Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 12 Mineral Nutrition

Class 11 Biology Solutions Chapter 12 Mineral Nutrition

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Question 1: 'All elements that are present in a plant need not be essential to its survival'. Comment.
Answer Plants tend to absorb different kinds of nutrients from soil. However, a nutrient is inessential for a plant if it is not involved in the plant's physiology and metabolism. For example, plants growing near radioactive sites tend to accumulate radioactive metals. Similarly, gold and selenium get accumulated in plants growing near mining sites. However, this does not mean that radioactive metals, gold, or selenium are essential nutrients for the survival of these plants.

Question 2: Why is purification of water and nutrient salts so important in studies involving mineral nutrition using hydroponics?
Answer Hydroponics is the art of growing plants in a nutrient solution in the absence of soil. Since the plant roots are exposed to a limited amount of the solution, there are chances that the concentrations of oxygen and other minerals in the plant roots would reduce. Therefore, in studies involving mineral nutrition using hydroponics, purification of water and nutrient salts is essential so as to maintain an optimum growth of the plants.

Question 3: Explain with examples: macronutrients, micronutrients, beneficial nutrients, toxic elements and essential elements.
Answer Macronutrients: They are the nutrients required by plants in large amounts. They are present in plant tissues in amounts more than 10 mmole kg–1 of dry matter. Examples include hydrogen, oxygen, and nitrogen.
Micronutrients: They are also called trace elements and are present in plant bodies in very small amounts, i.e., amounts less than 10 mmole kg– 1 of dry matter. Examples include cobalt, manganese, zinc, etc.
Beneficial nutrients: They are plant nutrients that may not be essential, but are beneficial to plants. Sodium, silicon, cobalt and selenium are beneficial to higher plants.
Toxic elements: Micronutrients are required by plants in small quantities. An excess of these nutrients may induce toxicity in plants. For example, when manganese is present in large amounts, it induces deficiencies of iron, magnesium, and calcium by interfering with their metabolism.
Essential elements: These elements are absolutely necessary for plant growth and reproduction. The requirement of these elements is specific and non-replaceable. They are further classified as macro and micro-nutrients.

Question 4: Name at least five different deficiency symptoms in plants. Describe them and correlate them with the concerned mineral deficiency.
Answer The five main deficiency symptoms arising in plants are:
• Chlorosis
• Necrosis
• Inhibition of cell division
• Delayed flowering
• Stunted plant growth

Chlorosis or loss of chlorophyll leads to the yellowing of leaves. It is caused by the deficiencies of nitrogen, potassium, magnesium, sulphur, iron, manganese, zinc, and molybdenum. Necrosis is the death of plant tissues as a result of the deficiencies of calcium, magnesium, copper, and potassium. Inhibition of cell division is caused by the deficiencies of nitrogen, potassium, sulphur, and molybdenum. Delayed flowering is caused by the deficiencies of nitrogen, sulphur, and molybdenum. Stunted plant growth is a result of the deficiencies of copper and sulphur.

Question 5: If a plant shows a symptom which could develop due to deficiency of more than one nutrient, how would you find out experimentally, the real deficient mineral element?
Answer In plants, the deficiency of a nutrient can cause multiple symptoms. For example, the deficiency of nitrogen causes chlorosis and delayed flowering.
In a similar way, the deficiency of a nutrient can cause the same symptom as that caused by the deficiency of another nutrient. For example, necrosis is caused by the deficiency of calcium, magnesium, copper, and potassium.
Another point to be considered is that different plants respond in different ways to the deficiency of the same nutrient.
Hence, to identify the nutrient deficient in a plant, all the symptoms developed in its different parts must be studied and compared with the available standard tables.

Question 6: Why is that in certain plants deficiency symptoms appear first in younger parts of the plant while in others they do so in mature organs?
Answer Deficiency symptoms are morphological changes in plants, indicating nutrient deficiency. Deficiency symptoms vary from one element to another. The plant part in which a deficiency symptom occurs depends on the mobility of the deficient element in the plant. Elements such as nitrogen, potassium, and magnesium are highly mobile. These elements move from the mature organs to the younger parts of a plant. Therefore, the symptoms for the deficiencies of these elements first appear in the older parts of the plant. Elements such as calcium and sulphur are relatively immobile. These elements are not transported out of the older parts of a plant. Therefore, the symptoms for the deficiencies of these elements first appear in the younger parts of the plant.

Question 7: How are the minerals absorbed by the plants?
Answer The absorption of soil nutrients by the roots of plants occurs in two main phases – apoplast and symplast.
During the initial phase or apoplast, there is a rapid uptake of nutrients from the soil into the free spaces of plant cells. This process is passive and it usually occurs through trans-membrane proteins and ion-channels.
In the second phase or symplast, the ions are taken slowly into the inner spaces of the cells. This pathway generally involves the expenditure of energy in the form of ATP.

