanderthalensi – H.erectus -- H.sapiens sapiens -- H.habilis
65.	Which of the following fossil man possessed a cranial capacity almost equal to that of modern man? A. Neanderthal man B. Java ape man C. Peking man D. Australopithecus africanus
66.	Which statement best characterizes natural selection? A. Blind, random chance hitting upon lucky combinations B. The slow accumulation of adaptive mutations C. Absolute dependence on carbon-based biochemistry D. Organisms perishing when unexpected calamities occur
67.	Which one of the following sequences was proposed by Darwin and Wallace for organic evolution? (CBSE-AIPMT 2003) A. Overproduction, Variations, Constancy of population size, Natural Selection B. Variations, Constancy of population size, Overproduction, Natural Selection C. Overproduction, Constancy of population size, Variations, Natural Selection D. Variations, Natural Selection, Overproduction, Constancy of population size,
68.	Which one of the following phenomenon supports Darwin's concept of natural selection in organic evolution? A. Development of transgenic animals B. Production of "Dolly" the sheep by cloning C. Prevalence of pesticide resistant insects D. Development of organs from "stem cells" for organ transplantation

69.	Which of the following statements is correct? (AFMC 2006) A. Genetic variability provides raw material for operation of natural selection and reproductive isolation B. Genetic variability is produced by somatic mutation C. Somatic mutations are inherited D. None of these
70.	The objections to Darwin's theory of natural selection is/are (AIIMS 2006) A. No differentiation between somatic and germinal variations B. It fails to explain the role of discontinuous variations C. It fails to explain the possible reason behind over speciation D. All the above
71.	The biogenetic law of Haeckel is A. <i>Omnis vivum – e – vivum</i> B. <i>Omnis cellula – e – cellula</i> C. Ontogeny repeats Phylogeny D. Phylogeny repeats Ontogeny
72.	Darwin Finches are an excellent example of (CBSE-AIPMT 2009) A. Adaptive radiation B. Seasonal Migration C. Brood Parasitism D. Connecting Links
73.	In the case of peppered moth (<i>Biston betularia</i>), the black coloured form became dominant over the light coloured form in England during industrial revolution. This is an example of A. Natural selection, whereby the darker forms are selected B. Appearance of the dark colored individuals due to very poor light (CBSE-AIPMT 2009) C. Protective mimicry D. Inheritance of dark coloured character acquired due to the darker environment.
74.	Select the correct statement from the following (CBSE –AIPMT 2007) A. Darwinian variations are small and directionless B. Fitness is the end result of the ability to adapt and gets selected by the nature C. All mammals except whales and camels have cervical vertebrae D. Mutations are random and directional.
75.	In random mating population in equilibrium, which of the following brings about a change in gene frequency in a non-directional manner? (CBSE-AIPMT 2003) A. Mutations B. Random shift C. Selection D. Migration
76.	Random Genetic Drift in a population probably results from (CBSE-PMT 2003) A. High genetically variable individuals B. Inter-breeding within this populations C. Constant low mutation rate D. Large population size
77.	Forthcoming generations will be less adaptive than the present generation due to A. Genetic Drift B. adaptation C. Mutation D. Natural selection (CBSE-AIPMT 2001)
78.	Frequency of an allele may change in a isolated population due to (CBSE-AIPMT 2001) A. Genetic Drift B. adaptation C. Mutation D. Natural selection
79.	The Hardy-Weinberg law of equilibrium was based on the following (AIIMS 2006) A. Random mating, Selection , Gene flow B. Random mating. Genetic drift, Mutation C. Non-random mating, Mutation, gene flow D. Random mating, No mutation, No gene flow, and No genetic drift
80.	Peppered moth (<i>Biston betularia</i>) is an example of (BHU 2006) A. Transient Polymorphism and Disruptive Selection B. Transient Polymorphism and Directional Selection C. Balanced Polymorphism and Disruptive Selection D. Balanced Polymorphism and Directional Selection

81.	Gene pool of a population tends to remain stable if the population is large, without large scale mutations, without migration and with (BHU 2000) A. Random mating B. Moderate environmental changes C.. Natural selection D. Reduction in predators
82.	In an industrial area, a dark peppered moth is able to survive in contrast to light coloured moth because (Manipal 2002) A. It is able to reproduce more B. It is naturally selected in the smoky environment C. It shows mimicry D. It undergoes lethal mutations
83.	In modern synthetic theory, the unit of evolution is A. Genus B. Species C. Population D. Individual
84.	Sickle cell anaemia is an example of (KCET-2006) A. Balanced Polymorphism B. Transient polymorphism C.. Balanced Polymorphism and natural selection D. All of the above
85.	There are two opposing views about the origin of modern man. According to one view, <i>Homo erectus</i> in Asia were the ancestors of modern man. A study of variations in DNA however suggested African origin of modern man. What kind of observation on DNA variation could suggest this? (CBSE-AIPMT 2005) A. Greater variation in Africa than in Asia B. Variation only in Asia and no variation in Africa C. Greater variation in Asia than in Africa D. Similar variation in Africa and Asia
86.	What evidence suggests that the chimpanzees is more closely related to humans than other hominoid apes? (CBSE – AIPMT 2004) A. DNA from sex chromosomes only B. Chromosomes morphology only C.. Fossil remains D. DNA of both autosomes and sex chromosomes
87.	Which of the following is irrelevant in the evolution of man? A. Loss of tail B. B. Protection of hand in tool making C.. Increase in the ability to communicate with others and develop community behavior D. Change of diet from hard nuts and hard roots to soft food.
88.	The illustration shows the skull of two different mammals. Use the illustration to answer the question that follows:  Which of the following accurately describes the differences between these skulls? A. Skull (A) has more teeth than Skull (B) B. Skull (A) has more brain capacity than Skull (B) C. Skull (A) is of Primate and skull (B) is not of a Primate D. Skull (A) is the skull of an ape because of simian gap and Skull (B) is of the human

89.	Which of the following is not true? A. About 15 mya, primates <i>Oryopithecus</i> and <i>Ramapithecus</i> existed B. <i>Ramapithecus</i> was more ape like C. <i>Homo erectus</i> has a large brain capacity about 900 cm ³ D. The brain capacities of <i>Homo habilis</i> were between 650 cm ³ and 800 cm ³
90.	A living connecting link that provides evidence of organic evolution : (CPMT 2009) A. Sphenodon between reptiles and birds B. Archaeopteryx between reptiles and birds C.. Lung fishes between pisces and reptiles D. Duck-billed platypus b/n reptiles and mammals
91.	Vestiges of girdles are found in A. Rattle snake B. Krait C. Cobra D. Python
92.	Which is the correct order in evolutionary history of man? (CBSE-AIPMT 2001) A. Peking man – Habilus man – Neanderthal man – Cro-magnon man B. Peking man – Heidelberg man – Neanderthal man – Cro-magnon man C. Peking man – Neanderthal man – Homo sapiens – Heidelberg man D. Peking man – Homo sapiens - Neanderthal man – Cro-magnon man
93.	Fossil evidences indicates that the original place for start of human evolution was (CBSE-AIPMT 2001) A. Java B. France C, Africa D. China
94.	What kind of evidence suggested that the man is more closely related with chimpanzee than with other hominoid apes? (Manipal 2007) A. Evidence from DNA from sex chromosomes only B. Comparison of chromosomes morphology only C. Evidence from fossil remains and the fossil mitochondrial DNA only D. Evidence from DNA extracted from the sex chromosomes, autosomes and mitochondria.
95.	<i>Homo erectus erectus</i> is the scientific name of A. Java ape man B. Pecking man C. Cro-magnan man D. Neanderthal man
96.	Most primary hominoid appeared in (AMU 2005) A. Pleistocene B. Early Miocene C. Late Miocene and early Pliocene D. Late Pliocene
97.	The first mammal occurred in which era-period? (UPCPMT – 2003) A. Permian – Paleozoic B. Triassic – Mesozoic C.. Tertiary – Cenozoic D. None of these
98.	Which one of the following ape is found in India. A. Gorilla B. Gibbon C. Chimpanzee D. Orangutan
99.	Evolution of man occurred because the ape like ancestors had (CET Chd. 2003) A. Large Cranium B. Migratory Habits C. Development of brain D. Binocular Vision.
100.	During evolution of man..... came after Dryopithecus. A. <i>Ramapithecus</i> B. <i>Procunsul</i> C. <i>Shivapithecus</i> D. <i>Austrlopithecus</i>

13. Assertion & Reasoning Questions

<p>In each of the following question a statement of Assertion (A): is given followed by a corresponding statement of Reason (R): just below it. Of the statements, mark the correct answer as</p> <p>A. If both assertion and reason are true and reason is the correct explanation of assertion B. If both assertion and reason are true but reason is not the correct explanation of assertion C. If assertion is true but reason is false D. If both assertion and reason are false</p>	
1	<p>Assertion (A): Coacervates are believed to be the precursors of life. Reason (R) : Coacervates are self duplicating aggregates of proteins surrounded by proteins. (AIIMS 2008)</p>
2	<p>Assertion (A): The earliest organisms that appeared on the earth were non-green and presumably anaerobes. Reason (R) : The first autotrophic organisms were chemoautotrophs that never released oxygen. (AIIMS 2008)</p>
3	<p>Assertion (A): The primitive atmosphere on earth was reducing type. Reason (R) : The primitive photo-autotrophs were anoxygenic. (AIIMS 2008)</p>
4	<p>Assertion (A) : We have lost all the direct evidences of origin of life. Reason (R) : The person responsible to protect the evidence were not skilled.</p>
5	<p>Assertion (A): Homologous organs have common ancestry and similar function. Reason (R): Analogous organs have unlike origin and dissimilar function.</p>
6	<p>Assertion(A) : Atavism is the reappearance of disappeared ancestral characters. Reason (R) : Third molars and hair on the body are examples of Atavism.</p>
7	<p>Assertion (A): Amphibians have evolved from fishes. Reason (R): Archaeopteryx is a fossil linking fishes and amphibians.</p>
8	<p>Assertion (A): There is more competition for survival between similar animals of the same niche. Reason (R): Intra-specific competition occurs between different species.</p>
9	<p>Assertion (A): Lamarkism is based on “Inheritance of Acquired Characters”. Reason (R): August Weisman disproved the Lamarkism.</p>
10	<p>Assertion (A): Darwin regarded discontinuous variations more important than continuous variations. Reason (R): The survival of the fittest is a result of selection and proliferation of fittest organisms.</p>
11	<p>Assertion (A): Genes may be added to gene pool by immigration from other gene pool and mutations. Reason (R): Genes are removed from gene pool by natural selection and chance elimination of alleles, which takes place in small populations.</p>
12	<p>Assertion (A): Founder principle is associated with the genetic drift. Reason (R): Genetic drift is significant in small populations.</p>
13	<p>Assertion (A): Gene floe increases genetic variations. Reason (R): The random introduction of new alleles into recipient population and their removal from the donor population affects allele frequency.</p>
14	<p>Assertion (A): Dominant alleles are selected more frequently than recessive alleles. Reason (R): Dominant alleles appear in phenotype more frequently.</p>
15	<p>Assertion (A): Mules fail to produce functional gametes. Reason (R): Mule shows hybrid sterility.</p>
















16	Assertion (A): Cranial capacity of Cro-magnan man was 1600 cc. Reason (R): Modern man has higher cranial capacity than Cro-magnon man.
17	Assertion (A): Interspecific hybrids are usually sterile. Reason : Interspecific hybrids receive chromosomes from two different species.
18	Assertion (A): Artificial selection is highly beneficial for humans. Reason (R): Artificial selection is carried out by man.
19	Assertion (A): Sympatric species are geographically isolated. Reason (R): Sympatric species are reproductively isolated.
20	Assertion (A): A single mutation may produce a new species. Reason (R): Mutation may cause major variations in genetic material and these are inheritable.
21	Assertion (A): Bird's embryo shows tooth buds for some time. Reason (R): Ontogeny repeats Phylogeny.
22	Assertion (A): Lung fish is a connective link between fishes and amphibians. Reason (R): Lung fishes show characters of both fishes and amphibian.
23	Assertion (A): Batesian mimicry is a form of mimicry in which an edible species resembles an inedible one. Reason (R): Batesian mimicry is a form of protective mimicry.
24	Assertion : Theory of special creation attributes the origin of life to a vital event. Reason (R): According to this theory, the God is creator of life.
25	Assertion (A): The earliest organisms were anaerobes, having arisen in a sea of organic molecules, and were chemoheterotrophs. Reason (R): Before the supply of organic molecules exhausted, some of the heterotrophs might have evolved into autotrophs.
26	Assertion (A): There are chances of breakdown of isolating mechanism in allopatric speciation. Reason (R): Allopatric speciation is rapid process of speciation.
27	Assertion (A): There is no life on moon Reason (R): Water is absent on moon.
28	Assertion (A): Somatic mutations are sometimes inheritable. Reason (R): Some organisms show vegetative reproduction.
29	Assertion (A): Change in structure of chromosome is "Chromosomal Aberration". Reason (R): Substitution is an example of Chromosomal aberration.
30	Assertion (A): Protein similarity in human and chimpanzee is maximum through the serum test. Reason (R): The book "Man's Place in nature" was written by T.H.Huxley.

14. Assignment Questions to answer

VSAQ***	1	What are Panspermia? 2. Define "Biogenetic law. Give an example.
**	3	Define Atavism with an example.
***	4	What is meant by genetic Load? Give an example.
***	5	Distinguish between Allopatric and Sympatric speciation.
SAQ***	1	Distinguish between Homologous and Analagous organs.
***	2	Write a short note on the theory of Mutations.
***	3	Explain Darwin's theory of Natural Selection with "Industrial Melanism"
***	4	Discuss the role of different patterns of selections in evolution.
***	5	Write a short note on Neo-Darwinism.
***	6	What is meant by Genetic drift? Explain citing Founder Effect.

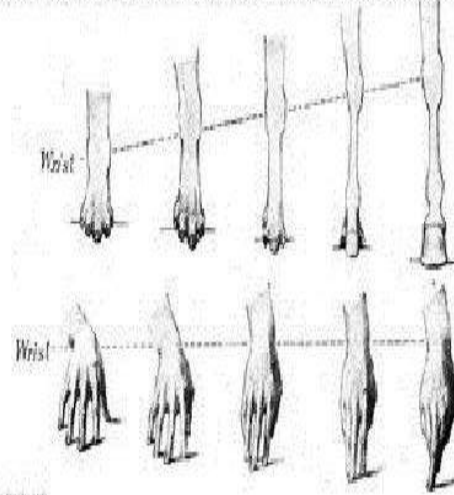
15. Hands on Experiences for you – Try to know on internet!!!

1. Understand evolution of Horse Leg:

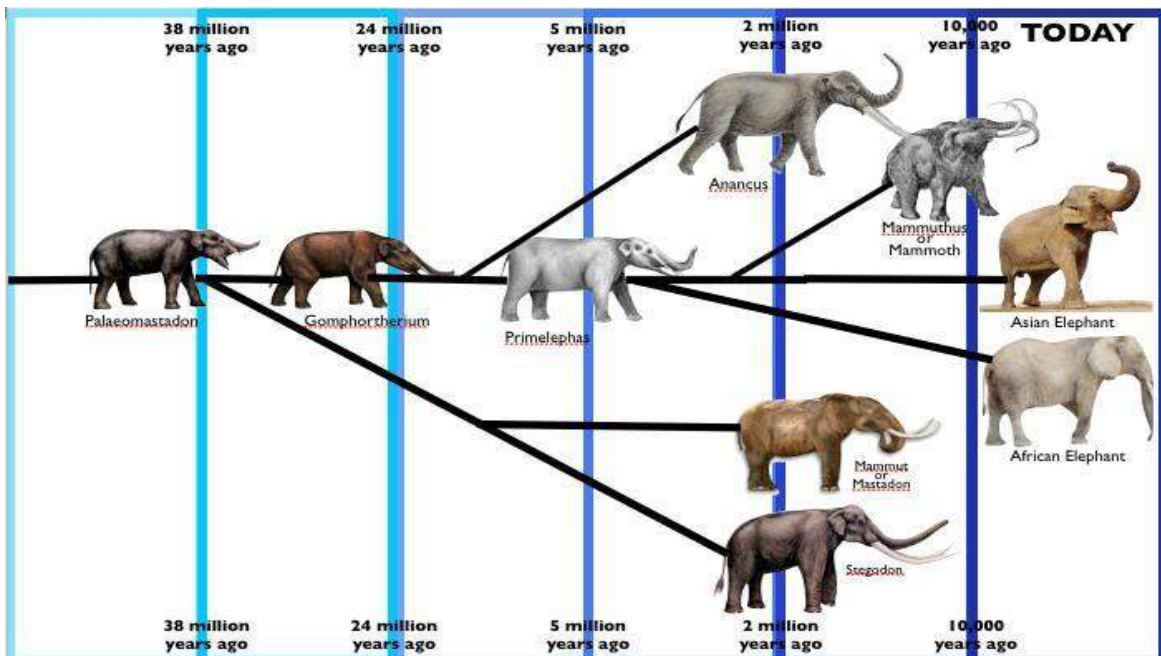
Equus	Pliohippus	Merychippus	Mesohippus	Hyracotherium
				
1 million years ago	10 million years ago	30 million years ago	40 million years ago	60 million years ago
1.6m	1.0m	1.0m	0.6m	0.4m
 Single hoof, runs quickly over hard ground	 Other toes lost as only middle hoof used	 Middle toe developed into a hoof, to run faster	 Toe lost for moving faster over dry ground	 4 toed hoof, well spread for walking on soft ground
				

HOMOLOGOUS STRUCTURES

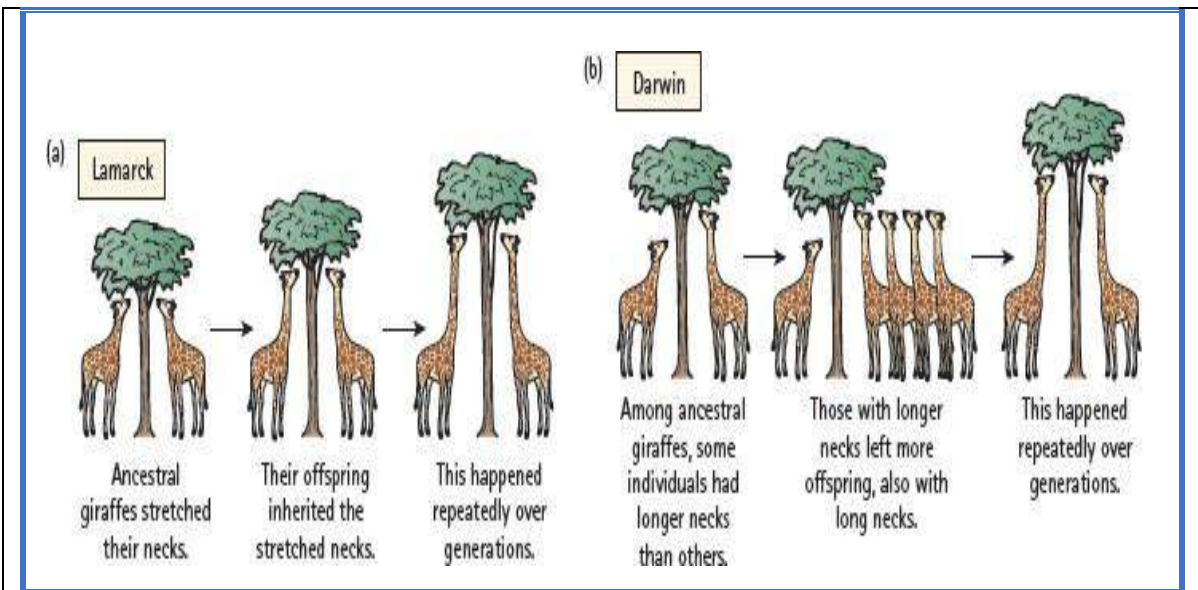
Sometimes, scientists can look at the homologous structures shared by the two organisms. Remember that a homologous structure is a structure that shows how certain species have inherited a trait from an ancestor.