Question 8: What are the conditions necessary for fixation of atmospheric nitrogen by Rhizobium. What is their role in N2 -fixation?
Answer Rhizobium is a symbiotic bacteria present in the root nodules of leguminous plants. The basic requirements for Rhizobium to carry out nitrogen fixation are as follows:
(a) Presence of the enzyme nitrogenase
(b) Presence of leg-haemoglobin
(c) Non-haem iron protein, ferrodoxin as the electron-carrier
(d) Constant supply of ATP
(e) Mg^{2+} ions as co-factors

Rhizobium contains the enzyme nitrogenase – a Mo-Fe protein – that helps in the conversion of atmospheric free nitrogen into ammonia.
The reaction is as follows:
$N_2 + 8e^- + 8H^+ + 16\ ATP \rightarrow 2\ NH_3 + H_2 + 16ADP + 16Pi$
The Rhizobium bacteria live as aerobes under free-living conditions, but require anaerobic conditions during nitrogen fixation. This is because the enzyme nitrogenase is highly sensitive to molecular oxygen. The nodules contain leg-haemoglobin, which protects nitrogenase from oxygen.

Question 9: What are the steps involved in formation of a root nodule?
Answer Multiple interactions are involved in the formation of root nodules. The Rhizobium bacteria divide and form colonies. These get attached to the root hairs and epidermal cells. The root hairs get curled and are invaded by the bacteria. This invasion is followed by the formation of an infection thread that carries the bacteria into the cortex of the root. The bacteria get modified into rod-shaped bacteroides. As a result, the cells in the cortex and pericycle undergo division, leading to the formation of root nodules. The nodules finally get connected with the vascular tissues of the roots for nutrient exchange increases in region C.

Question 10: Which of the following statements are true? If false, correct them:
(a) Boron deficiency leads to stout axis.
(b) Every mineral element that is present in a cell is needed by the cell.
(c) Nitrogen as a nutrient element, is highly immobile in the plants.
(d) It is very easy to establish the essentiality of micronutrients because they are required only in trace quantities.
Answer (a) True
(b) All the mineral elements present in a cell are not needed by the cell. For example, plants growing near radioactive mining sites tend to accumulate large amounts of radioactive compounds. These compounds are not essential for the plants.
(c) Nitrogen as a nutrient element is highly mobile in plants. It can be mobilised from the old and mature parts of a plant to its younger parts.
(d) True

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 13 Photosynthesis in Higher Plants

Class 11 Biology Solutions Chapter 13 Photosynthesis in Higher Plants

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 13 Photosynthesis in Higher Plants

Question 1: By looking at a plant externally can you tell whether a plant is C3 or C4? Why and how?
Answer One cannot distinguish whether a plant is C3 or C4 by observing its leaves and other morphological features externally. Unlike C3 plants, the leaves of C4 plants have a special anatomy called Kranz anatomy and this difference can only be observed at the cellular level. For example, although wheat and maize are grasses, wheat is a C3 plant, while maize is a C4 plant.

Question 2: By looking at which internal structure of a plant can you tell whether a plant is C3 or C4? Explain.
Answer The leaves of C4 plants have a special anatomy called Kranz anatomy. This makes them different from C3 plants. Special cells, known as bundle-sheath cells, surround the vascular bundles. These cells have a large number of chloroplasts. They are thick-walled and have no intercellular spaces. They are also impervious to gaseous exchange. All these anatomical features help prevent photorespiration in C4 plants, thereby increasing their ability to photosynthesise.

Question 3: Even though a very few cells in a C4 plant carry out the biosynthetic – Calvin pathway, yet they are highly productive. Can you discuss why?
Answer The productivity of a plant is measured by the rate at which it photosynthesises. The amount of carbon dioxide present in a plant is directly proportional to the rate of photosynthesis. C4 plants have a mechanism for increasing the concentration of carbon dioxide. In C4 plants, the Calvin cycle occurs in the bundle-sheath cells. The C4 compound (malic acid) from the mesophyll cells is broken down in the bundle-sheath cells. As a result, CO_2 is released. The increase in CO_2 ensures that the enzyme RuBisCo does not act as an oxygenase, but as a carboxylase. This prevents photorespiration and increases the rate of photosynthesis. Thus, C4 plants are highly productive.

Question 4: RuBisCo is an enzyme that acts both as a carboxylase and oxygenase. Why do you think RuBisCo carries out more carboxylation in C4 plants?
Answer The enzyme RuBisCo is absent from the mesophyll cells of C4 plants. It is present in the bundle-sheath cells surrounding the vascular bundles. In C4 plants, the Calvin cycle occurs in the bundle-sheath cells. The primary CO_2 acceptor in the mesophyll cells is phosphoenol pyruvate – a three-carbon compound. It is converted into the four-carbon compound oxaloacetic acid (OAA). OAA is further converted into malic acid. Malic acid is transported to the bundle-sheath cells, where it undergoes decarboxylation and CO_2 fixation occurs by the Calvin cycle. This prevents the enzyme RuBisCo from acting as an oxygenase.