2. Appreciate evolution of Elephant Trunk:

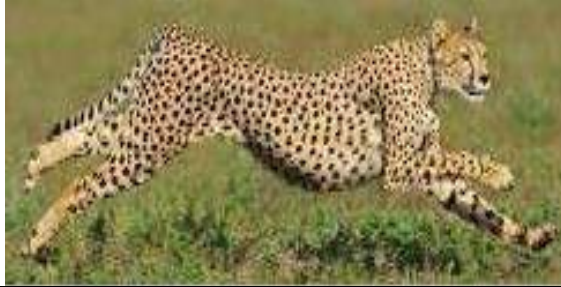






3. Relate : Who you are ? – Lamarckian or Darwinian?



Write Your Insights here:

4. Try to answer the following questions (Group discussion):

1		<p>Cheetahs are able to run faster than 60 miles per hour when chasing prey. How would a biologist explain how the ability to run these fast evolved in cheetahs, assuming their ancestors could only run 20 miles per hour?</p>
2		<p>Polar bears have white fur that blends in well with their snowy surroundings. This helps polar bears stalk and hunt seals. Polar bears are believed to have evolved from bears that had brown fur. How would a biologist explain how the white fur of polar bears evolved from bears with brown fur?</p>
3		<p>Flying squirrels have folds of skin between their front and back legs that allow them to glide (although not fly) between trees. How would a biologist explain how flying squirrels evolved these folds of skin, assuming their ancestors did not have these folds?</p>
4		<p>Eagles have keen eyesight that allows them to spot mice and other prey while soaring high above the ground. How would a biologist explain how eagles evolved their keen eye sight, assuming their ancestors had less keen eyesight?</p>
5		<p>Camels store fat in their humps, which allows them to travel for long distances without eating. How would a biologist explain how camels evolved their humps, assuming their ancestors did not have humps?</p>
6		<p>Whales are large mammals with streamlined bodies that allow them to swim easily in the ocean. Unlike most mammals, whales do not have hind limbs. How would a biologist explain how whales lost their hind limbs, assuming their ancestors had hind limbs?</p>

5. Amazing!!!! Where in the world is your DNA from?

Your DNA can tell you where your ancestors lived more than 500 years ago. Explore your ancestry's breakdown by region, including East Asia, Sub-Saharan Africa and Europe, with results becoming more refined as our database continues to grow. Explore the website: <https://www.23andme.com/en-int/dna-ancestry/> (Search Question: Know your genomic Ancestry).

Some of the most innovative ancestry features that let you drill down into the details:

- **Inheritance Tracing:** Trace how certain populations were passed down through different generations – which is more interesting if you have family members in the database
- **Ancestry percentages to the 0.1%:** We provide estimates of your ancestry percentages down to the 0.1%, and we also give you the option to explore results with different confidence levels
- **Breakdown of ancestry:** See how your DNA breaks out across the 2000+ regions worldwide
- **Compare DNA Relatives' segments:** In the DNA Relatives tool, see overlapping chromosome segments between you and your matches and compare them with up to 5 other matches at a time to help you triangulate new relatives for your family tree.

▪ **More on: results for women.**

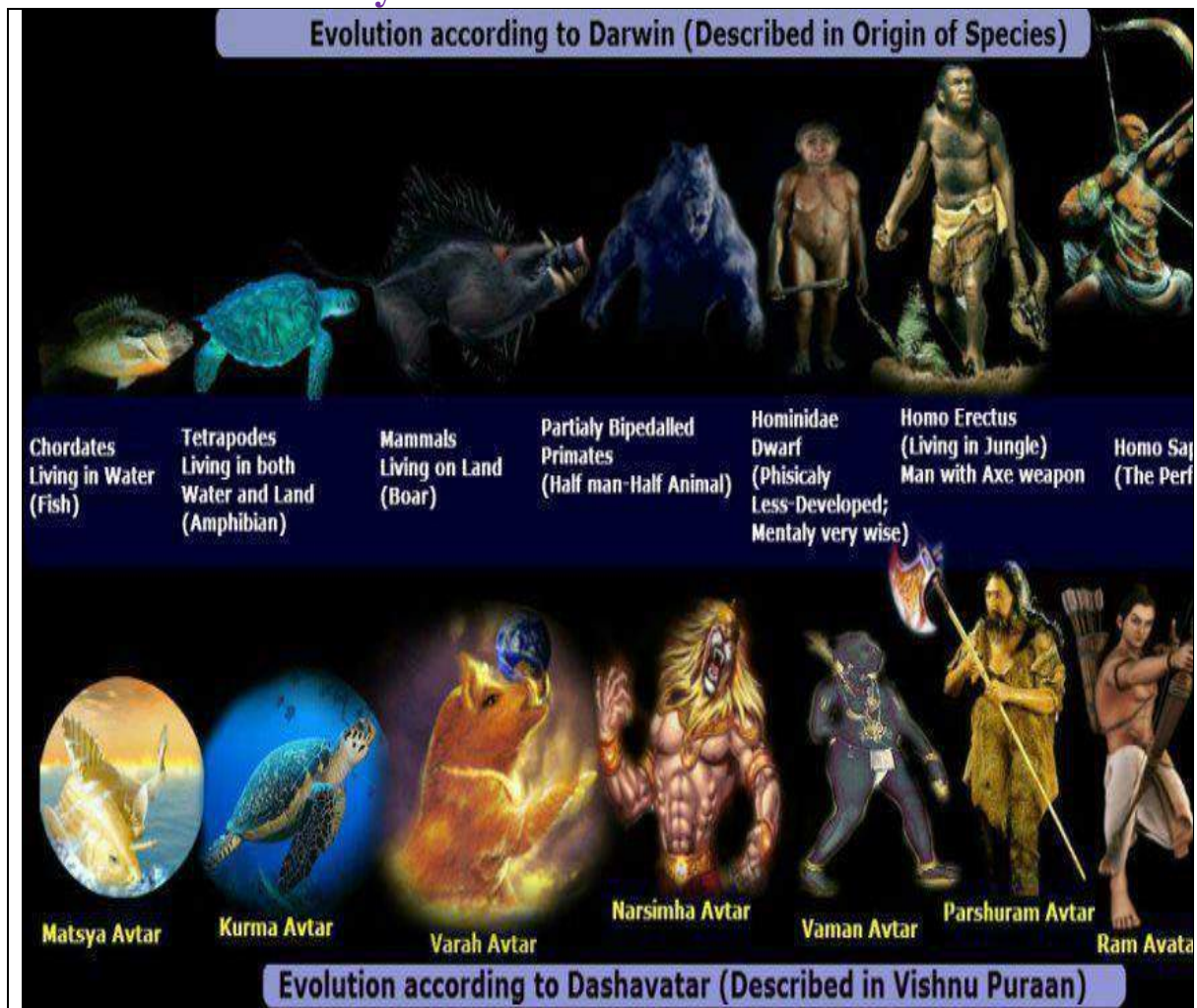
- The vast majority of our features, including the Ancestry Composition report and DNA Relatives tool, are based on autosomal DNA. Autosomal DNA is inherited from both parents, and women receive all these reports and tools.
- While men can trace both their maternal haplogroup (from mitochondrial DNA) and their paternal haplogroup (through the Y chromosome passed down from their father), women can only trace their maternal haplogroup (through the mitochondrial DNA passed down from their mother). This is because the paternal haplogroup is traced through the Y chromosome, which women do not inherit.
- Keep in mind that haplogroups are one small part of your ancestry analysis. If a male relative such as your father, brother, paternal uncle or paternal male cousin were genotyped, your own paternal haplogroup information could be inferred from any of them.

Find out if you're a little bit Neanderthal.

- Even though Neanderthals vanished about 40,000 years ago, their DNA lives on in us. Research tells us that they interbred with humans around 60,000 years ago.
- Tracing through your genome can tell you how much of your DNA is derived from Neanderthals and how that compares to others. We can even point to specific Neanderthal DNA that is associated with traits that you might have – like height and back hair.



6. Amazing!!!! Is Theory of “Hindu Dasavatarams” superior to Darwinian Theory?



Stages	Modern Science	Hinduism
Stage 1 – (Fish) – Life started in the water	Proto-Amphibians that primarily lived in the water, this can be seen as the first stage of life. Examples are prehistoric fishes.	The first incarnation or avatar of Lord Vishnu was in the form of a fish and is known as Matsya Avatar. It clearly parallels with the scientific view.
Stage 2 – (Tortoise) – Amphibious – Life moved from water to the land.	Fish finally evolved out of water became Reptiles (with legs to be accurate). The examples are tortoise, lizards etc.	Second avatar of Vishnu is Kurma. Kurma means Tortoise which is a reptile that walks on four legs. We all know that tortoise is a creature capable of living both on land & in water, which indicates the transition of life from water to land. Again it’s a direct parallel with the scientific view.
Stage 3 – (Boar) – Complete	Reptiles evolved into the semi-amphibian and then the animals that live in swamps and slush and	The Varaha Avatara, in the form of a wild boar, portrays the birth of the mammal. You may ask – why Boar?

<p>animal – Adapted to live on land.</p>	<p>that could bear children and lived only on the land.</p>	<p>Why not a deer or monkey or some other mammal? The reason is that Boar belongs to the Suina family whose maxillary or teeth are in front and therefore they do not have to swallow and regurgitate their food just like us humans! It's extremely enlightening to note that Hinduism had such a very insightful knowhow thousands of years ago!</p>
<p>Stage 4 – (Half ape) – Transformation from animal to ape.</p>	<p>Finally primates were evolving into Hominidae forms that looked more like humans, were partially bipedal (walk on legs) but their brains were still not quite developed. They can be figuratively seen as having partly human lower body and animal like upper body.</p>	<p>Narasimha Avatar is a Half man and Half animal, and indicates the transformation from animal to human form. The interesting thing to note here is that Narasimha has the upper body of a lion but lower body of a man. This is important because this directly relates to the idea of a pre-human without a well developed brain but with the partial ability to become bipedal (walk on legs). This may be early-extinct human ancestor such as someone who could be the missing link between apes and humans.</p>
<p>Stage 5 – (Dwarf) – Transformation from ape to human, developed intelligence.</p>	<p>Finally Hominidae got closer to Homo Erectus was evolved. He was bipedal (walk on legs) more human looking but very short (dwarf).</p>	<p>Vamana Avatar represents a being that is very close to humans but is extremely short. It indicates the complete transition into human form, and the beginning of intelligence in humans.</p>
<p>Stage 6 – (Forest dweller) – Humans developed stone tools.</p>	<p>Homo Erectus and then Homo Sapien was evolved that was about as tall as present day humans and could use tools. Homo Sapien is the present day human and biological evolution ends and at this stage the human might have a wavering mind, uncontrollable and act without reasons.</p>	<p>Sixth Avatar of Lord Vishnu was forest dweller called Parasuram, who has weapons such as axe for survival. This is the first avatar of Vishnu that has no animal characteristics and wields an Axe. So basically, Parashuram is what the current day human would be who could also use tools, in other words Homo Sapien.</p>
<p>Stage 7 – (Hunter) – Humans used superior</p>	<p>At this stage the humans developed to be perfect and they started giving importance to penance than the pleasure and</p>	<p>the seventh incarnation of Lord Vishnu is Lord Rama, who is well known among Hindus and is worshipped in temples as a deity. He civilized and</p>

<p>weapons, bows and arrows, created villages.</p>	<p>started respecting other humans. The survival of the fittest started here and this led to mutinies between mankind. This was the beginning.</p>	<p>has developed more superior weapons like the bow and arrows. He has cleared the forests and developed small communities or villages. He is very vigilant and protects his villages and people. Rama was a very moral man, and was very obedient to his parents. This shows the psychology and simplicity of early human beings.</p>
<p>Stage 8 – (farmer) – the beginning of full-fledged cultivation</p>	<p>People began planting seeds and covering the countryside with food producing plants. The earliest and most successful crops were grasses with large seeds such as barley, wheat, and rice.</p>	<p>The eight incarnation of Lord Vishnu is Lord Balarama. He is portrayed with the plough – the beginning of full-fledged cultivation. Human civilization has developed agriculture and is no longer depended on meat and forest for food.</p>
<p>Stage 9 – Advanced in civilizations and culture and to today’s world</p>	<p>Mankind never stopped since they learned to use tools and all the Neanderthalensis were eliminated. Civilizations were formed, wars were fought, kingdoms were born and finally the world is as we see it today. The chief characteristic here is the increasing complexity of life and society. The perfect human with cleverness and ability to think and win developed at this stage. The humans started loving music, dance, etc...</p>	<p>Lord Krishna is another popular deity worshipped in many temples, and is a clear representation of advanced human civilization.</p> <p>Recent excavations of Dwarka city confirm the well planned construction of cities, towns and streets.</p>
<p>Stage 10: End of the World</p>	<p>According to Big Bang theory and other Modern theories the universe is not stable. The life in world should end at one point and the creation starts from the beginning. This whole loop continues infinite times.</p>	<p>The 10th form is the final life form where Hinduism surpasses the modern theory of evolution, and predicts the future. Remember that we are looking at all the life forms that dominated planet earth since millions of years. So what would the final dominant species look like? According to Hindu mythology 10th Avatar of lord Vishnu, called Kalki is yet to be taken and this occurs when the whole life on earth ends. He would be here to restart the whole cycle, so that it starts again.</p>

		Species will be disappearing and the world will come to an end.”
What elite people said:		
Andhra University vice-chancellor G Nageshwar Rao has claimed that		
Dashavatar, which talks about ten avatars of Lord Vishnu in Hindu scripture Bhagavad Gita, has a more developed theory of evolution than the one proposed by 17th century English scientist Charles Darwin. During his presentation at the 106th Indian Science Congress here, Rao said while Darwin's Theory spoke about evolution of life from a marine animal to a man, Dashavtars went a step further by showing a transformation from "Ram" to "politically nuanced" Krishna.		
Monier Monier-Williams wrote “Indeed, the Hindus were ... Darwinians centuries before the birth of Darwin, and evolutionists centuries before the doctrine of evolution had been accepted by the Huxleys of our time, and before any word like evolution existed in any language of the world.”		
J. B. S. Haldane suggested that Dashavatara gave a “rough idea” of vertebrate evolution: a fish, a tortoise, a boar, a man-lion, a dwarf and then four men (Kalki is not yet born).		
C. D. Deshmukh also remarked on the “striking” similarity between Darwin’s theory and the Dashavatara.		

16. Careers in Evolution Studies

Evolutionary Biologists: An evolutionary biologist researches theory of evolution, studies living organisms in their natural habitats, runs tests on animals and microscopic organisms, and publishes findings on biodiversity and animal or plant behavior. Evolutionary biologists study the changes that occur in plants and animals over time. They also look at the generational history of certain organisms so they can understand their origins. As part of the main field of biology, evolutionary biology incorporates knowledge and skills from genetics, systematic biology, zoology, and behavioral biology.

Archaeologists: They are scientists who study people and cultures. They study artifacts found in the ground to learn about how people lived in the past. They are not geologists (who study rocks and minerals) or paleontologists (who study dinosaurs). ... This methodology set the standard for archaeological excavations.

Paleontologists: They are geoscientists who study the fossils of ancient life-forms, including human life, found in sedimentary rocks on or within the earth's crust. Paleontological analyses range from the description of large, easily visible features to biochemical analysis of incompletely fossilized tissue. A paleontologist really needs to know about physics, chemistry,

biology, and geology. A modern paleontologist needs to have a high level of computer skills and be competent in statistical analysis. A typical things a paleontologist does:

- determines location of fossils.
- excavates layers of sedimentary rock to locate fossils.
- gathers information on the fossils (age, location, etc)
- uses specific tools to excavate (chisels, drills, picks, shovels, brushes)
- evaluates any discoveries by using specialized computer programs

Anthropologists: An anthropologist is a person engaged in the practice of anthropology. Anthropology is the study of aspects of humans within past and present societies. Social anthropology, cultural anthropology and philosophical anthropology study the norms and values of societies.

Population Biologist Job Description: Population biologists may work for academic institutions, research foundations, government agencies or corporations. They conduct basic and applied research into the factors that affect the population sizes of specific biological organisms, ranging from prolific insects to endangered mammals. Population biology research integrates approaches from statistics, evolutionary biology and ecology. Areas of specialization include population genetics, biogeography and community ecology.

Answers

Activity: 8 (Hardy-Weinberg Principle)

Solution 1:

Given: $q^2 = 16\% = 0.16$ are the homozygous recessive individuals

Therefore

$$q = \sqrt{0.16} = 0.4 = \text{frequency of recessive allele}$$

$$p = 1.0 - 0.4 = 0.6 = \text{Frequency of dominant allele}$$

$$p^2 = (0.6 \times 0.6) = 0.36 = 36\% \text{ are homozygous dominant individuals } \} 80\% \text{ are the}$$

$$2pq = 2(0.6)(0.4) = 0.48 = 48\% \text{ are heterozygous individuals } \} \text{ dominant}$$

$$\text{Or } 1.00 - 0.52 = \mathbf{0.48}$$

Solution 2: In the given question, dark brown coat is dominant trait. So, % homozygous dominant individuals i.e. $p^2 = 64\%$ or 0.64

therefore, frequency of dominant allele i.e. $p = \sqrt{0.64} = 0.8$

Since $p + q = 1$, therefore, frequency of recessive allele $q = 1 - p = 1 - 0.8 = 0.2$

So, the answer is '**0.2**'.

Solution 3:

(a) Calculate the percentage of heterozygous individuals in the population.

According to the Hardy-Weinberg Equilibrium equation, heterozygotes are represented by the $2pq$ term. Therefore, the number of heterozygous individuals (Aa) is equal to $2pq$ which equals $2 \times 0.19 \times 0.81 = 0.31$ or 31%

(b) Calculate the percentage of homozygous recessives in the population.

The homozygous recessive individuals (aa) are represented by the q^2 term in the H-W equilibrium equation which equals $0.81 \times 0.81 = 0.66$ or 66%

Solution 4: We know that the frequency of the recessive homozygote genotype is q^2 and equal to 0.09.

$$\therefore q = \sqrt{q^2} = \sqrt{0.09} = 0.30 \quad \text{AND we also know that } p + q = 1$$

$$\text{Thus, } p = 1 - q \quad \therefore p = 1 - 0.30 = 0.70$$

\therefore The homozygote dominants are represented by $p^2 = (0.70)^2 = 0.49$ or 49%

Activity-11 (Fill in the blanks)

1. Reducing, oxidizing, photosynthesis	16. Large caecum
2. Organic monomers	17.. Vestigial organs
3. Heterotrophs	18. Coaservates
4. Fermentation	19. Macro evolution
5. Fossils	20. Population , Individual
6. Adaptations	21. Hinny
7. Natural Selection	22. sterile
8. Species, population	23. Hominidae
9. Alleles, individuals	24. Triassic period
10. Zero	25. Homo erectus
11 Super genes	26. Connecting Link
12. Stabilizing	27. Eugenics
13.. Reproductive rate	28. Living fossils
14. Mutations	29. Sibling species
15. Connecting Link	30. Speciation

Activity – 12 (TRUE or FALSE)

1	2	3	4	5	6	7	8	9	10
TRUE	FALSE	FALSE	FALSE	TRUE	TRUE	TRUE	FALSE	TRUE	FALSE
11	12	13	14	15	16	17	18	19	20
TRUE	FALSE	TRUE	FALSE	FALSE	TRUE	FALSE	TRUE	TRUE	TRUE
21	22	23	24	25	26	27	28	29	30
TRUE	FALSE	TRUE	FALSE	TRUE	FALSE	TRUE	TRUE	TRUE	TRUE
31	32	33	34	35					
TRUE	TRUE	TRUE	TRUE	TRUE					

Activity:13 (Answers to Multiple Choice Questions)

Que. No	Ans.	Explanation/Notes The students should explore unknown options &make notes here.
1.	B	
2.	C	
3.	B	
4.	B	
5.	B	
6.	D	
7.	C	
8.	B	
9.	D	
10.	A	

11.	D	
12.	D	
13.	C	
14.	A	
15.	D	
16.	A	
17.	C	
18.	C	
19.	B	
20.	D	
21.	D	
22.	D	
23.	A	
24.	C	
25.	A	
26.	A	
27.	C	
28.	B	
29.	D	A panmictic population is one where all individuals are potential partners. This assumes that there are no mating restrictions, neither genetic or behavioural, upon the population .
30.	C	
31.	D	
32.	C	
33.	A	
34.	D	In genetics Polymorphism involves one of two or more variants of a particular DNA sequence. The most common type of polymorphism involves variation at a single base pair. Polymorphisms can also be much larger in size and involve long stretches of DNA. A gene is said to be polymorphic if more than one allele occupies that gene's locus within a population
35.	B	
36.	D	
37.	C	
38.	C	
39.	B	
40.	B	
LEVEL - 2		
41.	B	
42.	D	Variations were one of the main postulates of Darwinism. Darwin recognized two types of variations – continuous and discontinuous, but he could not explain the inheritance of variations.
43.	C	
44.	D	
45.	D	
46.	B	
47.	A	
48.	D	