Question 5: Suppose there were plants that had a high concentration of Chlorophyll-b, but lacked chlorophyll-a, would it carry out photosynthesis? Then why do plants have chlorophyll-b and other

accessory pigments?
Answer Chlorophyll-a molecules act as antenna molecules. They get excited by absorbing light and emit electrons during cyclic and non-cyclic photophosphorylations. They form the reaction centres for both photosystems I and II. Chlorophyll-b and other photosynthetic pigments such as carotenoids and xanthophylls act as accessory pigments. Their role is to absorb energy and transfer it to chlorophyll-a. Carotenoids and xanthophylls also protect the chlorophyll molecule from photo-oxidation. Therefore, chlorophyll-a is essential for photosynthesis.
If any plant were to lack chlorophyll-a and contain a high concentration of chlorophyll-b, then this plant would not undergo photosynthesis.

Question 6: Why is the colour of a leaf kept in the dark frequently yellow, or pale green? Which pigment do you think is more stable?
Answer Since leaves require light to perform photosynthesis, the colour of a leaf kept in the dark changes from a darker to a lighter shade of green. Sometimes, it also turns yellow. The production of the chlorophyll pigment essential for photosynthesis is directly proportional to the amount of light available. In the absence of light, the production of chlorophyll-a molecules stops and they get broken slowly. This changes the colour of the leaf gradually to light green. During this process, the xanthophyll and carotenoid pigments become predominant, causing the leaf to become yellow. These pigments are more stable as light is not essential for their production. They are always present in plants.

Question 7: Look at leaves of the same plant on the shady side and compare it with the leaves on the sunny side. Or, compare the potted plants kept in the sunlight with those in the shade. Which of them has leaves that are darker green? Why?
Answer Light is a limiting factor for photosynthesis. Leaves get lesser light for photosynthesis when they are in shade. Therefore, the leaves or plants in shade perform lesser photosynthesis as compared to the leaves or plants kept in sunlight.
In order to increase the rate of photosynthesis, the leaves present in shade have more chlorophyll pigments. This increase in chlorophyll content increases the amount of light absorbed by the leaves, which in turn increases the rate of photosynthesis. Therefore, the leaves or plants in shade are greener than the leaves or plants kept in the sun.

Question 8: Figure shows the effect of light on the rate of photosynthesis. Based on the graph, answer the following questions:
(a) At which point/s (A, B or C) in the curve is light a limiting factor?
(b) What could be the limiting factor/s in region A?
(c) What do C and D represent on the curve?

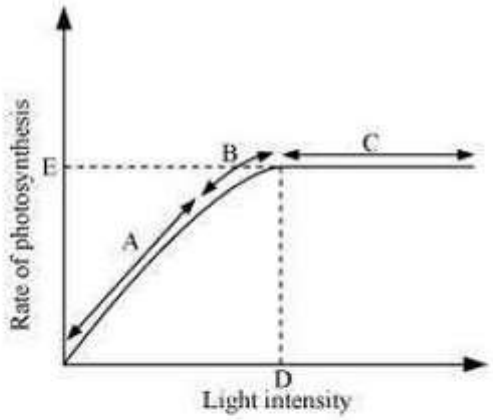
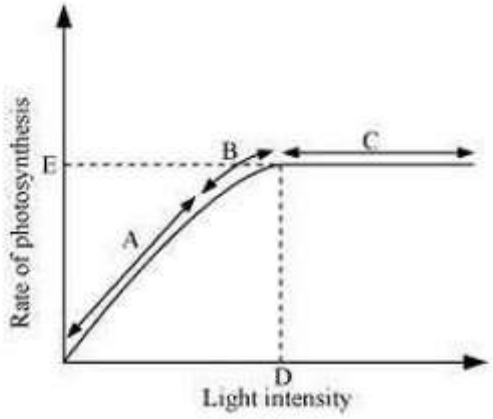


Figure 13.10

Answer



(a) Generally, light is not a limiting factor. It becomes a limiting factor for plants growing in shade or under tree canopies. In the given graph, light is a limiting factor at the point where photosynthesis is the minimum. The least value for photosynthesis is in region A. Hence, light is a limiting factor in this region.
(b) Light is a limiting factor in region A. Water, temperature, and the concentration of carbon dioxide could also be limiting factors in this region.
(c) Point D represents the optimum point and gives the light intensity at which the maximum photosynthesis is recorded. The rate of photosynthesis remains constant after this point, even though the intensity of light.

Question 9: Give comparison between the following:
(a) C3 and C4 pathways
(b) Cyclic and non-cyclic photophosphorylation
(c) Anatomy of leaf in C3 and C4 plants
Answer (a) C3 and C4 pathways

C_3 pathways		C_4 pathways	
1.	The primary acceptor of CO_2 is RUBP – a six-carbon compound.	1.	The primary acceptor of CO_2 is phosphoenol pyruvate – a three-carbon compound.
2.	The first stable product is 3-phosphoglycerate.	2.	The first stable product is oxaloacetic acid.
3.	It occurs only in the mesophyll cells of the leaves.	3.	It occurs in the mesophyll and bundle-sheath cells of the leaves.
4.	It is a slower process of carbon fixation and photo-respiratory losses are high.	4.	It is a faster process of carbon fixation and photo-respiratory losses are low.

(c) Anatomy of the leaves in C3 and C4 plants

Cyclic photophosphorylation		Non-cyclic photophosphorylation	
1.	It occurs only in photosystem I.	1.	It occurs in photosystems I and II.
2.	It involves only the synthesis of ATP.	2.	It involves the synthesis of ATP and $NADPH_2$.
3.	In this process, photolysis of water does not occur. Therefore, oxygen is not produced.	3.	In this process, photolysis of water takes place and oxygen is liberated.
4.	In this process, electrons move in a closed circle.	4.	In this process, electrons do not move in a closed circle.

(c) Anatomy of the leaves in C_3 and C_4 plants

C_3 leaves		C_4 leaves	
1.	Bundle-sheath cells are absent	1.	Bundle-sheath cells are present
2.	RuBisCo is present in the mesophyll cells.	2.	RuBisCo is present in the bundle-sheath cells.
3.	The first stable compound produced is 3-phosphoglycerate –a three-carbon compound.	3.	The first stable compound produced is oxaloacetic acid – a four-carbon compound.
4.	Photorespiration occurs	4.	Photorespiration does not occur

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 14 Respiration in Plants

Class 11 Biology Solutions Chapter 14 Respiration in Plants

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 14 Respiration in Plants

Question 1: Differentiate between
(a) Respiration and Combustion
(b) Glycolysis and Krebs' cycle
(c) Aerobic respiration and Fermentation
Answer (a) Respiration and combustion

Respiration		Combustion	
1.	It is a biochemical process.	**1.**	It is a physiochemical process.
2.	It occurs in the living cells.	**2.**	It does not occur in the living cells.
3.	ATP is generated	**3.**	ATP is not generated
4.	Enzymes are required	**4.**	Enzymes are not required
5.	It is a biologically-controlled process.	**5.**	It is an uncontrolled process.

(b) Glycolysis and Krebs cycle

Glycolysis		Krebs cycle	
1.	It is a linear pathway.	**1.**	It is a cyclic pathway.
2.	It occurs in the cell cytoplasm.	**2.**	It occurs in the mitochondrial matrix.
3.	It occurs in both aerobic and anaerobic respiration.	**3.**	It occurs in aerobic respiration.
4.	It generates 2 $NADH_2$ and 2 ATP molecules on the breakdown of one glucose molecule.	**4.**	It produces 6 $NADH_2$, $2FADH_2$, and 2 ATP molecules on the breakdown of two acetyl-CoA molecules.

(c) Aerobic respiration and fermentation

Aerobic respiration		Fermentation	
1.	Oxygen is used for deriving energy	**1.**	Occurs in the absence of oxygen
2.	Occurs in the cytoplasm and mitochondria	**2.**	Occurs in the cytoplasm
3.	End products are carbon dioxide and water	**3.**	End products are ethyl alcohol and carbon dioxide
4.	Complete oxidation of the respiratory substrate takes place	**4.**	Incomplete oxidation of the respiratory substrate takes place
5.	About 36 ATP molecules are produced	**5.**	Only 2 ATP molecules are produced

Question 2: What are respiratory substrates? Name the most common respiratory substrate.
Answer The compounds oxidised during the process of respiration are called respiratory substrates. Carbohydrates, especially glucose, act as respiratory substrates. Fats, proteins, and organic acids also act as respiratory substrates.