49.	D	According to Lamarckism, long neck and high forelimbs of giraffe developed due to their stretching for obtaining foliage from the trees when ground vegetation becomes sparse.
50.	D	
51.	A	
52.	C	
53.	B	
54.	D	
55.	C	
56.	C	Refer hardy –weinberg Activity
57.	D	
58.	D	
59.	B	
60.	D	
61.	C	
62.	C	
63.	A	
64.	A	
65.	A	
66.	B	
67.	C	
68.	C	According to Darwin’s concept of natural selection, the organisms, which are provided with favorable variations would survive because they are fittest to face their surrounding, while the organisms, which are unfit for surrounding variations are destroyed. Prevalence of pesticide resistant insects is due to the adaptability of these insects for the changes in environment (due to the use of pesticides).
69.	A	
70.	D	
71.	C	
72.	A	
73.	A	
74.	B	Fitness means ‘Survival of the fittest’
75.	B	
76.	B	Random Genetic Drift/Genetic Drift occurs when by chance only certain members of population reproduce.
77.	C	Mutation is a sudden, heritable change in an organism. It may be beneficial to that organism (make the organism more adaptive) or harmful (make the organism less adaptive).
78.	A	Genetic drift may be significant only, where alleles in a population may easily get extinct by chance alone.
79.	D	
80.	B	
81.	A	
82.	B	Refer Industrial Melanism. Natural selection favored over dark moths because on darkened trees they are less easily seen by moth eating birds.
83.	C	The unit of evolution is the population. The individual of a population form a unique set of genotypes or gene pool and local environment factors ast as selective agents to affect the gene pool in ways that adapt the organisms to

		the local conditions. Thus, each population of a species follows its own course of evolution.
84.	C	
85.	A	
86.	D	
87.	A	
88.	D	There is a simian gap among apes in between incisors and canine on each side of the jaw. The simian shelf is a bony thickening on the front of the ape mandible
89.	B	It splits up from the ape line 14 million years ago and marked the remarkable beginning of hominid line. The main reason for giving Ramapithecus a true hominid status is the similarity of its teeth with that of the later hominids .
90.	D	
91.	D	
92.	B	
93.	C	The first hominoid (humans evolved from) arose at the time when a change in weather led to the reduction in the size of the African forests favouring bipedalism.
94.	D	
95.	A	
96.	C	
97.	B	From the geological records, it is concluded that first mammal or mammal like forms appeared not later than middle Triassic or not earlier than lower Permian.
98.	A	
99.	B	
100.	A	

Activity 14: (Assertion & Reasoning Questions)

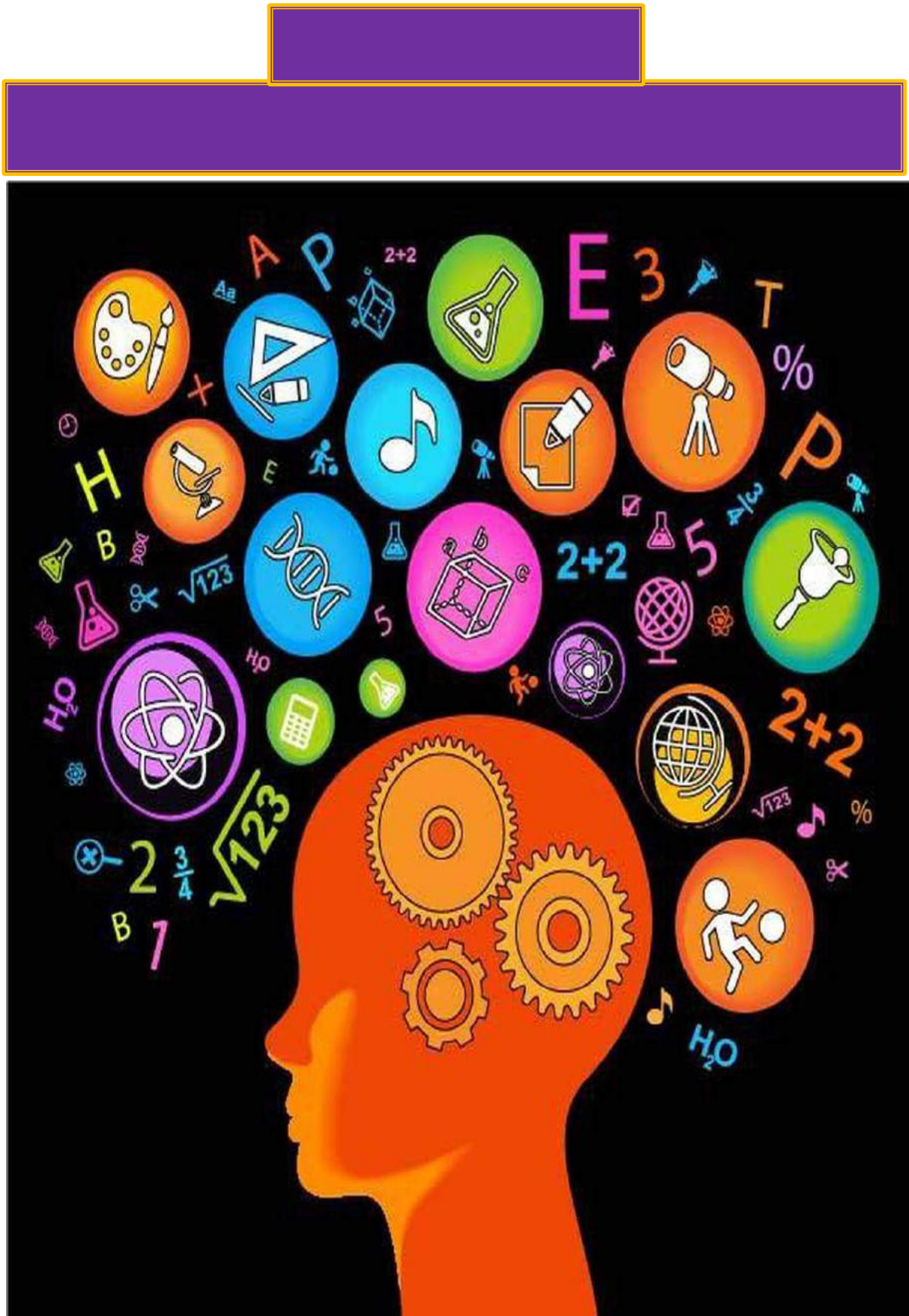
1	2	3	4	5	6	7	8	9	10
C	B	A	C	D	C	C	C	B	D
11	12	13	14	15	16	17	18	19	20
B	B	B	A	A	C	B	C	D	A
21	22	23	24	25	26	27	28	29	30
A	A	B	B	B	C	A	A	C	B

Dr. M.S.Prashanth

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• **J.L. IN ZOOLOGY**
GOVERNMENT JUNIOR COLLEGE
TANAKALLU - 515 571

• **Psychotherapist & Counselor,**
MANASADHARA, KADIRI



MAJOR LEARNING OBJECTIVE

- *Students will be able to comprehend how the knowledge of various fields of biology are applied for the human welfare.*
- *Able to understand, apply and appreciate the various facets of 'Applied Biology'.*

LEARNING OUTCOMES:

- Students will be able to apply concepts of breeding, physiology, nutrition, herd-health, economics and management into practical and profitable animal production programs.
- Students will be able to demonstrate critical thinking and problem-solving skills as they apply scientific principles to a variety of animal production systems, preparation of vaccines, gene therapy
- Students will understand how the application of modern animal production technologies and management practices impact their production facilities, their communities and the world.
- Understand basic aspects of cancer pathology,
- Understand the differences and overlap of cancers by tissue type
- Understand how progenitor and stem cells are specified and maintained through the life of animals and also concepts of pluripotency and self-renewal.
- Explain the use of stem cells and their use in medical applications
- Describe how gene therapy can be used, to treat human disease and how liposomes and viruses can be used to deliver the gene of interest
- Students will be able to understand how the principles of biophysics and biochemistry integrated and involved in diagnosis and treatment of human diseases.

ACTIVITIES

I. **Animal Husbandry:**

1. Identifying Photographs-A
2. Identifying Photographs-B
3. Writing about the Photographs
4. Identifying and Filling the tables under appropriate headings
5. Writing about the photographs
6. Defining the key words
7. Fill in the blanks
8. Multiple Choice Questions for Competitive exams
9. Answer "TRUE" or "FALSE"
10. Fill in the tables appropriately
11. Match the following
12. Filling the Flow Charts
13. Assertion & Reasoning Questions

II. **Biotechnological Applications in Medicine**

1. Identifying Photographs-A
2. Define and Expand the concepts
3. Fill in the blanks
4. Multiple Choice Questions for Competitive exams
5. Answer "TRUE" or "FALSE"
6. Fill in the tables appropriately
7. Match the following
8. Filling the Flow Charts
9. Assertion & Reasoning Questions

III. Biomedical technology:

1. Identifying Photographs
2. Define and Expand the concepts
3. Fill in the blanks
4. Multiple Choice Questions for Competitive exams
5. Answer “TRUE” or “FALSE”
6. Fill in the tables appropriately
7. Match the following
8. Filling the Flow Charts
9. Assertion & Reasoning Questions

IV. Assignment Questions to answer

V. Hands on Experiences for you – Try It!!!

VI. Careers in Evolution Studies

VII. Answers to the activities and note making

INSTRUCTIONS TO LECTURER

- Ask the students to take aid of the textbook
- Ask the students to work with a partner
- Explain each part of the worksheet & Come up with some examples to help
- Clarify doubts of the students before starting the work book

INSTRUCTIONS TO STUDENTS

- First read the text book thoroughly and logically.
- Always try to attempt this workbook with a friend cooperatively
- While attempting the activities analyze them.
- While attempting the multiple choice questions, make notes on the other options too

PART – I ANIMAL HUSBANDRY

1.1. CAN YOU IDENTIFY THE FOLLOWING PHOTOGRAPHS ?

1.



2.



3.



4.



5.



6.



CAN YOU IDENTIFY THE FOLLOWING PHOTOGRAPHS ?

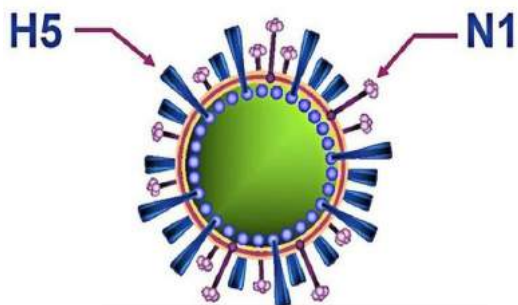
1.



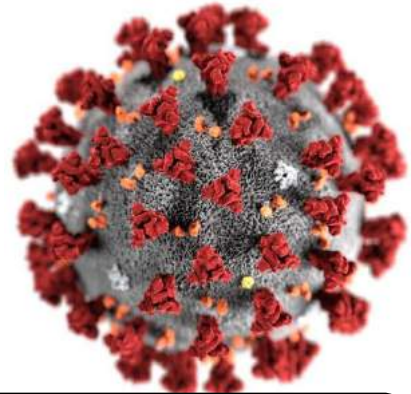
2.



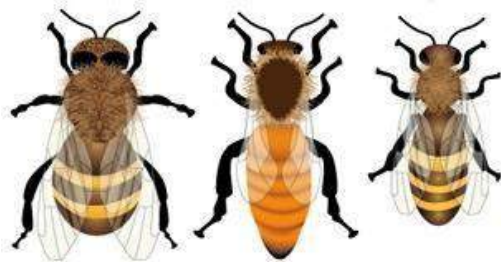
3.



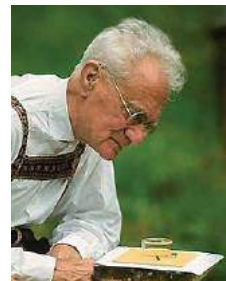
4.



5.





6.






SEE THE PHOTOGRAPHS AND WRITE FEW LINES ABOUT THEM





1.

 <p>Apis mellifera</p>	 <p>Apis cerana indica</p>

2.




 <p>Drone</p>	 <p>Queen</p>	 <p>Worker</p>

IDENTIFY THE FOLLOWING PHOTOGRAPHS AND FILL UP THE TABLE-3



SN O.	IDENTIFY THE FOLLOWING FISH	COMMON NAME	SCIENTIFIC NAME	IDENTIFICATION CHARACTERISTICS
1				
2				
3				
4				

SEE THE PHOTOGRAPHS AND WRITE FEW LINES ABOUT THEM




1.

		
<p>Silver carp</p>	<p>Grass carp</p>	<p>Common Carp</p>

2.

3. Write Economic importance of the following animals

<p>A</p>		
<p>B</p>		
<p>C</p>		

DEFINE THE FOLLOWING WORDS

WORD	DEFINITION
1. Animal husbandry	
2. Dairying	
3. Sire	
4. Dam	
5. Out-cross	
6. Cross-breed	
7. Jack/ass	
8. Jennet	
9. Stallion	
10. Mare	
11. Artificial insemination	
12. MOET	
13. Super Ovulation	
14. Surrogate mother	
15. Inbreeding depression	
16. Layers	
17. Broilers	
18. NECC	
19. IVRI	
20. H5N1 virus	
21. Pandemic disease	
22. Apiculture	
23. Arrhenotoky	
24. Waggle dance	
25. Capture fisheries	
26. Culture fisheries	
27. Aquaculture	
28. Pisciculture	
29. Hypophysation	
30. Green revolution	
31. Blue revolution	
32. White revolution	

Fill in the blanks

1. All domesticated animals reared for the benefit of man are called_____.
2. The agricultural practice of breeding and raising livestock is_____.
3. The animals included in livestock_____.
4. Worlds livestock population in India and China together is more than_____.
5. The farm produce of India and China together is_____.
6. Average annual milk yield of Indian cow is_____.
7. Average annual milk yield of cow in Netherlands is_____.
8. The Indian cow is known as ‘teacup cow’ as its annual milk yield is___ liters.
9. The superior milch buffalo breed is_____.
10. The costliest breed bull in India is_____.
11. Expand AMUL_____.
12. Expand NDDB_____.
13. The father of ‘white revolution’ in India is_____.
14. The founder of Anand Dairy_____.
15. The founder chairman of NDDB_____.
16. Holstein-Frisian cow yields up to___ liters per day.
17. Aiming at increasing the yield of animals and improving the desirable qualities of the produce is_____.
18. The crossing between animals of same breed is called_____.
19. Cousin mating is called_____.
20. The mating between male parent and female offspring or female parent and male offspring is called_____.
21. The breeding of unrelated animals is known as_____.
22. The practice of mating of animals within the same breed, but having no common ancestors on either side of the pedigree for 4-6 generations is_____.
23. The mating of superior males of one breed with superior females of another breed is called_____.
24. The mating of male and female animals of two different related species is ___.
25. Continued inbreeding, especially close breeding leads to_____.
26. Expand MOET_____.
27. The breeder and producer center of top quality frozen semen of pure exotic breeds is at _.
28. In super ovulation, the animal produces_____ eggs.
29. In MOET, the embryos at_____ celled stages are recovered and transferred to surrogate mother.
30. The father of modern poultry in India_____.
31. The central poultry breeding farms established at_____,_____ and _____develop hybrid strains of layers.
32. The institute that produces quality broiler strains and poultry vaccines is_____.
33. Hybrid layers used in India are_____.
34. Commercial broiler strains used in India_____.
35. Biological value of egg is_____ and protein efficiency ratio is_____.

36. Bird flu or Avian flu is caused by_____.
37. Apiculture is_____.
38. The two species of honey bees widely used in beekeeping in India are
39. Waggle dance is discovered by_____.
40. The abdominal glands that produce bee wax are present on_____ segments.
41. Propolis is used in the treatment of_____.
42. Bee venom is used in the treatment of_____.
43. The Indian carps are_____.
44. The exotic Chinese carps are_____.
45. The synthetic gonadotropin used in hypophysation is_____.
46. Fish meat is good source of_____.
47. Shark and cod liver oils are good sources of vitamins_____.
48. Oil from Sardine and Salmon are good sources of_____.
49. The fertilizer prepared from scrap fish is_____.
50. The substance obtained from dried swim bladders of mostly cat fish, used in clarification of wines is_____.

MULTIPLE CHOICE QUESTIONS

1. The largest milk producer in the world is
a. Indiab. China c. Netherlands d. UK
2. The technique in which semen is collected from superior male is
a. MOET b. AMUL c. AI d. NDDB
3. Sire is
a. male parent b. female parent c. male offspring d. female offspring
4. Dam is
a. male parent b. female parent c. male offspring d. female offspring
5. The cross between Jack and Mare is
a. Mule b. Hisardale c. Hinny d. Marino rams
6. The cross between Stallion and Jennet is
a. Mule b. Hisardale c. Hinny d. Marino rams
7. The largest egg producer state in India
a. UP b. AP c. MP d. West Bengal
8. The largest individual in bee colony is
a. Drone b. Worker c. Male d. Queen
9. The Indian carp among the following
a. Common carp b. Silver carp c. catla d. Grass carp
10. The exotic carp among the following
a. Rohu b. Catla c. Mrigal d. Silver carp
11. The fertilizer prepared from scrap fish is
a. Fish guano b. Isinglass c. Shagreen d. Liver oil

TRUE OR FALSE QUESTIONS

S.No.	Statement	True/False
1	1. Operation flood is white revolution.	
2	2. The largest milk producer of India is Andhra Pradesh.	
3	3. Inbreeding increases heterozygosity.	
4	4. Bullocks are draught breeds.	
5	5. A breed is a group of animals related by descent and similar in most characters like appearance, features, size, configuration, etc.	
6	6. The mating of superior male with the superior female of different breeds is outcross.	
7	7. Controlled breeding experiments in animal breeding are AI and MOET.	
8	8. Vencobb is broiler strain.	
9	9. BV-300 is layer strain.	
10	10. Drones are robust diploid males.	
11	11. Propolis is used for the treatment of arthritis.	
12	12. Oil sardine fishery along the Kerala coast is the largest fishery in India.	
13	13. Fish meat is rich in Iodine.	
14	14. Silver carp is Indian carp.	
15	15. Omega 3 fatty acids prevent cancer cell growth.	

FILL IN THE TABLES

1.

Farm animal	Used by humans for
1. Bees	
2. Silk worm	
3. Prawns	
4. Crabs	
5. Fishes	
6. Birds	
7. Pigs	
8. Cattle	
9. Sheep	
10. Goats	
11. Camels	

2.

Animal	Milk Yield
1. Netherlands cow (annual)	
2. Indian cow (annual)	
3. Holstein-Frisian cow (per day)	

3.

Mating between	New breed
1. Bikaneri ewes and Marino rams	
2. Jack and Mare	
3. Stallion and Jennet	

4.

Layer strains	Broiler strains

5.

Avian flu symptoms	Covid-19 symptoms

6 . Fill the following table with respect to Avian flu (Bird flu)

S.No.	Item	Description
1	Causative organism	
2	Mode of Infection	
3	Symptoms	
4	Prevention	

7.

S.No.	Feature	Queen	Drone	Worker
1	Size			
2	Chromosomal sets			
3	Sex			
4	Fertility			
5	Developed by fertilized/unfertilized eggs.			
6	Role in bee colony			

8.

S.No.	Bee Product	Uses
1	Honey	
2	Bee's wax	
3	Propolis	
4	Bee's venom	
5	Role in pollination	

9.

S.No.	Fish Product	Uses
1	Fish meat	
2	Liver oils	
3	Fish guano	
4	Isinglass	

10.

Indian carps	Exotic carps	Marine water fishes	Aquatic animals having export value

1.11 MATCH THE FOLLOWING

- | | | |
|----|---------------------------------|---------------------|
| 1. | 1. Superior milch buffalo breed | a. Holstein-Frisian |
| | 2. The costliest bull in India | b. Murrah |
| | 3. Indian cow | c. Ongole breed |
| | 4. Indian buffalo | d. Bos indicus |
| | 5. Exotic breed | e. Bubalis bubalis |

Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

- | | | |
|----|-------------|------------------------------------|
| 2. | 1. Layer | a. raised for meat |
| | | 2. Broiler b. a viral disease |
| | | 3. Poona pearls c. Broiler variety |
| | | 4. Vencobb d. raised for eggs |
| | 5. Ranikhet | e. Layer variety |

Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

- | | | |
|----|--------------------------|--------------|
| 3. | 1. Female bird | a. Broiler |
| | 2. Male and female birds | b. Flu virus |
| | 3. H5N1 | c. Layer |
| | 4. BV-300 | |
| | 5. Hubbard | |

Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

4. 1. Queen bee
2. Drone
3. Worker bee
4. Scout bee
5. Nurse bee

Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

5. 1. Pearl oyster
2. Hilsa
3. Cat fish
4. Cirrhinus mrigala
5. Common carp

Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

6. 1. Dr. Kurian
2. Dr. B.V. Rao
3. Karl von Frisch
4. Anand Dairy
5. IVRI

Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

7. 1. Shrimp
2. Sardine
3. Catla catla
4. Silver carp

Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

- a. Fertile male
b. Sterile female
c. Fertile female

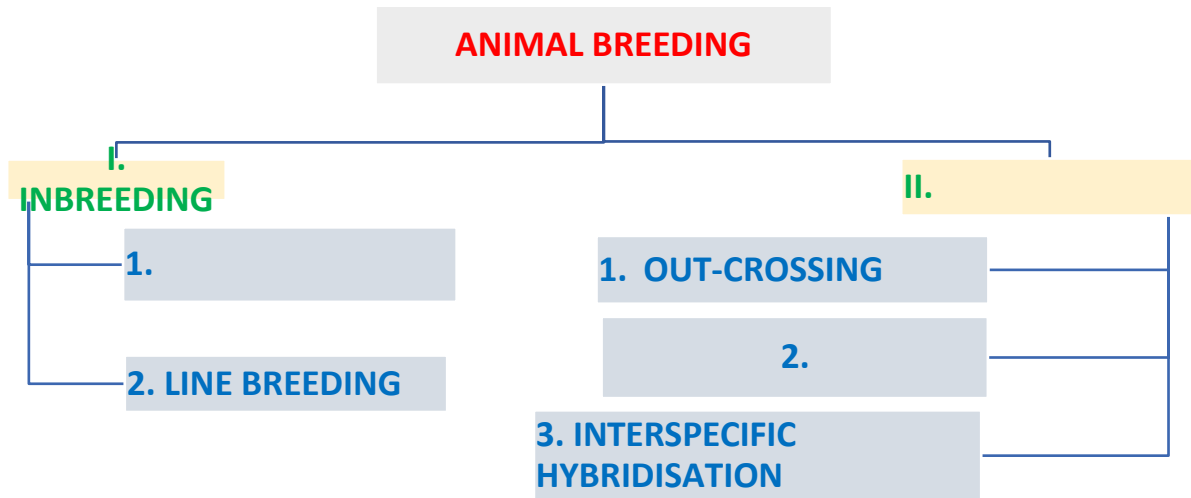
- a. Indian carp
b. Exotic carp
c. Export value
d. Isinglass
e. Marine water fish

- a. Izatnagar
b. Founder Chairman of NDDB
c. Gujarat
d. Founder Chairman of NECC
e. Waggle dance

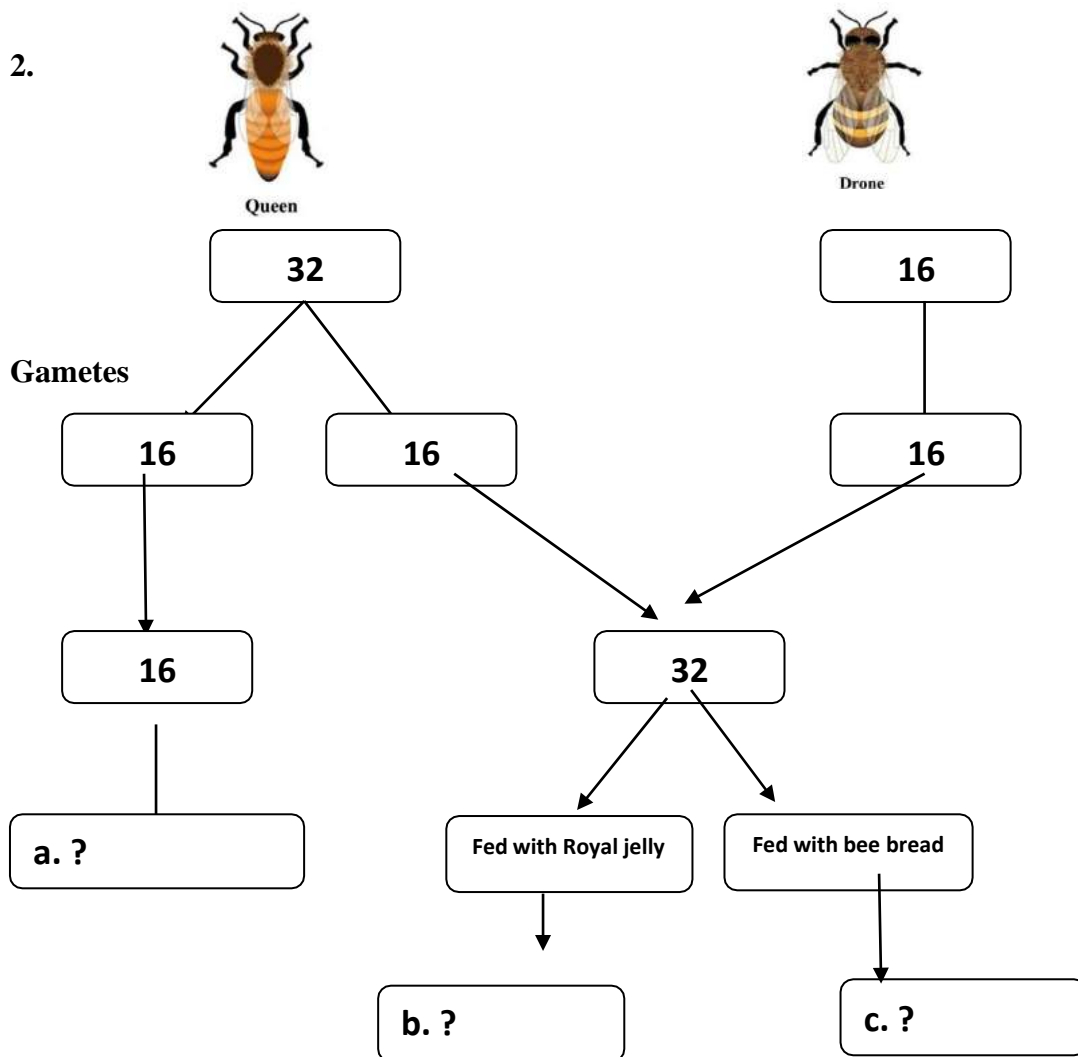
- a. Exotic carp
b. Indian carp
c. Marine fish
d. Export value

1. 12 FILL IN THE FLOW-CHART

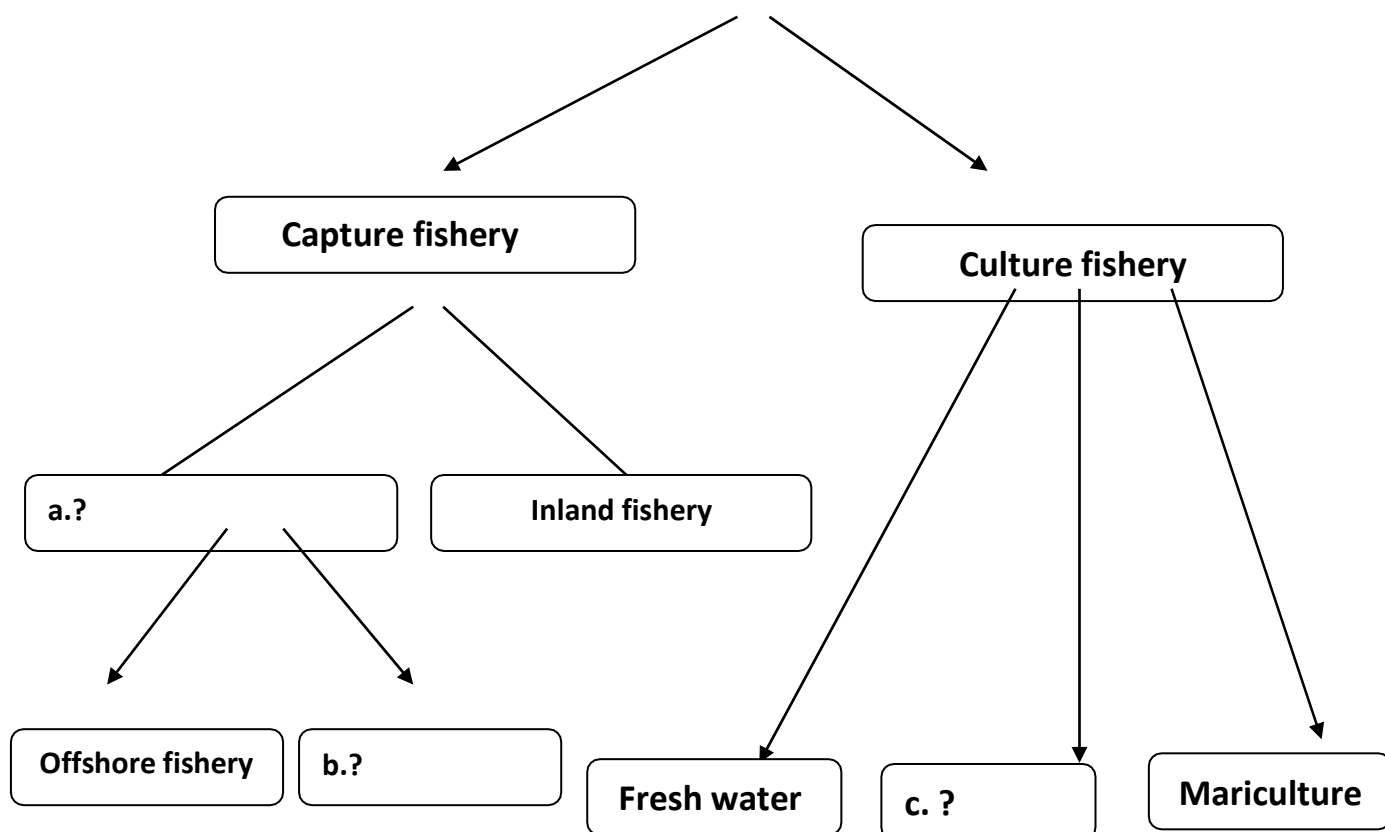
1.



2.



3.



1.13 ASSERTION AND REASONING QUESTIONS

Instructions: Read the following statements and answer as given below.

- a) (A) and (R) are true and (R) is the correct explanation of (A).
- b) (A) and (R) are true and (R) is not the correct explanation of (A).
- c) (A) is true and (R) is false.
- d) Both (A) and (R) are false.

- | |
|---|
| 1. (A) Inbreeding increases homozygosity.
(R) Inbreeding is necessary for evolving pure line animal. |
| 2. (A) Inbreeding exposes harmful recessive genes.
(R) Inbreeding helps in the accumulation of superior genes. |
| 3. (A) Continued inbreeding reduces fertility and productivity.
(R) In case of inbreeding depression the animal should be mated with unrelated superior animal of the same breed to restore fertility and yield. |
| 4. (A) The cross breeds are superior to their parents.
(R) Cross breeding allows the desirable qualities of two different breeds to be combined. |

5. (A) In MOET, the embryos at 8-32 celled stages are recovered surgically from genetic mother. (R) In MOET, the surrogate mother is the genetic mother.
6. (A) Workers of poultry should use protective clothing and special breathing masks. (R) Avian flu spreads simply by touching contaminated surfaces.
7. (A) The bee developed from fertilized egg that is fed with royal jelly even after 4 days of birth becomes Queen. (R) The bee developed from fertilized egg that is fed with bee bread after 4 days of birth becomes Worker.
8. (A) The scout bees inform other worker bees about the source of nectar. (R) The scout bees inform other worker bees the direction with reference to sun's position and distance of availability of food by waggle dance.
9. (A) Covid-19 positives should take eggs and meat daily. (R) Eggs and meat are good sources of proteins.
10. (A) Drone is homogametic. (R) Queen is heterogametic.

PART – II : BIOMEDICAL APPLICATIONS, VACCINES, MOLECULAR DIAGNOSIS, GENE THERAPY, TRANSGENIC ANIMALS, CANCER BIOLOGY AND STEM CELLS

2. 1 - Cancer is detected by biopsy, blood test, Mammogram, Prostate Specific Antigen test, CT scan, MRI scan and PET scan etc. Can you identify the following photographs?

1.



2.



3.



4.



5.



6.



DEFINITE/EXPAND THE FOLLOWING CONCEPTS

WORD	DEFINE/EXPAND
1. r-DNA Technology	
2. Dairying	
3. Humulin	
4. Vaccine	
5. Attenuated whole agent vaccine	
6. Inactivated whole agent vaccine	
7. Taxoids	
8. Adjuvant	
9. Gene Therapy	
10. Therapeutic human gene	
11. SCID	
12. ADA	
13. Transfection	
14. Transgenic animal	
15. GEAC	
16. Cancer	

17. Neoplasm	
18. Neoplasia	
19. Oncology	
20. Contact inhibition	
21. Cadherins	
22. Apoptosis	
23. angiogenesis	
24. Oncogenes	
25. Tumor suppressor genes	
26. Carcinoma	
27. Sarcoma	
28. Lymphoma	
29. Leukemia	
30. Oncovirus	
31. Biopsy	
32. PSA	
33. Mammogram	
34. Chemotherapy	
35. Immunotherapy	
36. Stem cells	
37. Totipotent	
38. Pluripotent	
39. Multipotent	
40. Unipotent	
41. Embryonic Stem Cells	
42. Adult Stem Cells	
43. Haemopoetic Stem cells	
44. Myeloid Stem Cells	
45. Lymphoid Stem Cells	

Fill in the blanks

1. Manipulation of genes or microorganisms to produce certain products useful to mankind is _____.
2. Recombinant DNA technological processes are used in the production of _____.
3. Human insulin is known as _____.
4. Humulin is produced by genetically engineered organism _____.
5. Human insulin is made up of ___ amino acids arranged in two polypeptide chains, chain A ___ amino acids and chain B ___ amino acids.
6. The two polypeptide chains of human insulin are linked together by _____ bonds.
7. The insulin prohormone has ___ polypeptide chains.
8. The brand named group of biosynthetic human insulin products is _____.
9. The term vaccine was coined by _____.
10. A vaccine is _____.
11. The prophylactic biological preparation that improves immunity is _____.
12. Mostly used adjuvants are _____.
13. The disease that is eradicated completely in India/World by intensive vaccination is _____.
14. The vaccines that contain disable (made less virulent) live microorganisms are _____.
15. Examples for attenuated whole agent vaccines are _____.
16. The vaccines that contain killed microbe (virulent before killing) are called as _____.
17. Examples for inactivated whole agent vaccines _____.
18. The vaccines that are inactivated exotoxins of certain microbes are called as _____.
19. Examples for taxoids are _____.
20. The techniques that help early diagnosis of a disease are _____.
21. PCR is now routinely used to detect disorders like _____.
22. The insertion of genes into an individual's cells and tissues to treat a hereditary disease is known as _____.
23. In Germ line gene therapy the functional genes are introduced into _____.
24. In Somatic line therapy the functional genes are introduced in to _____.
25. The first clinical gene therapy was given in the year _____ to a four year old girl with _____ deficiency.
26. ADA deficiency causes _____.
27. In gene therapy, the scientists are focusing on diseases caused by single-gene defects like _____.
28. The process by which the genetically modified DNA can be introduced into a eukaryotic cell is known as _____.
29. Transgenic animals are the animals that _____.
30. 95% of all existing transgenic animals are _____.
31. Today transgenic models exist for many human diseases such as _____.
32. The human protein that is used to treat emphysema is _____.
33. _____ is rich in essential amino acids and is the dominant protein in human milk.
34. The first transgenic cow is _____.
35. The milk of first transgenic cow consists of human milk protein _____.

36. The transgenic animals that are developed for use in testing the safety of vaccines before they are used on humans are_____.
37. The committee that is setup by Indian Government to look into misuse of DNA manipulation and safety of introducing GM-organisms for public services is_____.
38. The formation of malignant tumors in our body is called_____.
39. Unchecked division of cells leads to abnormal proliferation of cells. This is called_____.
40. The 3 types of neoplasm (tumors) are_____.
41. The branch of medicine that deals with development of tumors, diagnosis, treatment and prevention is_____.
42. The programmed cell death is known as_____.
43. The guardian angel of cell's genome is_____.
44. Two examples for tumor suppressor proteins_____.
45. The protein p53 plays important role with reference to_____, in the regulation of cell division cycle.
46. The substance that causes cancer is a_____.
47. The types of cancers are 1._____, 2._____, 3._____,
4._____, 5._____ and 6._____.
48. The virus that causes 'avian sarcoma' is_____.
49. The virus that causes cervical cancer is_____.
50. Cervical cancer screening test is_____or_____.
51. Removal and microscopic examination of a sample of body tissue from a living organism for diagnostic purposes is known as_____.
52. Screening test for Prostate cancer is_____.
53. Test to detect breast cancer is_____.
54. Treatment of cancer generally involves 1._____, 2._____,
3._____ and 4._____.
55. Anti-cancer drug is_____.
56. Example for Biological Response Modifiers is_____.
57. Monoclonal antibody based biological drug treatment for cancer is known as_____.
58. The cells which have the ability to go through numerous mitotic cycles, which are in undifferentiated state and can differentiate into diverse specialized cell types are known as_____.
59. The stem cells that can construct a complete, viable organism are called_____.
60. The stem cells that are derived from the three germ layers are called_____.
61. The stem cells that can differentiate into a number of closely related family of cells are called_____.
62. The cells that can produce only one cell type are called_____.
63. Examples for multipotent stem cells are_____.
64. The two broad categories of stem cells are_____and_____.
65. The embryonic stem cells are derived from_____.
66. The stem cells that are found in the body of developed animal that has ability to divide and create another cell like it is called_____.
67. The rich source of adult stem cells is_____.
68. The multipotent adult stem cells that are derived from red bone marrow are called_____.

69. The two types of Haemopoietic stem cells are 1. _____ and 2. _____.
70. The secondary stem cells of haemopoietic stem cells are _____.
71. The cells that originate from both myeloid stem cells and lymphoid stem cells directly are _____.
72. The pluripotent adult stem cells occur in _____.

2.4 MULTIPLE CHOICE QUESTIONS

1. The number of amino acids in human insulin, A-chain and B-chain respectively...
a. 51, 21, 30 b. 51, 30, 21 c. 51, 31, 20 d. 51, 20, 31
2. Mature insulin has
a. A, B & C chains b. A & B chains c. B & C chains d. A & C chains
3. Insulin pro-hormone has
a. A, B & C chains b. A & B chains c. B & C chains d. A & C chains
4. The first developed vaccine is
a. Cow pox b. Polio c. Small pox d. Tetanus
5. The disease that is eradicated completely in India/World by intensive vaccine programme in organized manner is
a. Measles b. Polio c. Diphtheria d. Small pox
6. The disease that is going to be eradicated completely in India/World by Intensive vaccine programme in organized manner is
a. Measles b. Polio c. Diphtheria d. Small pox
7. The vaccine that contains disabled live microorganisms is...
a. Attenuated whole agent vaccine b. Inactivated whole agent vaccine c. Taxoids d. None of the above.
8. The vaccine that contains killed microbes is
a. Attenuated whole agent vaccine b. Inactivated whole agent vaccine c. Taxoids d. None of the above.
9. The vaccine that contains inactivated exotoxins of microbes is
a. Attenuated whole agent vaccine b. Inactivated whole agent vaccine c. Taxoid d. None of the above.
10. Early detection of a disease is possible by
a. rDNA technology b. PCR c. Both a & b d. None
11. The disorder for which the first gene therapy was given in 1990
a. Muscular dystrophy b. Cystic fibrosis c. Haemophilia d. SCID
12. SCID is due the deficiency of
a. ADH b. ADA c. DNA d. RNA
13. The process by which genetically modified DNA can be introduced into a eukaryotic cell
a. Electrophoresis b. Transduction c. PCR d. Transfection
14. Human protein enriched cow milk consists of
a. Lactose b. Casein c. alpha-lactalbumin d. Calcium
15. The substance that is produced by transgenic animals for the treatment of emphysema is
a. α -lactalbumin b. α -1 antitrypsin c. Adenosine deaminase d. Trypsinogen

16. 95% of existing transgenic animals are	a. Rabbits	b. Mice	c. Sheep	d. Cow
17. The committee that looks into misuse of DNA manipulation and safety of introducing GM-organisms for public services is	a. NECC	b. NDDB	c. GEAC	d. None
18. Formation of a tumor is	a. Hyperplasia	b. Cancer	c. Neoplasia	d. Metastasis
19. Benign tumors are	a. Cancerous	b. Harmful	c. Harmless	d. Pre-cancerous
20. Carcinoma in situ is	a. Benign	b. Malignant	c. Pre-malignant	d. None of these
21. Which of the following is not a feature of cancer cells	a. Contact inhibition	b. Angiogenesis	c. lack cadherins	d. Metastasis
22. Cancer cells from liver causing tumor in brain	a. Liver cancer	b. Brain cancer	c. Secondaries of liver cancer	d. Liver-brain cancer
23. When a retro virus enters a host cell and converts its RNA into cDNA.	a. Translation	b. Reverse Translation	c. Transcription	d. Reverse Transcription
24. HPV causes	a. cervical cancer	b. prostate cancer	c. breast cancer	d. leukemia
25. Carcinogens that are present in tobacco are	a. benzopyrene	b. nitrosamines	c. Chromium	d. All
26. The following is not cancer detection test	a. Autopsy	b. Biopsy	c. PSA	d. Mammogram
27. The cell that has the capacity to construct a complete and viable organism is	a. Totipotent	b. Pluripotent	c. Multipotent	d. Unipotent
28. The cell that has the capacity to differentiate into a number of cells of a closely related family of cells is	a. Totipotent	b. Pluripotent	c. Multipotent	d. Unipotent
29. The cell that has the capacity to differentiate into nearly all types of cells is	a. Totipotent	b. Pluripotent	c. Multipotent	d. Unipotent
30. The cell that has the capacity to produce one cell type is	a. Totipotent	b. Pluripotent	c. Multipotent	d. Unipotent
31. Haemopoietic stem cells of red bone marrow are	a. Totipotent	b. Pluripotent	c. Multipotent	d. Unipotent
32. The dendritic cells originate directly from	a. myeloid stem cells	b. Lymphoid stem cells	c. Both a and b	d. None of these
33. The natural killer cells originate directly from	a. myeloid stem cells	b. Lymphoid stem cells	c. Both a and b	d. None of these
34. The stem cells that can transform into specialized cells to replace myocytes or neurons are present in	a. myeloid stem cells	b. Lymphoid stem cells	c. Both a and b	d. Stem cells of umbilical

TRUE OR FALSE QUESTIONS

S.No.	Statement	True/False
1	Insulin is a protein hormone produced from alpha cells of islets of Langerhans of pancreas.	
2	The chain A and the chain B of insulin are linked together by disulphide linkages.	
3	Vaccines may not guarantee total protection from a disease.	
4	Attenuated whole agent vaccines are killed virulent microbes.	
5	Early detection of diseases can be done by molecular diagnosis.	
6	PCR is now routinely used to detect HIV suspected cases.	
7	The normal gene that is inserted into the genome to supplement an abnormal gene is called the 'therapeutic human gene'.	
8	ADH deficiency causes SCID.	
9	The first transgenic cow is Rosie.	
10	The dominant protein in human milk is alpha-lactalbumin.	
11	The failure of cell cycle regulation leads to neoplasia.	
12	The function of pRB is similar to that of p53 and functional in several major cancers.	
13	Vaccine against HPV prevents cervical cancer.	
14	The embryonic stem cells are isolated from hypoblast of blastocyst.	
15	The cells that are directly originate from haemopoietic stem cells are NK cells and dendritic cells.	