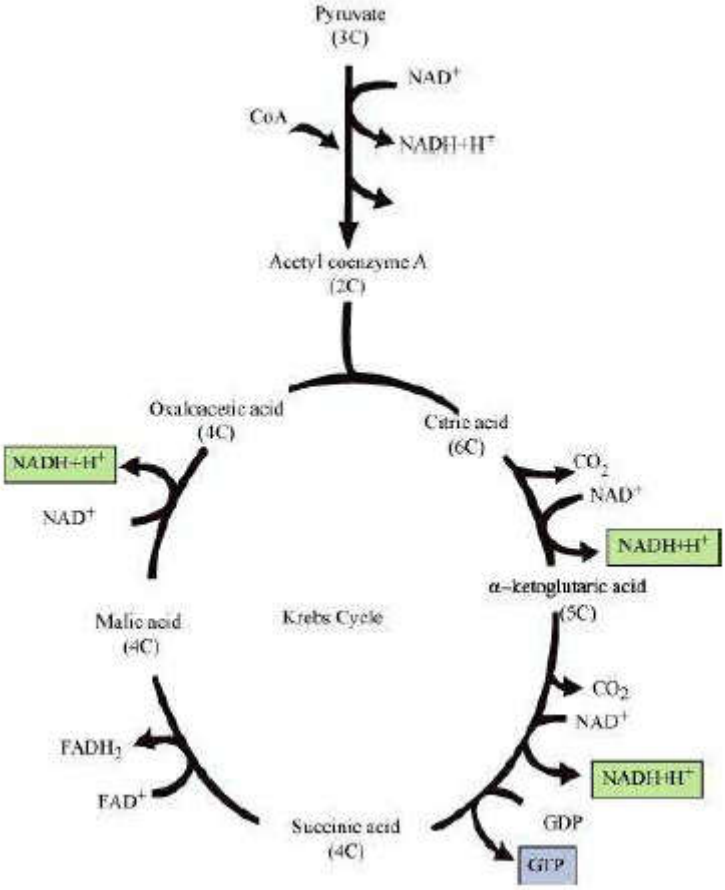
Question 3: Give the schematic representation of glycolysis?
Answer

Question 4: What are the main steps in aerobic respiration? Where does it take place?
Answer The major steps in aerobic respiration and the sites where they occur are listed in the given

table.

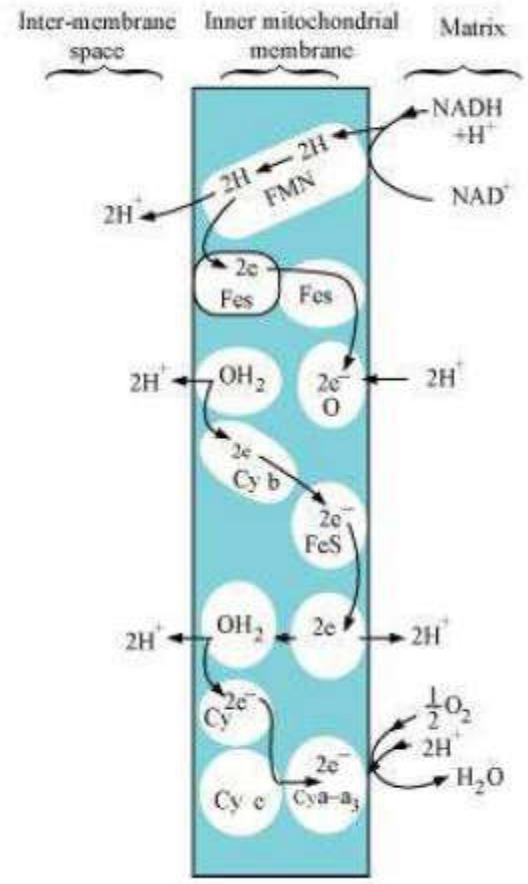
Step		Site of occurrence	
1.	Glycolysis	1.	Cytoplasm
2.	Krebs cycle	2.	Matrix of mitochondria
3.	Electron transport system	3.	Inner mitochondrial membrane
4.	Oxidative phosphorylation	4.	F_0-F_1 particles in the inner mitochondrial membrane

Question 5: Give the schematic representation of an overall view of Krebs cycle.
Answer



Question 6: Explain ETS.
Answer ETS or electron transport system is located in the inner mitochondrial membrane. It helps in releasing and utilizing the energy stored in NADH+H+ and FADH2. NADH + H+, which is formed during glycolysis and citric acid cycle, gets oxidized by NADH dehydrogenase (complex I).
The electrons so generated get transferred to ubiquinone through FMN. In a similar manner, FADH2

(complex II) generated during citric acid cycle gets transferred to ubiquinone. The electrons from ubiquinone are received by cytochrome bc1 (complex III) and further get transferred to cytochrome c. The cytochrome c acts as a mobile carrier between complex III and cytochrome c oxidase complex, containing cytochrome a and a3, along with copper centres (complex IV). During the transfer of electrons from each complex, the process is accompanied by the production of ATP from ADP and inorganic phosphate by the action ATP synthase (complex V). The amount of ATP produced depends on the molecule, which has been oxidized. 2 ATP molecules are produced by the oxidation of one molecule of NADH. One molecule of FADH2, on oxidation, gives 3 ATP molecules.