FILL IN THE TABLES APPROPRIATELY

1. S.No.	Type of vaccine	Decription
1	Attenuated Whole agent Vaccines	
2	Inactivated Whole Agent Vaccines	
3	Toxoids	

2.

S.No.	Feature	Normal cell	Cancer cell
1	Cell cycle regulation		
2	Contact inhibition		
3	Cadherins		
4	Apoptosis		
5	Surface antigens		
6	Angiogenesis		

3.

S.No.	Feature	Description
1	Totipotent stem cells	
2	Pluripotent stem cells	
3	Multipotent stem cells	
4	Unipotent stem cells	

MATCH THE FOLLOWING

- | | | |
|----|--------------------------|------------------------------------|
| 1. | 1. Yellow fever vaccine | a. Attenuated Whole Agent Vaccine |
| | 2. Diphtheria vaccine | b. Inactivated Whole agent Vaccine |
| | 3. Sabin's polio vaccine | c. Toxoid |
| | 4. Salk's polio vaccine | |
| | 5. Rubella | |

Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

- | | | |
|----|----------------------|--------------|
| 2. | 1. Epithelial cells | a. Leukemia |
| | 2. Lymphatic system | b. Sarcoma |
| | 3. Bone marrow | c. Carcinoma |
| | 4. Connective tissue | d. Lymphoma |
| | 5. WBC | |

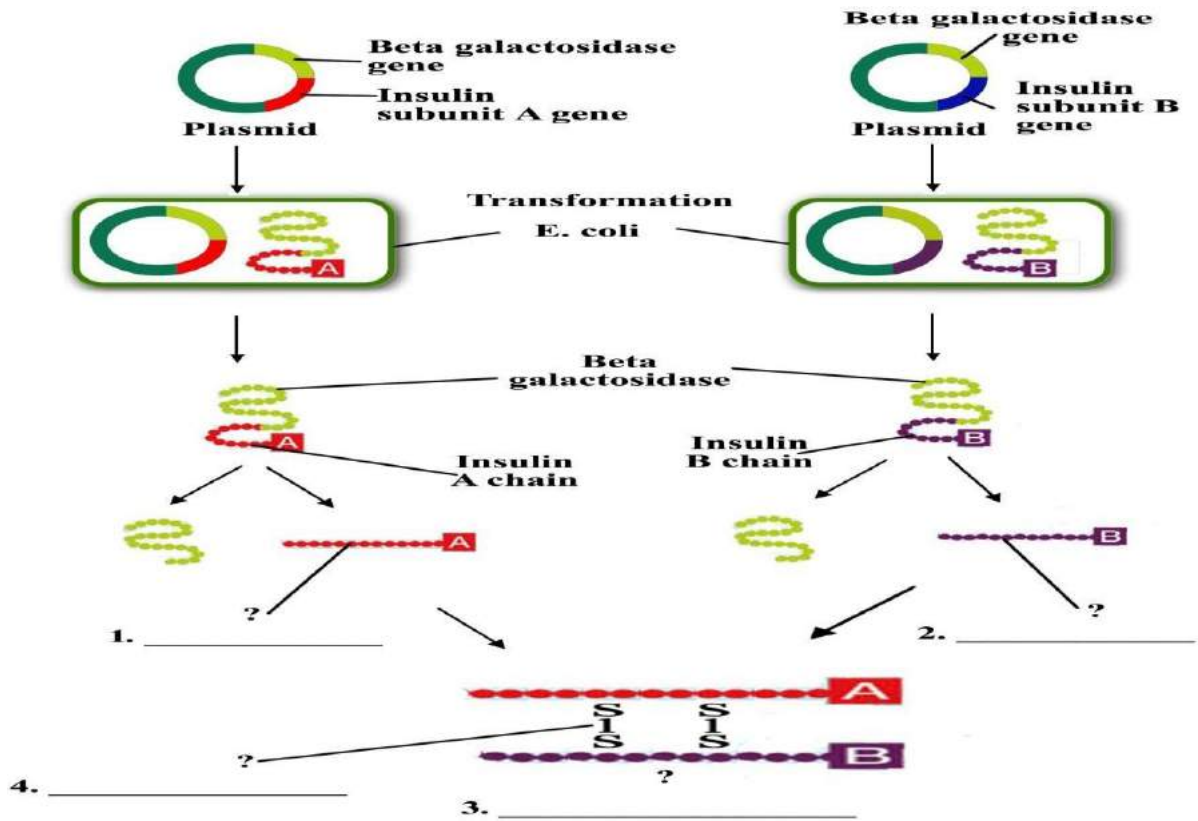
Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

- | | | |
|----|---------------------------------|----------------|
| 3. | 1. Muscle stem cell | a. Multipotent |
| | 2. Cells of germinal layers | b. Omnipotent |
| | 3. Cells of morula | c. Pluripotent |
| | 4. Haemopoietic stem cells | d. Unipotent |
| | 5. Stem cells of umbilical cord | |

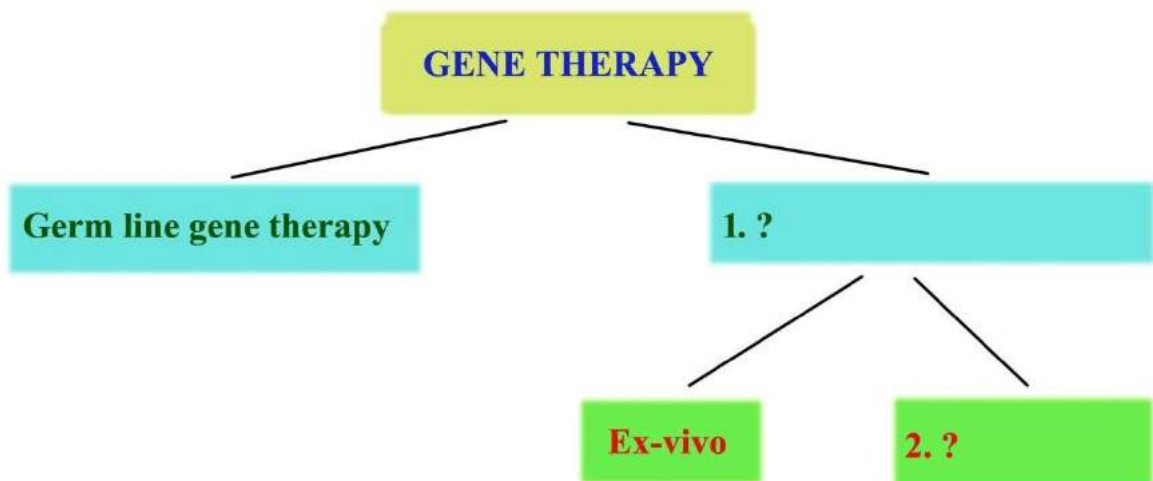
Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

FILL IN THE FLOW-CHART

1. The following is the process by which Eli Lilly company produced human insulin, Humulin, solving the challenge of the production of mature human insulin. Study the process and answer four questions given in the flow chart.

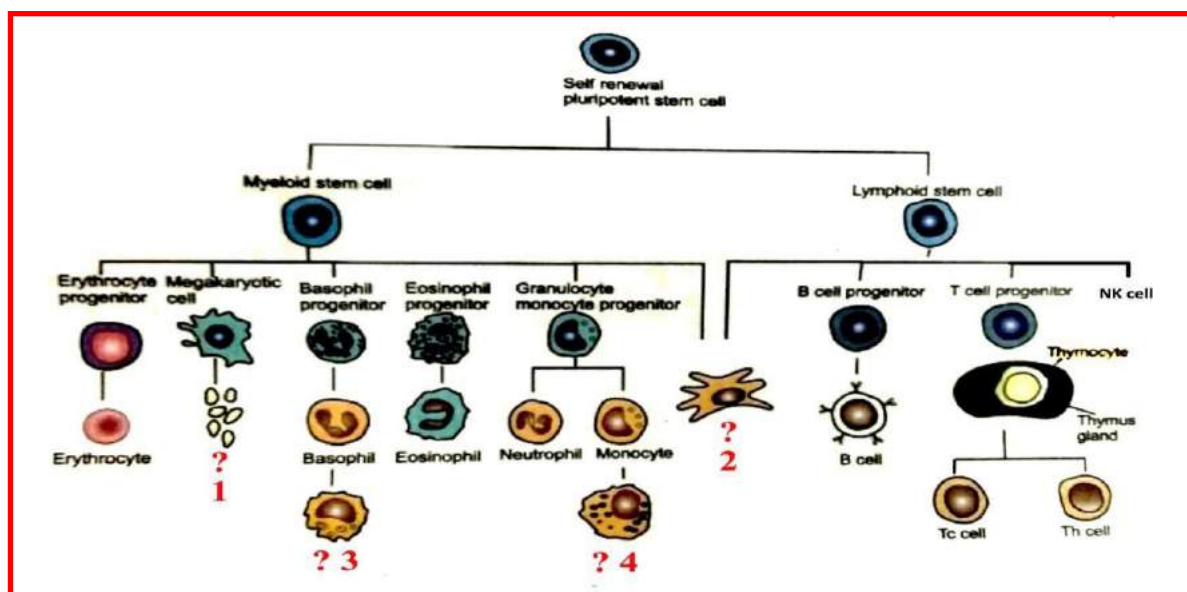


2. Study the following flow chart and answer.



1. _____ 2. _____

3. Study the haemopoietic stem cells lineage and find the cells which are marked with question mark and write the answers.



1. _____ 2. _____ 3. _____ 4. _____

ASSERTION AND REASONING QUESTIONS

Instructions: Read the following statements and answer as given below.

- a) (A) and (R) are true and (R) is the correct explanation of (A).
 b) (A) and (R) are true and (R) is not the correct explanation of (A).
 c) (A) is true and (R) is false. d) Both (A) and (R) are false.

- | |
|--|
| 1. (A) Insulin cannot be administered orally.
(R) Insulin is a protein. It is broken down in the stomach before it can be absorbed. |
| 2. (A) Insulin pro-hormone has 3 peptide chains i.e., chain-A, chain-B and chain-C.
(R) The chain-C is not present in mature insulin. |
| 3. (A) Small pox was completely eradicated in the world.
(R) Intensive vaccination programme for small pox had been taken up in organized way |
| 4. (A) Vaccines are generally prophylactic.
(R) Vaccines give total protection from the disease, it is intended for. |
| 5. (A) ADA is crucial for the immune system to function.
(R) ADA causes SCID. |
| 6. (A) GM-organisms are used for testing toxicity of drugs.
(R) Toxicity testing in GM-organisms will allow us to obtain results in less time. |
| 7. (A) Cancer cells cause metastasis.
(R) Cancer cells lack cadherins. |
| 8. (A) Most common cancers are carcinomas.
(R) The epithelial cells divide more often. |
| 9. (A) Taxol is used in chemotherapy of cancer.
(R) Chemotherapy has side effects like hair loss. |
| 10. (A) Fragmentation of megakaryocyte produces blood platelets.
(R) Megakaryoblast forms megakaryocyte. |
| 11. (A) Stem cells taken from umbilical cord can perhaps produce the entire organism through cell culture
(R) Umbilical stem cells are pluripotent. |

PART -III : BIOMEDICAL TECHNOLOGY

CAN YOU IDENTIFY THE FOLLOWING PHOTOGRAPHS ?

1.



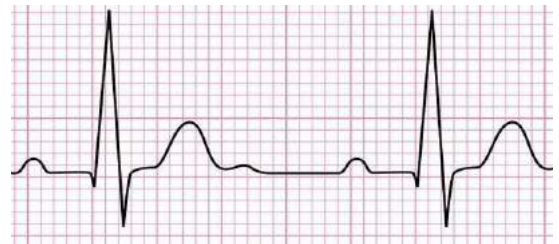
2.



3.



4.



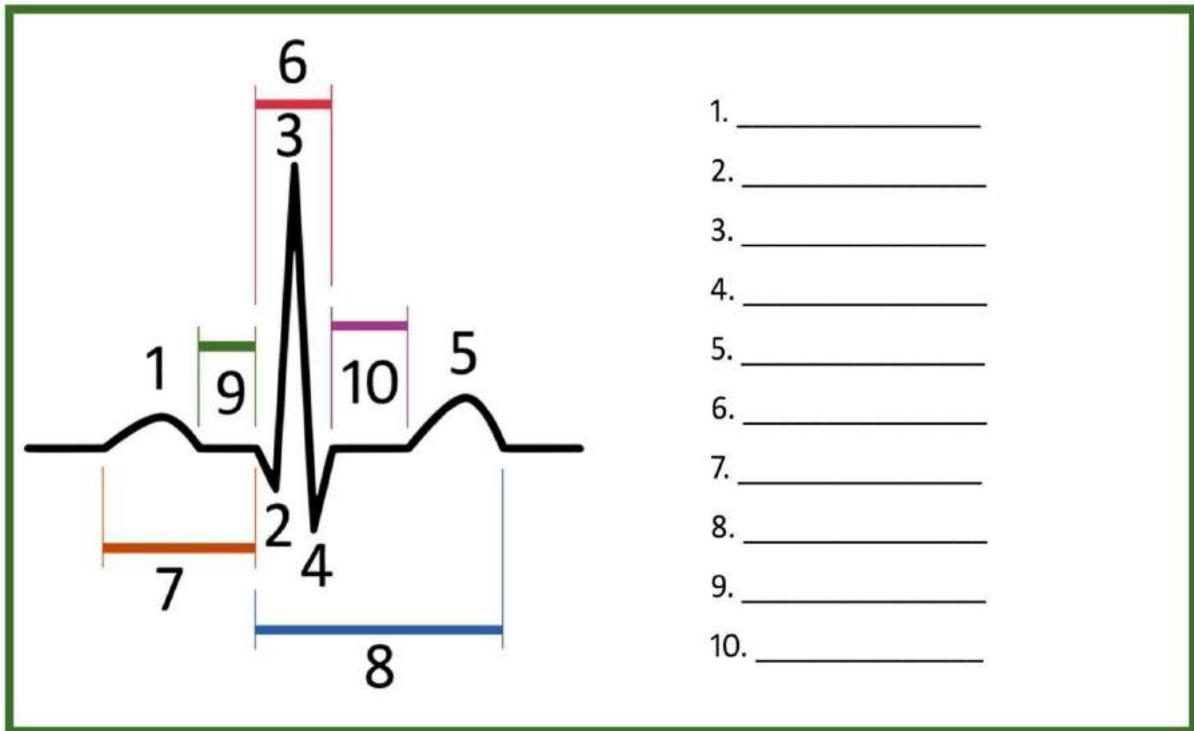
5.



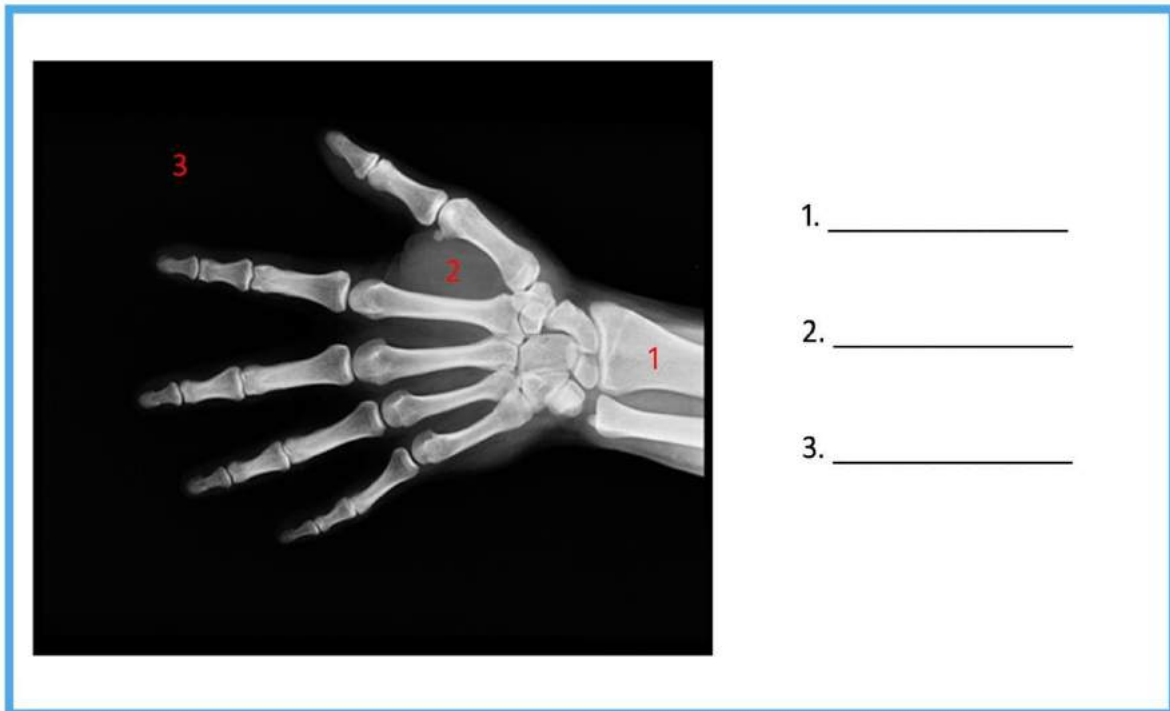
6.



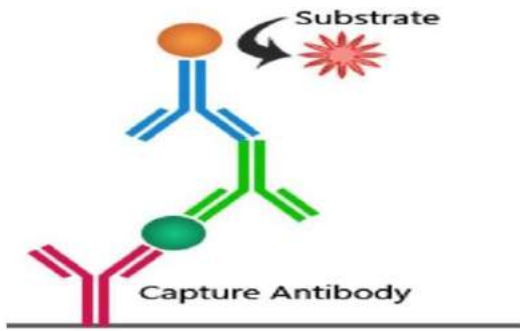
7. The following is the diagram of ECG. Write the names of 1 to 10 parts of ECG.



8. Study the following X-ray radiograph of hand and write what do white, grey and black portions denote.

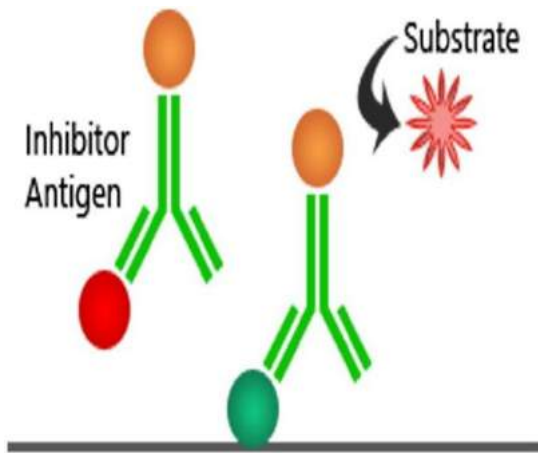


9. Study the following ELISA and find what type of ELISA it is.



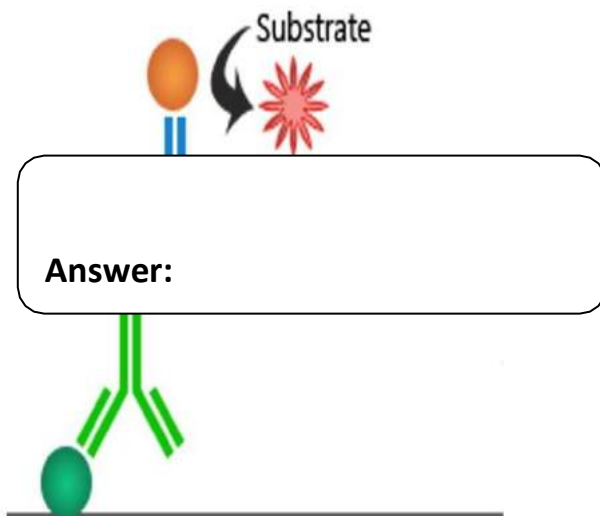
Answer:

9. Study the following ELISA and find what type of ELISA it is.



Answer:

10. Study the following ELISA and find what type of ELISA it is.



DEFINE/EXPAND THE FOLLOWING WORDS

WORD	DEFINE/EXPAND
1. Biomedical technology	
2. Radiographs/skiagraphs	
2. Angiography	
4. Ionizing radiation	
3. CAT	
4. Tomogram	
5. MRI	
6. ECG	
7. EEG	
8. PET	
9. ELISA	
10. Spectrophotometer	

III.3 Fill in the blanks

1. The application of principles of biophysics and biochemistry for studying certain biological aspects is_____.
2. X-rays discovered by_____.
3. Photographs developed using X-rays are known as_____.
4. Taking series of X-rays as blood flows through blood vessels as in the coronary or carotid arteries to study blocks in them is known as_____.
5. The angiography used nowadays to get a better resolution images is_____.
6. The recorded image by CT scanner is called_____.
7. The scan which is useful to measure accurately the density of bones in evaluating osteoporosis is_____.
8. The diagnostic radiology technique that uses magnetism is_____.
9. Non-invasive medical imaging technique is_____.
10. One of the radio contrast agent is_____.
11. The diagnostic imaging technique which can show even hairline fractures of the pelvis and hip is_____.
12. The non-invasive and commonly used procedure for recording electrical changes in the heart is_____.
13. ECG is recorded using____leads.
14. The normal ECG consists of_____.
15. Atrial systole/atrial depolarization is represented in ECG by_____.
16. Ventricular depolarization/ventricular systole is represented in ECG by_____.
17. Ventricular repolarization is represented in ECG by_____.

18. The electrical activity of brain is recorded by _____.
19. Useful tool in diagnosing neurological and sleep disorders is _____.
20. The diagnosis of epilepsy, coma, brain death and insomnia can be detected by _____.
21. The waves recorded by an EEG consist of _____.
22. The most basic biochemical procedure to detect antigens or antibodies in a given sample is _____.
23. ELISA is used to detect pathogen like _____ and to detect the presence of hormones such as _____.
24. Examples for enzymes used in ELISA are _____.
25. ELISA used to detect antigens is _____.
26. ELISA used to detect antibodies is _____.
27. Two types of Direct ELISA are _____.
28. Enzyme coupled antibodies are used in _____ ELISA.
29. In Sandwich Assay the antigen to be measured should contain at least _____ antigenic sites.
30. Sandwich Assay is used to quantify multivalent antigens such as _____.
31. An example for which Competitive ELISA is conducted _____.
32. In pregnancy test, the two types of hCGs compete for the space on the antibodies. Hence this type of ELISA is called _____.
33. The intensity of the colour change in ELISA is measured by _____.

MULTIPLE CHOICE QUESTIONS

1. Which of the following diagnostic imaging technique does not use ionizing radiations is
a. X-ray imaging b. CAT c. MRI d. None of these
2. Which of the following diagnostic imaging technique gives 2D images is
a. X-ray imaging b. CAT c. MRI d. None of these
3. Which of the following diagnostic imaging techniques give 3D images are
a. X-ray imaging b. CAT c. MRI d. None of these
4. In which of the following diagnostic imaging technique, the density of bones in evaluating osteoporosis is measured
a. X-ray imaging b. CAT c. MRI d. None of these
5. In which of the following diagnostic imaging technique, even the hairline fractures of pelvis and hip can be detected
a. X-ray imaging b. CAT c. MRI d. None of these
6. In which of the following diagnostic imaging techniques, X-rays are used
a. X-ray imaging b. CAT c. MRI d. None of these
7. In which of the following diagnostic imaging technique, magnetism is used
a. X-ray imaging b. CAT c. MRI d. None of these
8. In which of the following diagnostic imaging technique, a powerful magnetic field, radio frequency pulses and a computer is used
a. X-ray imaging b. CAT c. MRI d. None of these
9. In X-ray radiograph, dense bones are in
a. white colour b. grey colour c. black colour d. None of these

10. In X-ray radiograph, soft tissues are in	a. white colour	b. grey colour	c. black colour	d. None of these
11. In X-ray radiograph, air in lungs is in	a. white colour	b. grey colour	c. black colour	d. None of these
12. The diagnostic imaging technique that provides good contrast between the different soft tissues of the body is	a. X-ray imaging	b. CAT	c. MRI	d. None of these
13. In ECG, normal P- wave duration is	a. 0.8 sec.	b. 0.1sec.	c. 0.2 sec	d. 0.08 – 0.1 sec.
14. In ECG, normal QRS Complex of waves' duration is	a. 0.8 sec.	b. 0.1sec.	c. 0.2 sec	d. 0.08 – 0.1 sec.
15. In ECG, normal T- wave duration is	a. 0.8 sec.	b. 0.1sec.	c. 0.2 sec	d. 0.08 – 0.1 sec.
16. In ECG, normal P-R interval is	a. 0.8 sec.	b. 0.4sec.	c. 0.12 – 0.2 sec	d. 0.08 – 0.1 sec.
17. In ECG, normal Q-T interval is	a. 0.8 sec.	b. 0.1sec.	c. 0.2 sec	d. 0.08-0.1 sec.
18. In ECG, normal R-R interval is	a. 0.8 sec.	b. 0.4sec.	c. 0.2 sec	d. 0.08-0.1 sec.
19. Which of the following interval signifies the duration of one cardiac cycle	a. QT interval	b. R-R interval	c. P-R interval	d. None of these
20. Enlarged P wave in ECG indicates	a. bundle branch block	b. enlarged atria	c. bradycardia	d. tachycardia
21. Variations in the duration, amplitude and morphology of the QRS complex in ECG indicates	a. bundle branch block	b. enlarged atria	c. bradycardia	d. tachycardia
22. Prolonged P-R interval in ECG indicates	a. bundle branch block	b. enlarged atria	c. bradycardia	d. tachycardiac
23. Shortened P-R interval in ECG indicates	a. bundle branch block	b. enlarged atria	c. bradycardia	d. tachycardia
24. Prolonged Q-T interval in ECG indicates	a. hypothyroidism	b. myocardial infarction	c. hypokalemia	d. hypercalcemia
25. Shortened Q-T interval in ECG indicates	a. hypothyroidism	b. myocardial infarction	c. hypokalemia	d. hypercalcemia
26. Elevated S-T segment in ECG indicates	a. hypothyroidism	b. myocardial infarction	c. hypokalemia	d. hypercalcemia
27. Tall T-wave in ECG indicates	a. hyperkalemia	b. myocardial infarction	c. hypokalemia	d. hypercalcemia
28. Small, flat or inverted T-wave in ECG indicates				

a. hyperkalemia	b. myocardial infarction
c. hypokalemia	d. hypercalcemia
29. The frequency of Alpha waves is	
a. 4-7 cycles per second	b. 13-40 cycles per second
c. 8-13 cycles per second	d. less than 3 cycles per second
30. The frequency of Beta waves is	
a. 4-7 cycles per second	b. 13-40 cycles per second
c. 8-13 cycles per second	d. less than 3 cycles per second
31. The frequency of Theta waves is	
a. 4-7 cycles per second	b. 13-40 cycles per second
c. 8-13 cycles per second	d. less than 3 cycles per second
32. The frequency of Delta waves is	
a. 4-7 cycles per second	b. 13-40 cycles per second
c. 8-13 cycles per second	d. less than 3 cycles per second
33. The brain wave pattern seen in persons who are drowsy/ sleepy with closed eyes is	
a. Theta wave pattern	b. Delta wave pattern
c. Alpha wave pattern	d. Beta wave pattern
34. The brain wave pattern seen in persons who are mentally active and tense is	
a. Theta wave pattern	b. Delta wave pattern
c. Alpha wave pattern	d. Beta wave pattern
35. The brain wave pattern seen in adults who are in deep sleep is	
a. Theta wave pattern	b. Delta wave pattern
c. Alpha wave pattern	d. Beta wave pattern
36. The brain wave pattern commonly seen in early childhood is	
a. Theta wave pattern	b. Delta wave pattern
c. Alpha wave pattern	d. Beta wave pattern
37. The brain wave pattern commonly seen in children of less than 5 years of age is	
a. Theta wave pattern	b. Delta wave pattern
c. Alpha wave pattern	d. Beta wave pattern
38. The brain wave pattern recorded during emotional stress in adults is	
a. Theta wave pattern	b. Delta wave pattern
c. Alpha wave pattern	d. Beta wave pattern
39. Which of the following is used to quantify multivalent antigens like proteins or polysaccharides	
a. Indirect ELISA	b. Sandwich Assay
c. Competitive ELISA	d. Beta wave pattern
40. Which of the following is used for pregnancy test	
a. Indirect ELISA	b. Sandwich Assay
c. Competitive ELISA	d. Beta wave pattern
41. Which of the following is used screen for HIV antibodies	
a. Indirect ELISA	b. Sandwich Assay
c. Competitive ELISA	d. Beta wave pattern

TRUE OR FALSE STATEMENTS

S.No.	Statement	True/False
1	Photographs developed using X-rays are known as skiagraphs.	
2	CAT is non-invasive medical imaging technique.	
3	X-ray radiography and CAT uses X-rays for imaging.	
4	Ballooning of blood vessels is called aneurysms.	
5	In MRI normal healthy cells and pathological cells emit same energy waves.	
6	ECG records depolarisations and repolarisations of heart muscle.	
7	The tallest negative wave in ECG is R wave.	
8	The smallest negative wave is Q wave.	
9	EEG is a very useful tool in diagnosing seizures.	
10	In ELISA, unbound substances in the well are removed by buffer.	
11	If there is colour change in ELISA pregnancy test, it indicates pregnancy.	
12	In ELISA substrate is chromogenic substance.	

III.6 FILL IN THE TABLES APPROPRIATELY

1. S.No.	Diagnostic tool	Useful in
1	X-ray radiography	
2	CAT	
3	MRI	
4	ECG	
5	EEG	

2.

S.No.	Component of ECG	Duration	Significance
1	P wave		
2	QRS complex		
3	T wave		
4	P-R interval		
5	Q-T interval		
6	R-R interval		

3.

S.No.	Waves of EEG	Frequency	Recorded when
1	Alpha waves		
2	Beta waves		
3	Theta waves		
4	Delta waves		

4.

S.No.	Requirements for ELISA	Significance
1	Microtitre plate	
2	Purified antibody	
3	Purified antigen	
4	Enzyme	
5	Buffer	
6	Substrate	
7	Spectrophotometer	

5.

S.No.	Type of ELISA	To detect (antigen/antibody)	Used in
1	Sandwich Assay		
2	Competitive Assay		
3	Indirect ELISA		

MATCH THE FOLLOWING

1. Match the following with respect to Medical biotechnology.

- | | |
|------------------------------------|--------------|
| 1. Digital Subtraction Angiography | a. Tomogram |
| 2. CAT | b. 12 LEADS |
| 3. MRI | c. Insomnia |
| 4. ECG | d. Magnetism |
| 5. ELISA | e. X-Rays |
| 6. EEG | f. HIV |

Ans:- 1.____ 2.____ 3.____ 4.____ 5.____ 6. ____

2. Match the following with respect to X-ray radiography.

- | | |
|-----------------------------|-----------------------------------|
| 1. Soft tissues | a. Black |
| 2. Blocks in arteries | b. Grey |
| 3. Better resolution images | c. Angiography |
| 4. Air | d. White |
| 5. Bones | e. Digital Extraction Angiography |

Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

3. Match the following with respect to ECG

1. Bradycardia
2. Hypokalemia
3. Tachycardia
4. Hypercalcemia
5. Hyperkalemia

- a. Shortened P-R interval
- b. Shortened Q-T interval
- c. Tall T wave
- d. Prolonged P-R interval
- e. small, flat or inverted T wave

Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

4. Match the following with respect to EEG

1. Alpha waves
2. Beta waves
3. Theta waves
4. Delta waves

- a. Deep sleep
- b. Emotional stress
- c. Sleepy with closed eyes
- d. Mentally active and tense

Ans:- 1.____ 2.____ 3.____ 4.____

5. Match the following with respect to ELISA

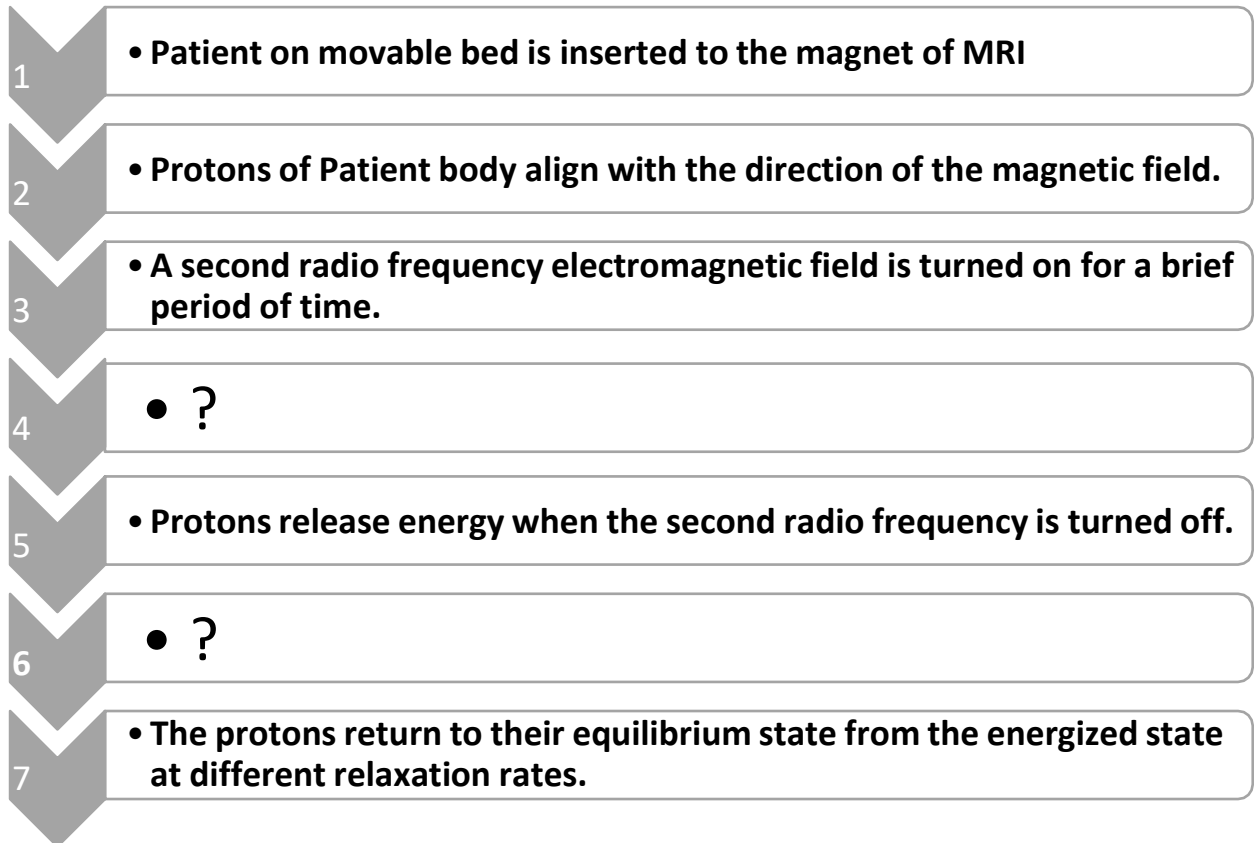
1. Chromogenic substance
2. Beta galactosidase
3. Multivalent antigens
4. hCG
5. Antihuman serum globulins

- a. Sandwich Assay
- b. Competitive Assay
- c. Substrate
- d. Indirect ELISA
- e. Enzyme

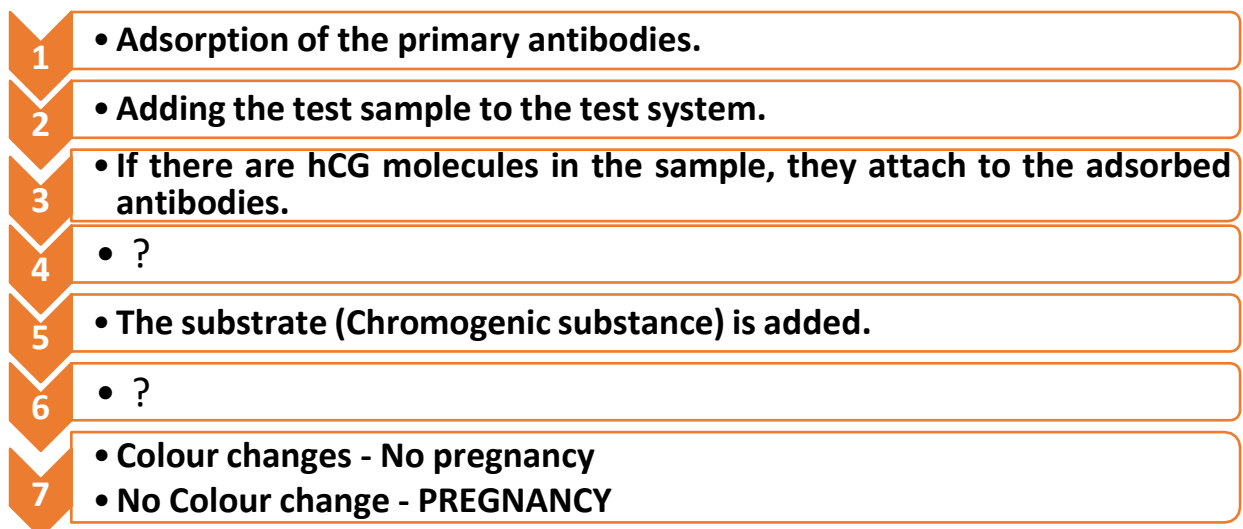
Ans:- 1.____ 2.____ 3.____ 4.____ 5.____

FILL IN THE FLOW-CHART

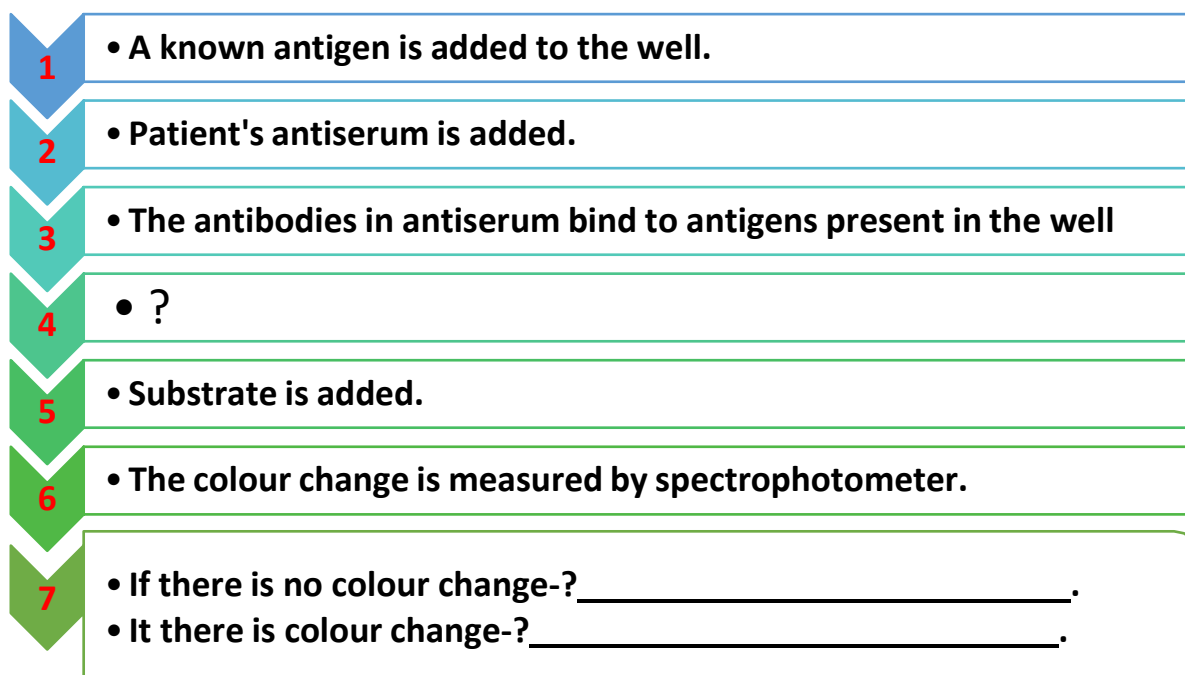
1. Study the following MRI scanning procedure and fill in the blanks.