Question 7: Distinguish between the following:
(a) Aerobic respiration and Anaerobic respiration
(b) Glycolysis and Fermentation
(c) Glycolysis and Citric acid Cycle
Answer

(a) Aerobic respiration and Anaerobic respiration

Aerobic respiration		**Anaerobic respiration**	
1.	It uses oxygen for deriving energy.	1.	It occurs in the absence of oxygen.
2.	It occurs in cytoplasm and mitochondria.	2.	It occurs in cytoplasm.
3.	The end products of aerobic respiration are carbon dioxide and water.	3.	The end products of fermentation are ethyl alcohol and carbon-dioxide.
4.	Complete oxidation of respiratory substrate takes place.	4.	Incomplete oxidation of respiratory substrate takes place.
5.	36-38 ATP molecules are produced.	5.	Only 2 ATP molecules are produced.

(b) Glycolysis and Fermentation

	Glycolysis		**Fermentation**
1.	Glycolysis occurs during aerobic and anaerobic respiration.	1.	Fermentation is a type of anaerobic respiration.
2.	Pyruvic acid is produced as its end product.	2.	Ethanol or lactic acid is produced as its end product.

(c) Glycolysis and citric acid cycle

Glycolysis		Citric acid cycle (Krebs cycle)	
1.	It is a linear pathway.	1.	It is a cyclic pathway.
2.	It occurs in the cell cytoplasm.	2.	It occurs in the mitochondrial matrix.
3.	It occurs in both aerobic and anaerobic respiration.	3.	It occurs in aerobic respiration.
4.	One glucose molecule breaks down to generate 2 $NADH_2$ and 2 ATP molecules.	4.	It produces 6 $NADH_2$, 2 $FADH_2$, and 2 ATP molecules on breakdown of two acetyl-coA molecules.

Question 8: What are the assumptions made during the calculation of net gain of ATP?
Answer For theoretical calculation of ATP molecules, various assumptions are made, which are as follows.
(a) It is assumed that various parts of aerobic respiration such as glycolysis, TCA cycle, and ETS occur in a sequential and orderly pathway.
(b) NADH produced during the process of glycolysis enters into mitochondria to undergo oxidative phosphorylation.
(c) Glucose molecule is assumed to be the only substrate while it is assumed that no other molecule enters the pathway at intermediate stages.
(d) The intermediates produced during respiration are not utilized in any other process.

Question 9: Discuss "The respiratory pathway is an amphibolic pathway."
Answer Respiration is generally assumed to be a catabolic process because during respiration, various substrates are broken down for deriving energy. Carbohydrates are broken down to glucose before entering respiratory pathways. Fats get converted into fatty acids and glycerol whereas fatty acids get converted into acetyl CoA before
entering the respiration. In a similar manner, proteins are converted into amino acids, which enter respiration after deamination. During synthesis of fatty acids, acetyl CoA is withdrawn from respiratory pathway. Also, in the synthesis of proteins, respiratory substrates get withdrawn. Thus, respiration is also involved in anabolism. Therefore, respiration can be termed as amphibolic pathway as it involves both anabolism and catabolism.

Question 10: Define RQ. What is its value for fats?
Answer Respiratory quotient (RQ) or respiratory ratio can be defined as the ratio of the volume of CO2 evolved to the volume of O2 consumed during respiration. The value of respiratory quotient depends on the type of respiratory substrate. Its value is one for carbohydrates. However, it is always less than one for fats as fats consume more oxygen for respiration than carbohydrates. It can be

illustrated through the example of tripalmitin fatty acid, which consumes 145 molecules of O_2 for respiration while 102 molecules of CO_2 are evolved. The RQ value for tripalmitin is 0.7.

Question 11: What is oxidative phosphorylation?
Answer Oxidative phosphorylation is a process in which electrons are transferred from electron donors to oxygen, which acts as electron acceptor. The oxidation-reduction reactions are involved in the formation of proton gradient. The main role in oxidative phosphorylation is played by the enzyme ATP synthase (complex V). This enzyme complex consists of F_0 and F_1 components. The F_1 headpiece is a peripheral membrane protein complex and contains the site for ATP synthesis from ADP and inorganic phosphate. F_0 component is a part of membrane protein complex, which acts as a channel for crossing of the protons from inner mitochondrial membrane to the mitochondrial matrix. For every two protons passing through F_0–F_1 complex, synthesis of one ATP molecule takes place.

Question 12: What is the significance of step-wise release of energy in respiration?
Answer The process of aerobic respiration is divided into four phases – glycolysis, TCA cycle, ETS, and oxidative phosphorylation. It is generally assumed that the process of respiration and production of ATP in each phase takes place in a step-wise manner. The product of one pathway forms the substrate of the other pathway. Various molecules produced during respiration are involved in other biochemical processes. The respiratory substrates enter and withdraw from pathway on necessity. ATP gets utilized wherever required and enzymatic rates are generally controlled. Thus, the step-wise release of energy makes the system more efficient in extracting and storing energy.