2. Study the following Competitive Assay protocol for pregnancy test and fill up the blanks.



3. Study the following Indirect ELISA protocol of HIV and fill up the blanks.



ASSERTION AND REASONING QUESTIONS

Instructions: Read the following statements and answer as given below.

a) (A) and (R) are true and (R) is the correct explanation of (A).

b) (A) and (R) are true and (R) is not the correct explanation of (A).

c) (A) is true and (R) is false. d) Both (A) and (R) are false.

1. (A) In X-ray radiography air in lungs appears blackish.

(R) Air absorbs most of the X-radiation.

2. (A) Tomogram is 3-D cross sectional image.

(R) CT scanner emits a series of narrow beams through the human body as it moves through an arc.

3. (A) In MRI abnormal tissues can be detected.

(R) Different types of tissues emit different quanta of energy.

4. (A) In ECG sometimes Q-T interval is shorter.

(R) The shorter the heart rate – the shorter the interval.

5. (A) Delta waves are recorded in the EEG of a person how is in awaken stage.

(R) Delta waves commonly occur in deep sleep.

6. (A) A purified antibody has to be obtained to detect an antigen in ELISA.

(R) A purified antigen is used to generate specific monoclonal antibodies.

7. (A) In Sandwich Assay antigen should contain at least 2 antigenic sites.

(R) In Sandwich Assay antibody is sandwiched between two layers of antigens.

8. (A) In Competitive Assay the colour change is intense, it indicates pregnancy.

(R) Colour change in Competitive Assay means the primary antibodies are occupied by the hCG molecules of test sample.

9. (A) Human serum proteins are injected to experimental animals to get antihuman immune serum globulins.

(R) Indirect ELISA is used to detect antigens.

10. (A) The enzyme used in ELISA acts on chromogenic substance to produce colour.

(R) The enzyme in ELISA catalyses the substrate.

Assignment Questions to answer

VSAQ**	1	Distinguish between Out- Cross and Cross-Breed.
***	2	Define the terms Layer and Broiler.
***	3	What is Apiculture?
***	4	Explain the term “Hypophysation”?
***	5	List out any two Indian Carps and two Exotic carps.
*	6	Mention any four fish by-products.
*	7	Define the term Vaccine.
**	8	Mention any two features of PCR.
*	9	Define the term “Transgenic Animals”.
**	10	What is popularly called “Guardian Angel of Cell’s Genome”?
***	11	List out any four features of cancer cells.
**	12	What is Tomogram?
***	13	MRI scan is harmless- Justify.
**	14	What does prolonged P-R interval indicate in an ECG?
**	15	Which substances in a sample are detected by direct and indirect ELISA respectively?
SAQ***	1	List out the various steps involved in MOET.
**	2	Discuss in brief about “Avian Flu”.
***	3	Honey bees are economically important – Justify.
**	4	Explain in brief the structure of “Insulin”.
***	5	Write in brief the types of gene therapy.
***	6	Explain the different types of Cancer.
***	7	List out any four salient features of cancer Cells.
*	8	Discuss briefly the process of indirect ELISA.
**	9	Write short note on EEG.
LAQ **	17	Write in detail about Out breeding.
**	18	Explain in detail about the clinical inferences from ECG.

V. Hands on Experience For you – Try It !!!!

1. Visiting Breeding and Care Taking Farms:

Andhra Pradesh has some of the richest livestock resources in the Country and is one of the most advanced States in Animal Husbandry activities. The Livestock play a vital role in Socio-economic and cultural life of our people. The State has the world famous breed of Ongole Cattle an Aseel breed of poultry, which is the principle source for the development of broiler breeds in the world. Andhra Pradesh is also famous for Nellore breed of sheep, which is well known for quality mutton production.

Presently Andhra Pradesh stands first in poultry (1005.80 lakhs) and sheep population (210.15 lakhs), second in Buffalo population (107.68 lakhs), seventh in goat population (64.27 lakhs), and eighth in cattle (94.24 lakhs) and pig population (5.4.9 lakhs) in the Country.

The per capita availability of Milk has increased from 168 gms/day (1997-98) to 286 gms/day (2005-06). The Per capita availability of Eggs has increased from 141 nos/annum (1997-98) to 202 nos/annum (2005-06). The Per capita availability of Meat has increased from 9.21 gms/day (1997-98) to 15.35 gms/day (2005-06) in spite of rapid growth in human population, which is a remarkable achievement.

Students and Lecturers are advised to make field trips to the following stations for first hand experience in various branches of Animal husbandry.

1. Gosamrakshana Samithi, in your Districts and Mandals.
2. Breeding Farms in Your Vicinity
3. Dairy Farming .
4. Sheep farming .
5. Goat Farming .
6. Poultry Farming .
7. Emu Farming .
8. Rabbit Farming .
9. Quail Farming .
10. Turkey Farming.
11. Apiaries in your vicinity.
12. Near by Fisheries and Aqua Farms

2. Visiting Centres of Biotechnology:

Andhra Pradesh's position as a Biotech Destination:

The Government plans to develop Visakhapatnam as the biotechnology hub of Andhra Pradesh. Government of Andhra Pradesh shall encourage partnerships with private players for development of infrastructure in the form of life sciences parks and skill training centres etc. at Visakhapatnam.

Currently, a host of global and national players have made Visakhapatnam their manufacturing hub, especially for bulk drug exports.

Several Japanese and American companies are operating in Visakhapatnam along with Indian companies. Today Andhra Pradesh is

✓ Home to 200+ pharmaceutical units
✓ Amongst the top 3 states in pharmaceutical exports
✓ Having Pharmaceutical industry worth USD 1 billion in North Andhra Region
✓ Having - JN Pharma City in Visakhapatnam houses more than 60 pharmaceutical units
✓ Home for Andhra Med Tech Zone – Asia's 1 st medical devices park being set up in Visakhapatnam
✓ 128 pharmaceutical colleges producing over 11,000 highly-skilled personnel annually

Students and Lecturers are advised to make field trips to Visakapatnam JN Pharma City and other pharmaceutical industries in your district headquarters to have first-hand experience on various job opportunities and developing entrepreneurial skills.

3. Visiting Research Centers in the state

- **Homi Bhabha Cancer Hospital & Research Centre** is a cancer care hospital and research centre in [Visakhapatnam](#) Andhra Pradesh state, India. This regional cancer centre is funded by the Government of India and [Tata Memorial Centre](#). The Indian Council of Medical Research has recognized this referral Institution as a research organization.
- **The Centre for Cellular & Molecular Biology (CCMB)** is a premier research organization in frontier areas of modern biology. The objectives of the Centre are to conduct high quality basic research and training in frontier areas of modern biology, and promote centralised national facilities for new and modern techniques in the inter-disciplinary areas of biology.

● All India Institute of Medical Science (AIIMS) at Mangalagiri
● Indian Institute of Science Education & Research (IISER) at Tirupati
● Indian Institute of Technology (IIT) at Tirupati
● National Institute of Ocean Technology (ESSO-NIOT) at Thupilipallam near Nellore

4. Visiting Medical Laboratories or Multi-speciality Hospitals in your area

Multi- Specialty Hospital is the hospital which has all the different branches of Medicine and surgery under one roof.

A medical laboratory or clinical laboratory is a [laboratory](#) where tests are carried out on clinical specimens to obtain information about the [health](#) of a [patient](#) to aid in diagnosis, treatment, and prevention of disease.

Visiting these centres will enhance your knowledge on various branches of Biomedical Technology, like

Radiodiagnosis, MRI scan, CT scan, CAT scan etc.,

VI. Careers in Applied Biology:

1. Careers in Animal Husbandry:

“Animal Husbandry as a career offers immense job opportunities.”

After pursuing courses in this field you will be able to work with farm, zoo and lab animals anywhere in India and in abroad. Animal Husbandry sector also offers large self employment opportunities. You can also do teaching jobs in universities or colleges.

You can become professionals in this field including poultry, livestock, dairy and farmers. Most common career in animal husbandry is animal technician, animal caretaker, breeding supervisor and livestock farm manager.

Animal husbandry professionals can do the work themselves or oversee other workers, depending upon the size of the farm. After holding a degree in this field you can manage a livestock operation, consult for an agribusiness company or start your own breeding farm.

Job Profiles:

- Farm Manager
 - Research Assistant
 - Entrepreneur
 - Animal Husbandry Technician
 - Subject Matter Specialist
 - Post Graduate Teacher
 - Animal Husbandry Officer
-

Employment Area

- Stud farms
 - Poultry Farms
 - Rabbit farms
 - Veterinary Hospitals
 - Wildlife Sanctuaries
 - Animal Husbandry Clinics
 - Aviaries
 - Zoological parks
 - Dairy farms
 - Universities
-

Some major recruiters are:

- National Dairy Development Board (NDDB)
 - Veterinary Council of India
 - Indian Council for Agricultural Research
 - State Animal Husbandry Department
 - Central Cattle Breeding Farm
 - Indian Forest Services
-

2. Careers in Biotechnology:

Biotechnologists can work for various organizations/industries under these positions:

Medical scientists, Biological technicians,

Medical and Clinical Lab Technologists & Technicians

Biochemists and Biophysicists, Biomedical Engineers, Microbiologists

Epidemiologists, R&D and Process Development Scientists

Biomanufacturing Specialists, Bioproduction Operators

1.1 CAN YOU IDENTIFY THE FOLLOWING PHOTOGRAPHS ? -1

1.1	Dr. Verghese Kurien
1.2	Murrah
1.3	Ongole breed bull
1.4	Holstein-Friesian cow
1.5	Mule
1.6	Hinny

CAN YOU IDENTIFY THE FOLLOWING PHOTOGRAPHS ? -2

I.2.1	Dr. B.V. Rao
2.2	National Egg Coordination Committee
2.3	Avian flu virus
2.4	severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)
2.5	Drone, Queen and Worker bees
2.6	<u>Nobel laureate Karl von Frisch</u>

SEE THE PHOTOGRAPHS AND WRITE FEW LINES ABOUT THEM

I.3.1	Apis mellifera: A European bee. A favourite for apiculture. It yields large quantities of quality honey.	Apis cerana indica: An Indian or Asian hive bee. It is wild and is also domesticated.
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3.2	Drone	Queen	Workers
	It is robust, large winged, haploid male, small numbered, short lived, and fed with bee bread by nurse workers. They are developed from the unfertilized ova by arrhenotoky.	It is the largest individual in the colony. It is a fertile, diploid female, present one for bee hive, develops from fertilized egg and egg layer of the colony.	They are sterile diploid females which develop from fertilized eggs. They perform diverse functions.

IDENTIFY THE FOLLOWING PHOTOGRAPHS AND FILL UP THE TABLE-3

I.4.1	Dog shark	Scoliodon	<ol style="list-style-type: none"> 1. The body is spindle shaped and covered with placoid scales. 2. The mouth is crescent shaped and ventral in position. 3. There are five pairs of gill-slits on either side of the head without operculum. 4. Two dorsal fins are present and the caudal fin is heterocercal.
4.2	Rohu	Labeo rohita	<ol style="list-style-type: none"> 1. The head has a short, obtuse and blunt snout. 2. The body is covered with cycloid scales with orange to reddish centre. 3. The mouth is sub-terminal, surrounded by fringed and fleshy lips. The upper lip has a pair of filamentous barbules. 4. Large operculum covers the gills on either side.
4.3	Catla	Catla catla	<ol style="list-style-type: none"> 1. The dorsal side of the body is convex. Head is very large without scales. 2. Snout round and blunt. The head has pair of large eyes. 3. Mouth is wide and upturned with prominent and protruding lower jaw. 4. Lips are prominent. Lower lip is thick. Barbules are absent.
4.4	Mrigal	Cirrhinus mrigala	<ol style="list-style-type: none"> 1. The head is without scales and ends in a blunt snout. 2. The mouth is broad. The upper lip is thick and curved to down. 3. The lower lip is indistinct. A pair of barbules are present. 4. The dorsal fin is grey in colour; pectoral, pelvic and caudal fins are orange tipped.

SEE THE PHOTOGRAPHS AND WRITE FEW LINES ABOUT THEM

I.5.1	Silver carp, Grass carp and Common Carps	These are exotic-Chinese carps. These are also used in pisciculture in recent years in India. Growth, rate and reproductive potential are high in them.
I.5.2	Layers	Broilers
	These are raised exclusively for the production of their meat. The central poultry breeding farms established at Mumbai, Bhubaneswar and Hesserghatta develop hybrid strains of layers. Hybrid layers are BV-300, Hyline, Poona pearls, etc.	They are raised exclusively for their meat. They are of any sex under the age of 8-10 weeks weighing 1.5 kg with smooth textured breast. Indian Veterinary Research Institute at Izatnagar produces quality broiler strains. Commercial broiler strains used in India include Hubbard, Vencobb, etc.

I.5.A	Poultry birds	Poultry birds give us eggs and meat. Egg is a highly nutritious food item for humans because of its biological value (96%) and PER (4.5). 100g of egg has 13.3% proteins, 11.5% fat and gives 173 K.cal of energy. 100g of chicken meat has 20% protein, 2.5% fat and gives 109 K.cal energy.
5.B	Honey bees	<ol style="list-style-type: none"> 1. Honey: rich source of fructose, glucose, minerals, vitamins and water. 2. Bee's wax: Preparation of cosmetics, polishes and candles. 3. Propolis: used in treatment of inflammation and superficial burns. 4. Bee venom: Used in treatment of rheumatoid arthritis. 5. Pollination: Bees are best pollinators, particularly for Brassica, apple and pear.
5.C	Fishes	<ol style="list-style-type: none"> 1. Food: Good source of proteins, Vitamins A & D, minerals, rich in iodine. 2. Shark and Cod liver oils: Good sources of Vitamins A & D. Sardine and Salmon are good sources of omega 3 fatty acids which reduce cholesterol, help prevent cancer cell growth etc. 3. Fish guano: Fertilizer prepared from 'scrap fish' 4. Isinglass: Substance obtained from dried swim bladders of mostly cat fish, used in clarification of wines. 5. Shagreen: dried shark skin used as an abrasive and decorative material.

DEFINE THE FOLLOWING WORDS

WORD	DEFINITION/EXPANSION
1. Animal husbandry	It is the agricultural practice of breeding and raising livestock.
2. Dairying	It is the breeding, feeding and management of milch animals, production, processing and marketing of their milk and milk products on economic basis.
3. Sire	Male parent animal
4. Dam	Female parent animal
5. Out-cross	The offspring produced in mating of animals within the same breed, but having no common ancestors on either side of the pedigree for 4-6 generations is known as out-cross.
6. Cross-breed	The offspring produced in mating of superior males of one breed with superior females of another breed.
7. Jack/ass	Male donkey
8. Jennet	Female donkey
9. Stallion	Male horse
10. Mare	Female horse
11. Artificial insemination	It is the technique in which semen is collected from superior bulls and introduced into the female reproductive tract when the female is in 'heat'. This semen can be used immediately or can be frozen and used at a later period.
12. MOET	Multiple Ovulation and Embryo Transfer
13. Super Ovulation	It is the technique in which female animals are induced with hormones like FSH to produce 6-8 eggs instead of one egg which they normally produce per cycle.

14. Surrogate mother	It is an animal that develops the offspring of another animal in its womb.
15. Inbreeding depression	Continued inbreeding usually reduces fertility and productivity of farm animals. This is called inbreeding depression.
16. Layers	The birds which are raised exclusively for the production of eggs.
17. Broilers	The birds which are raised exclusively for meat.
18. NECC	National Egg Coordination Committee
19. IVRI	Indian Veterinary Research Institute.
20. H5N1 virus	Avian flu virus (Bird flu virus)
21. Pandemic disease	The disease which is widespread in entire country/continent/whole world.
22. Apiculture	It is the maintenance of hives of honey bees for the production of honey and wax.
23. Arrhenotoky	It is the development of male offspring from unfertilized ova. (male parthenogenesis)
24. Waggle dance	It is dance performed by scout honey bees (worker bees) by which they inform other worker bees the direction with reference to sun's position and distance of availability of food.
25. Capture fisheries	In which resource is obtained from the natural body of water.
26. Culture fisheries	It involves rearing and management of selected aquatic organisms under regulated conditions and their subsequent harvesting after the stipulated time.
27. Aquaculture	It includes culturing of fish and other aquatic organisms of human use.
28. Pisciculture	It is the culture of exclusively fin fishes.
29. Hypophysation	It is the induced or artificial breeding in which pituitary extracts of gonadotropins or ovaprim are injected to the brood fish to induce release of spawn for seed production.
30. Green revolution	The Green Revolution involved the production of high yielding varieties of seeds, resulting in an increase in agricultural production to combat food shortage and increase the revenue of the agricultural sector.
31. Blue revolution	The adoption of a package programme to increase the production of fish and marine products is called Blue Revolution.
32. White revolution	The Operation Flood enhanced the growth of milk production and encouraged Indian dairy farmers to keep more animals for increasing production of milk. This is known as White Revolution.

Fill in the blanks

1. Animal husbandry	2. Animal husbandry
3. Buffaloes, cows pigs, horses, cattle, sheep, goats etc.	
4. 70%	
5. 25%	6. 170 liters
7. 4,100 liters	8. 170 liters
9. Murrah	10. Ongole breed bull
11. Anand Milk Union Limited	12. National Dairy Development Board
13. Dr. Kurian	14. Dr. Kurian
15. Dr. Kurian	16. 30 liters
17. Animal breeding	18. Inbreeding
19. Line breeding	20. Close breeding
21. Out breeding	22. Out crossing
23. Cross-breeding	24. Interspecific hybridization
25. Inbreeding depression	26. Multiple Ovulation & Embryo Transfer
27. Salon, Rae Bareli	28. 6-8 eggs
29. 8-32	30. Dr. B.V. Rao
31. Mumbai, Bhubaneswar,	32. Indian Veterinary Research Institute, Hesserghatta
33. BV-300, Hyline, Poona pearls	34. Hubbard, Vencobb
35. 96%, 4.5	36. Avian flu virus – H5N1
37. the maintenance of hives of honey bees for the production of honey and wax.	
38. Apis mellifera, Apis cerana indica	
39. Noble Laureate Karl von Frisch	40. 2 nd to 5 th abdominal
41. inflammation and superficial Burns	42. Rheumatoid arthritis
43. Catla catla, Labeo rohita, Cirrhinus mrigala	
44. Common carp, grass carp and silver carp	
45. ovaprim	46. Proteins, vitamins A & D, minerals, Iodine
47. A and D	48. Omega 3 fatty acids
49. fish guano	50. Isinglass

MULTIPLE CHOICE QUESTIONS

1. a	2. c	3. a	4. b	5. a	6. c
7. b	8. d	9. c	10. d	11. a	

TRUE OR FALSE QUESTIONS

1. True	2. False	3. False	4. True	5. True	6. False
7. True	8. True	9. True	10. False	11. False	12. True
13. True	14. False	15. True			

FILL IN THE TABLES

1.

Farm animal	Used by humans for
1. Bees	Honey
2. Silk worm	Silk
3. Prawns	Meat
4. Crabs	Meat
5. Fishes	Meat
6. Birds	Meat,
7. Pigs	Meat, hide
8. Cattle	Meat, Milk, hide
9. Sheep	Meat, Milk, Wool, hide
10. Goats	Meat, Milk, hide
11. Camels	Meat, Milk, wool, hide

2.