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 15 Plant Growth and Development

Class 11 Biology Solutions Chapter 15 Plant Growth and Development

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 15 Plant Growth and Development

Question 1: Define growth, differentiation, development, dedifferentiation, redifferentiation, determinate growth, meristem and growth rate.
Answer (a) Growth
It is an irreversible and permanent process, accomplished by an increase in the size of an organ or organ parts or even of an individual cell.
(b) Differentiation
It is a process in which the cells derived from the apical meristem (root and shoot apex) and the cambium undergo structural changes in the cell wall and the protoplasm, becoming mature to perform specific functions.
(c) Development
It refers to the various changes occurring in an organism during its life cycle – from the germination of seeds to senescence.
(d) De-differentiation
It is the process in which permanent plant cells regain the power to divide under certain conditions.
(e) Re-differentiation
It is the process in which de-differentiated cells become mature again and lose their capacity to divide.
(f) Determinate growth
It refers to limited growth. For example, animals and plant leaves stop growing after having reached maturity.
(g) Meristem
In plants, growth is restricted to specialised regions where active cell divisions take place. Such a region is called meristem. There are three types of meristems – apical meristem, lateral meristem, and intercalary meristem.
(h) Growth rate
It can be defined as the increased growth in plants per unit time.

Question 2: Why is not any one parameter good enough to demonstrate growth throughout the life of a flowering plant?
Answer In plants, growth is said to have taken place when the amount of protoplasm increases. Measuring the growth of protoplasm involves many parameters such as the weight of the fresh tissue sample, the weight of the dry tissue sample, the differences in length, area, volume, and cell number measured during the growth period. Measuring the growth of plants using only one parameter does not provide enough information and hence, is insufficient for demonstrating growth.

Question 3: Describe briefly:
(a) Arithmetic growth
(b) Geometric growth
(c) Sigmoid growth curve
(d) Absolute and relative growth rates
Answer

(a) Arithmetic growth
In arithmetic growth, one of the daughter cells continues to divide, while the other differentiates into maturity. The elongation of roots at a constant rate is an example of arithmetic growth.
(b) Geometric growth
Geometric growth is characterised by a slow growth in the initial stages and a rapid growth during the later stages. The daughter cells derived from mitosis retain the ability to divide, but slow down because of a limited nutrient supply.
(c) Sigmoid growth curve
The growth of living organisms in their natural environment is characterised by an S-shaped curve called sigmoid rowth curve. This curve is divided into three phases – lag phase, log phase or exponential phase of rapid growth, and stationary phase.

(d) Absolute and relative growth rates
Absolute growth rate refers to the measurement and comparison of total growth per unit time.
Relative growth rate refers to the growth of a particular system per unit time, expressed on a common basis.

Question 4: List five main groups of natural plant growth regulators. Write a note on discovery, physiological functions and agricultural/horticultural applications of any one of them.
Answer Plant growth regulators are the chemical molecules secreted by plants affecting the physiological attributes of a plant. There are five main plant growth regulators. These are:
(i) Auxins
(ii) Gibberellic acid
(iii) Cytokinins
(iv) Ethylene
(v) Abscisic acid
(i) Auxins
Discovery:
The first observations regarding the effects of auxins were made by Charles Darwin and Francis Darwin wherein they saw the coleoptiles of canary gross bending toward a unilateral source of light. It was concluded after a series of experiments that some substance produced at the tip of coleoptiles was responsible for the bending. Finally, this substance was extracted as auxins from the tips of coleoptiles in oat seedlings.
Physiological functions:
1. They control plant cell-growth.
2. They cause the phenomenon of apical dominance.
3. They control division in the vascular cambium and xylem differentiation.
4. They induce parthenocarpy and prevent abscission of leaves and fruits.
Horticultural applications:
1. They are used as the rooting hormones in stem cuttings.
2. 2-4 D is used weedicide to kill broadleaf, dicotyledonous weeds.
3. They induce parthenocarpy in tomatoes.
4. They promote flowering in pineapple and litchi.
(ii) Gibberellic acid
Discovery:
Bakane or the “foolish rice seedling” disease was first observed by Japanese farmers. In this disease, rice seedlings appear to grow taller than natural plants, and become slender and pale green. Later, after several experiments, it was found that this condition was caused by the infection from a certain fungus Gibberella fujikuroi. The active substance was isolated and identified as gibberellic acid.