Animal	Milk Yield
1. Netherlands cow (annual)	4,100 liters
2. Indian cow (annual)	170 liters
3. Holstein-Frisian cow (per day)	30 liters

3.

Mating between	New breed
1. Bikaneri ewes and Marino rams	Hisardale
2. Jack and Mare	Mule
3. Stallion and Jennet	Hinny

4.

Layer strains	Broiler strains
BV-300, Hyline, Poona pearl	Hubbard, Vencobb

5.

Avian flu symptoms	Covid-19 symptoms
In human beings: <ul style="list-style-type: none"> ➤ Flu like symptoms ➤ Cough (dry or with phlegm) ➤ Diarrhoea ➤ Difficulty in breathing ➤ Fever ➤ Headache ➤ Malaise ➤ Muscle aches ➤ Sore throat 	<p>The main symptoms include:</p> Fever, Coughing, Shortness of breath, Trouble breathing, Fatigue, Chills, sometimes with shaking, Body aches, Headache, Sore throat Loss of smell or taste, Nausea, Diarrhea. The virus can lead to <u>pneumonia</u> , respiratory failure, <u>septic shock</u> , and death. Many COVID-19 complications may be caused by a condition known as cytokine release syndrome or a cytokine storm. They can kill tissue and damage patient's organs. <p>IMPORTANT:</p> If you notice the following severe symptoms in yourself or a loved one, get medical help right away: <ul style="list-style-type: none"> ➤ <u>Trouble breathing</u> or shortness of breath ➤ Ongoing <u>chest pain</u> or pressure ➤ New confusion, Can't wake up fully, Bluish lips or face

6.

S.No.	Item	Description
1	Causative organism	H5N1 virus (Avian flu virus)
2	Mode of Infection	By touching contaminated surfaces. Birds infected by this type of influenza, continue to release virus in their faeces and saliva for as long as 10 days.
3	Symptoms	In human beings: Flu like symptoms, Cough (dry or with phlegm), Diarrhoea, Difficulty in breathing, Fever, Headache, Malaise, Muscle aches and Sore throat.
4	Prevention	1. Avoiding consumption of undercooked chicken meat reduces the risk of exposure to avian flu. 2. People who work with birds should use protective clothing and special masks. 3. Complete culling of infected flock by burying/burning them.

7.

S.No.	Feature	Queen	Drone	Worker
1	Size	Largest	Robust, large winged	Smallest
2	Chromosomal sets	Diploid	Haploid	Diploid
3	Sex	Female	Male	Female
4	Fertility	Fertile	Fertile	Sterile
5	Developed by fertilized/unfertilized eggs.	Fertilized eggs	Unfertilized eggs	Fertilized eggs
6	Role in bee colony	Laying eggs	Reproduction	Secrete wax, build honey comb, nurse larvae, gather nectar from flowers, manufacture and store honey, gather pollen and make propolis.

8.

S.No.	Bee Product	Uses
1	Honey	It is a rich source of fructose, water, glucose, minerals and vitamins.
2	Bee's wax	Used in the preparation of cosmetics, polishes of various kinds and candles.
3	Propolis	It is used in the treatment of inflammation and superficial burns.
4	Bee's venom	Used in the treatment of rheumatoid arthritis.
5	Role in pollination	Best pollinators especially sunflower, Brassica, apple and pear.

9.

S.No.	Fish Product	Uses
1	Fish meat	It is a good source of proteins, vitamins A & D, minerals and rich in Iodine.
2	Liver oils	Good sources of Vitamins A & D, and Omega 3 fatty acids.
3	Fish guano	Fertilizer.
4	Isinglass	Clarification of wines.

10.

Indian carps	Exotic carps	Marine water fishes	Aquatic animals having export value
Labeo rohita Catla catla Cirrhinus mrigala	Common carp Grass carp Silver carp	Hilsa, Sardine, Bombayduck, Mackerel and Silver pomfret.	Tunas, shrimps, crabs, prawns and pearl oysters.

I.11 MATCH THE FOLLOWING

1. Ans:-	1. b	2. c	3. d	4. e	5. a
2. Ans:-	1. d	2. a	3. e	4. c	5. b
3. Ans:-	1. c	2. a	3. b	4. c	5. a
4. Ans:-	1. c	2. a	3. b	4. b	5. b
5. Ans:-	1. c	2. e	3. d	4. a	5. b
6. Ans:-	1. b	2. d	3. e	4. c	5. a
7. Ans:-	1. d	2. c	3. b	4. a	5. b

I.12 FILL IN THE FLOW-CHART

1.	1. Close breeding	2. Cross-breeding	
2.	a. Drone	b. Queen	c. Worker
3.	a. Marine fishery	b. Inshore fishery	c. Brackish water

1.13 ASSERTION AND REASONING QUESTIONS

1. b	2. a	3. a	4. b	5. c
6. a	7. b	8. a	9. a	10. c

PART – II : BIOMEDICAL APPLICATIONS, VACCINES, MOLECULAR DIAGNOSIS, GENE THERAPY, TRANSGENIC ANIMALS, CANCER BIOLOGY AND STEM CELLS

IDENTIFYING PHOTOGRAPHS

1. Prostate Specific Antigen test	2. Blood test
3. MRI scanner	4. Biopsy
5. CAT scanner	6. PET scanner
7. Mammogram	

DEFINE/EXPAND THE FOLLOWING WORDS

WORD	DEFINE/EXPAND
1. r-DNA Technology	It is the manipulation of genes or microorganisms to produce certain products useful to mankind.
2. Dairying	Breeding, feeding and management of milch animals, production, processing and marketing of their milk and milk products on economic basis constitute dairying.
3. Humulin	Human insulin
4. Vaccine	It is a biological preparation that improves immunity to a particular disease.
5. Attenuated whole agent vaccine	It contains disabled or made less virulent live microorganisms.
6. Inactivated whole agent vaccine	It contains killed microbes which are virulent before killing.
7. Taxoids	They contain inactivated exotoxins.
8. Adjuvant	An adjuvant is a pharmacological or immunological agent that improves the immune response of a vaccine. Adjuvants may be added to a vaccine to boost the immune response to produce more antibodies and longer-lasting immunity, thus minimizing the dose of antigen needed.
9. Gene Therapy	It is the insertion of genes into an individual's cell and tissues to treat disease, such as a hereditary disease in which a deleterious mutant allele is replaced with a functional one.
10. Therapeutic human gene	The normal gene that is inserted into the genome to supplement an abnormal gene is therapeutic human gene.
11. SCID	Severe Combined Immuno Defficiency
12. ADA	Adenosine deaminase
13. Transfection	This is the process in which genetically modified DNA is introduced into a eukaryotic cell.
14. Transgenic animal	These are the animals that havetheir own genome and had their DNA manipulated to possess and express an extra (foreign) gene.
15. GEAC	Genetic Engineering Approval Committee
16. Cancer	It is the development of malignant tumor in human body due to failure of cell cycle regulation.
17. Neoplasm	It the tumor formed due to unchecked division of cells.

18. Neoplasia	It is the abnormal proliferation of cells leading to formation of tumor.
19. Oncology	It is the branch of medicine that deals with tumors, including studying of their development, diagnosis, treatment, and prevention.
20. Contact inhibition	It is the cessation of cell division and cell mobility when are in close physical contact with each other.
21. Cadherins	Cadherins are intercellular adhesion proteins (Calcium dependent cell membrane proteins) that join normal cells together.
22. Apoptosis	It is the programmed cell death.
23. angiogenesis	It is the formation of new blood vessels.
24. Oncogenes	These are the cells causing cancers.
25. Tumor suppressor genes	These are the genes that inhibit the development and growth of tumors.
26. Carcinoma	This is the cancer of epithelial cell.
27. Sarcoma	This is the cancer of connective tissue.
28. Lymphoma	It is the cancer of lymphatic system.
29. Leukemia	It is the cancer of bone marrow.
30. Oncovirus	These are tumor forming RNA viruses.
31. Biopsy	It is removal and microscopic examination of a sample of body tissue from a living organism for diagnostic purposes.
32. PSA	Prostate Specific Antigen Test
33. Mammogram	It is a low-energy x-ray exam of breasts to detect breast cancer.
34. Chemotherapy	Chemotherapy is a drug treatment that uses powerful chemicals to kill fast-growing cells in the body.
35. Immunotherapy	Immunotherapy is a treatment that uses biological response modifiers like alpha interferon which activates the immune system and help in destroying tumors.
36. Stem cells	Stem cell are the cells with the unique ability to develop into specialized cell types in the body.
37. Totipotent	These are the cells that can construct a complete and viable organism.
38. Pluripotent	These are the descendents of totipotent cells which can differentiate into nearly all types of cells.
39. Multipotent	These are the cells that can differentiate into a number of cells, but only those of a closely related family of cells.
40. Unipotent	These are the cells which can produce only one cell type.
41. Embryonic Stem Cells	These are the pluripotent cells isolated from the epiblast tissue of the inner cell mass of a blastocyst.
42. Adult Stem Cells	These are the multipotent cells that are found in various tissues of children as well as adults.
43. Haemopoetic Stem cells	These are the multipotent stem cells that are present in red bone marrow.
44. Myeloid Stem Cells	These are one type of multipotent stem cells (Haemopoietic stem cells) that are present in red bone marrow.
45. Lymphoid Stem Cells	These are one type of multipotent stem cells (Haemopoietic stem cells) that are present in red bone marrow.

Fill in the blanks

1. recombinant DNA technology vaccines, products etc.	2. Hormones, synthetic effective therapeutic
3. humulin	4. E. coli
5. 51, 21, 30	6. disulphide
7. 3	8. Eli Lilly
9. Edward Jenner that	10. a biological preparation improves immunity to a particular disease.
11. vaccine	12. Aluminium adjuvants.
13. small pox	14. Attenuated Whole Agent Vaccines
15. vaccines against yellow fever, Measles, rubella and mumps, Typhoid.	16. Inactivated Whole Agent Vaccines
17. vaccines against influenza, Cholera, bubonic plague, Polio, hepatitis A, rabies, Sabin's oral polio vaccine.	18. Taxoids
19. vaccines against Diphtheria and Tetanus.	20. Recombinant DNA technology and Polymerase Chain Reaction.
21. HIV, mutations in suspected Cancer patients, identifying Genetic disorders like Haemophilia, phenylketonuria.	22. Gene therapy
23. sperms or ova	24. Somatic cells
25. 1990, adenosine deaminase	26. Severe Combined Immunodeficiency
27. cystic fibrosis, haemophilia, Muscular dystrophy, sickle Cell anemia	28. Transfection
29. had their DNA manipulated to possess and express a foreign gene.	30. Mice.
31. cancer, cystic fibrosis, Rheumatoid arthritis and Alzheimer's.	32. A-1 antitrypsin
33. alpha-lactalbumin	34. Rosie
35. alpha-lactalbumin	36. Mice.
37. Genetic Engineering Approval Committee (GEAC)	38. cancer
39. Neoplasia	40. Benign, Pre-malignant and Malignant
41. oncology	42. Apoptosis
43. protein p53	44. p53, pRB

45. the G1 check point	46. Carcinogen
47. carcinomas, sarcomas, leukemias , Lymphomas, familial cancers,	Sporadic cancers.
48. Rous sarcoma virus	
49. Human papilloma virus	50. Pap test or pap smear
51. biopsy	52. Prostate Specific Antigen test (PSA test)
53. mammogram	54. Surgical removal, radiation, chemotherapy immunotherapy
55. taxol	56. Alpha interferon
57. biotherapy	58. Stem cells
59. totipotent	60. Pluripotent
61. Multipotent	62. Unipotent
63. haemopoietic stem cells	64. Embryonic stem cells, Adult stem cells
65. epiblast of blastocyst	66. Adult stem cells
67. red bone marrow	68. Haemopoietic stem cells
69. Myeloid stem cells & lymphoid Stem cells	
70. Myeloid stem cells & lymphoid Stem cells	
71. dendritic cells	72. Umbilical cord.

MULTIPLE CHOICE QUESTIONS

1. a	2. b	3. a	4. c	5. d	6. b	7. a
8. b	9. c	10. c	11. d	12. b	13. d	14. c
15. b	16. b	17. c	18. c	19. c	20. c	21. a
22. c	23. d	24. c	25. d	26. a	27. a	28. c
29. b	30. d	31. c	32. c	33. b	34. d	

TRUE OR FALSE QUESTIONS

1. False	2. True	3. True	4. False	5. True	6. True	7. True
8. False	9. True	10. True	11. True	12. False	13. True	
14. False	15. True					

FILL IN THE TABLES

1.

S.No.	Type of vaccine	Decription
1	Attenuated Whole agent Vaccines	They contain disabled (made less virulent) live microorganisms.
2	Inactivated Whole Agent Vaccines	They contain killed microbes which are virulent before killing.
3	Toxoids	They are inactivated exotoxins of certain microbes.

2.

S.No.	Feature	Normal cell	Cancer cell
1	Cell cycle regulation	Regulated	Unregulated
2	Contact inhibition	Is present	Is lost
3	Cadherins	Present	Absent
4	Apoptosis	Undergoes apoptosis	Does not undergo apoptosis.
5	Surface antigens	Normal	Abnormal changes in surface antigens
6	Angiogenesis	Not seen	seen

3.

S.No.	Feature	Description
1	Totipotent stem cells	These are the stem cells that can construct a complete, viable organism
2	Pluripotent stem cells	These are the descendants of totipotent cells and can differentiate into nearly all types of cells.
3	Multipotent stem cells	These are the stem cells that can differentiate into a number of cells, but only those of a closely related family of cells.
4	Unipotent stem cells	These are the cells that can produce one cell type.

MATCH THE FOLLOWING

1. Ans:-	1. a	2. c	3. b	4. a	5. a
2. Ans:-	1. c	2. d	3. a	4. b	5. a
3. Ans:-	1. d	2. c	3. b	4. a	5. c

FILL IN THE FLOW-CHART

1.	1. Insulin A chain	2. Insulin B chain	3. Humulin	4. Disulphide bond
2.	1. Somatic line therapy		2. in-vivo	
3.	1. blood platelets	2. dendritic cell	3. Mast cell	4. Macrophage

ASSERTION AND REASONING QUESTIONS

1. a	2. b	3. a	4. c	5. a	6. a
7. a	8. a	9. b	10. b	11. a	

PART –III : BIOMEDICAL TECHNOLOGY

CAN YOU IDENTIFY THE FOLLOWING PHOTOGRAPHS ?

1. X-ray radiography	2. CAT Scanner	3. MRI	4. ECG	5. ECG	6. EEG
7. 1. P wave	2. Q wave	3. R wave	4. S wave	5. T wave	
6. QRS complex	7. P-R interval	8. Q-T interval	9. P-R segment		
10. S-T segment					
8. 1. Bone	2. Soft tissue	3. air			
9. Sandwich Assay ;	10. Competitive Assay;	11. Indirect ELISA			

DEFINE/EXPAND THE FOLLOWING WORDS

WORD	DEFINE/EXPAND
1. Biomedical technology	It is the application of principles of biophysics and biochemistry for studying certain biological aspects.
2. Radiographs/skiagraphs	These are the photographs developed using X-rays.
2. Angiography	It involves taking a series of X-rays as blood flows through blood vessels such as coronary or carotid arteries to study blocks in them.
4. Ionizing radiation	Ionizing radiation is a type of energy released by atoms that travels in the form of electromagnetic waves (gamma or X-rays) or particles (neutrons, beta or alpha).
3. CAT	Computerized Axial Tomography
4. Tomogram	The 3D cross sectional recorded image obtained by CAT scan is tomogram.
5. MRI	Magnetic Resonance Imaging
6. ECG	Electro Cardiogram
7. EEG	Electro Encephalogram
8. PET	Positron Emission Tomography
9. ELISA	Enzyme Linked Immunosorbant Assay
10. Spectrophotometer	It is to measure the intensity of the colour of the substrate in ELISA.

Fill in the blanks

1. Biomedical technology	2. Rontgen
3. radiographs/skiagraphs	4. Angiography
5. Digital Subtraction Angiography	6. Tomogram
7. CAT Scan	8. MRI
9. MRI	10. Gadolinium
11. MRI	12. ECG
13. 12	14. waves, intervals, segments and complexes
15. P wave	16. QRS complex of waves
17. T wave	18. EEG
19. EEG	20. EEG

21. alpha, beta, theta, delta waves	22. ELISA
23. HIV, Human chorionic gonadotropins (hCGs)	
24. peroxidase, alkaline phosphatase, Beta galactosidase	
25. Direct ELISA	26. Indirect ELISA
27. Sandwich Assay and Competitive Assay	28. Sandwich assay
29. two	30. proteins or polysaccharides.
31. pregnancy test	32. competitive ELISA
33. Spectrophotometer	

MULTIPLE CHOICE QUESTIONS

1. c	2. a	3. b, c	4. b	5. c	6. a, b
7. c	8. c	9. a	10. b	11. c	12. c
13. b	14. d	15. c	16. c	17. b	18. a
19. b	20. b	21. a	22. c	23. d	24. b
25. d	26. b	27. a	28. c	29. c	30. b
31. a	32. d	33. c	34. d	35. b	36. b
37. a	38. a	39. b	40. c	41. a	

TRUE OR FALSE QUESTIONS

1. True	2. False	3. True	4. True	5. False	6. True
7. False	8. True	9. True	10. True	11. False	12. True

FILL IN THE TABLES

1.

S.No.	Diagnostic tool	Useful in
1	X-ray	Skeletal fractures, pneumonia, tuberculosis, cancers etc.
2	CAT	Osteoporosis, Head injuries, skull fractures, knowing anatomy of various visceral organs.
3	MRI	Brain tumors, hairline fracture of hip and the pelvis, aneurysms etc.
4	ECG	Heart disorders
5	EEG	Diagnosis of epilepsy, coma, brain death, analyzing sleep disorders such as insomnia.

2.

S.No.	Component of ECG	Duration	Significance
1	P wave	0.1 sec	Atrial deloplarization/ atrial systole
2	QRS complex	0.08-0.1 sec	Ventricular depolarization/ Ventricular systole
3	T wave	0.2 sec	Ventricular repolarization
4	P-R interval	0.12 – 0.2sec	Indicates conduction of impulses from S-A node to A-V node.
5	Q-T interval	0.4 sec	Electrical activity in the muscles of ventricles
6	R-R interval	0.8 sec	Signifies the duration of one cardiac cycle.

3.

S.No.	Waves of EEG	Frequency	Recorded when
1	Alpha waves	8-13 cycles	Persons who are drowsy/ sleepy with closed eyes.
2	Beta waves	13-40 cycles	Persons who are mentally very active and tense.
3	Theta waves	4-7 cycles	Children of less than 5 years of age and during emotional stress in adults.
4	Delta waves	Less than 3 cycles	Adults in deep sleep, common in early childhood; Occur in adults when they are in awoken state in the case of brain tumors, epilepsy, mental depression

4.

S.No.	Requirements for ELISA	Significance
1	Microtitre plate	For adsoption of antigens/antibodies
2	Purified antibody	For detecting antigens
3	Purified antigen	For detecting antibodies
4	Enzyme	It catalyzes the production of colour from a chromogenic substance
5	Buffer	Fluid to remove unbound substances in the well.
6	Substrate	It is the chromogenic substance.
7	Spectrophotometer	To measure colour intensity in the test.

5.

S.No.	Type of ELISA	To detect (antigen/antibody)	Used in
1	Sandwich Assay	Antigen	To quantify multivalent antigens such as proteins and polysaccharides.
2	Competitive Assay	Antigen	Pregnancy test
3	Indirect ELISA	Antibody	HIV screening

MATCH THE FOLLOWING

1. Ans:-	1. e	2. a	3. d	4. b	5. f	6. c
2. Ans:-	1. b	2. c	3. e	4. a	5. d	
3. Ans:-	1. d	2. e	3. a	4. b	5. c	
4. Ans:-	1. c	2. d	3. b	4. a		
5. 1. Ans:-	1. c	2. e	3. a	4. b	5. d	

FILL IN THE FLOW-CHART

1.	4. The protons absorb some energy from these radio waves.
	6. The protons release energy at a radiofrequency which can be detected by the MRI Scanner.
2.	4. Now a purified hCG linked to an enzyme is added to the test system.
	6. The change in the colour of the solution is measured, if there is any change.
3.	4. Enzyme linked antihuman serum globulins are added. They bind to the antibody which is already bound to the antigen.
	7. No colour change : HIV negative
	There is colour change: HIV positive

ASSERTION AND REASONING QUESTIONS

1. a	2. a	3. a	4. c	5. b
6. b	7. a	8. d	9. c	10. a

-0-