Physiological functions:
1. It causes elongation of internodes.
2. It promotes bolting in rosette plants.
3. It helps in inducing seed germination by breaking seed dormancy and initiating the synthesis of hydrolases enzymes for digesting reserve food.
Horticultural applications:
1. It helps in increasing the sugar content in sugarcane by increasing the length of the internodes.
2. It increases the length of grape stalks.
3. It improves the shape of apple.
4. It delays senescence.
5. It hastens maturity and induces seed-production in juvenile conifers.
(iii) Cytokinins
Discovery:
Through their experimental observations, F. Skoog and his co-workers found that the tobacco callus differentiated when extracts of vascular tissues, yeast extract, coconut milk, or DNA were added to the culture medium. This led to the discovery of cytokinins.
Physiological functions:
1. They promote the growth of lateral branches by inhibiting apical dominance.
2. They help in the production of new leaves, chloroplasts, and adventitious shoots. 3. They help in delaying senescence by promoting nutrient mobilisation.
Horticultural applications:
1. They are used for preventing apical dominance.
2. They are used for delaying senescence in leaves.
(iv) Ethylene
Discovery:
It was observed that unripe bananas ripened faster when stored with ripe bananas. Later, the substance promoting the ripening was found to be ethylene.
Physiological functions:
1. It helps in breaking seed and bud dormancy.
2. It promotes rapid internode-elongation in deep-water rice plants.
3. It promotes root-growth and formation of root hairs.
4. It promotes senescence and abscission of leaves and flowers.
5. It hastens the respiration rate in fruits and enhances fruit ripening.
Horticultural applications:
1. It is used to initiate flowering and synchronising the fruit set in pineapples.
2. It induces flowering in mango.
3. Ethephon is used to ripen the fruits in tomatoes and apples, and accelerate the abscission of flowers and leaves in cotton, cherry, and walnut.
4. It promotes the number of female flowers in cucumbers.
(v) Abscisic acid
Discovery:
During the mid 1960s, inhibitor-B, abscission II, and dormin were discovered by three independent researchers. These were later on found to be chemically similar and were thereafter called ABA (Abscisic acid).
Physiological functions:
1. It acts as an inhibitor to plant metabolism.
2. It stimulates stomatal closure during water stress.
3. It induces seed dormancy.
4. It induces abscission of leaves, fruits, and flowers. Horticultural application:
It induces seed dormancy in stored seeds.

Question 5: What do you understand by photoperiodism and vernalisation? Describe their significance.
Answer Photoperiodism refers to the response of plants with respect to the duration of light (i.e., period of day and night). On the basis of its response to the duration of light, a plant is classified as a short-day plant, a long-day plant, or a day-neutral plant. Short-day plants flower when they are exposed to light for a period less than the critical day-length (for example: Chrysanthemum). Long-day plants flower when they are exposed to light for a period more than the critical day-length (for example: radish). When no marked correlation is observed between the duration of exposure to light and the flowering response, plants are termed as day-neutral plants (for example: tomato).It is hypothesised that the hormonal substance responsible for flowering is formed in the leaves, subsequently migrating to the shoot apices and modifying them into flowering apices.
Photoperiodism helps in studying the response of flowering in various crop plants with respect to the duration of exposure to light. Vernalisation is the cold-induced flowering in plants. In some plants (such as the winter varieties of wheat and rye and biennials such as carrot and cabbage), exposure to low temperature is necessary for flowering to be induced. The winter varieties of rye and wheat are planted in autumn. They remain in the seedling stage during winters and flower during summers. However, when these varieties are sown in spring, they fail to flower. Similar response is seen in cabbage and radish.

Question 6: Why is Abscisic acid also known as stress hormone?
Answer Abscisic acid is called stress hormones as it induces various responses in plants against stress conditions. It increases the tolerance of plants toward various stresses. It induces the closure of
the stomata during water stress. It promotes seed dormancy and ensures seed germination during favourable conditions. It helps seeds withstand desiccation. It also helps in inducing dormancy in plants at the end of the growing season and
promotes abscission of leaves, fruits, and flowers.

Question 7: 'Both growth and differentiation in higher plants are open'. Comment.
Answer Growth and development in higher plants is referred to as being open. This is because various meristems, having the capacity for continuously dividing and producing new cells, are present at different locations in these plant bodies.

Question 8: 'Both a short day plant and a long day plant can flower simultaneously in a given place'. Explain.
Answer The flowering response in short-day plants and long-day plants is dependent on the durations for which these plants are exposed to light. The short-day plant and longday plant can flower at the same place, provided they have been given an adequate photoperiod.

Question 9: Which one of the plant growth regulators would you use if you are asked to:
(a) Induce rooting in a twig
(b) Quickly ripen a fruit
(c) Delay leaf senescence
(d) Induce growth in axillary buds
(e) 'Bolt' a rosette plant
(f) Induce immediate stomatal closure in leaves.
Answer
(a) Induce rooting in a twig – Auxins

(b) Quickly ripen a fruit – Ethylene
(c) Delay leaf senescence – Cytokinins
(d) Induce growth in axillary buds – Cytokinins
(e) 'Bolt' a rosette plant – Gibberellic acid
(f) Induce immediate stomatal closure in leaves – Abscisic acid

Question 10: Would a defoliated plant respond to photoperiodic cycle? Why?
Answer A defoliated plant will not respond to the photoperiodic cycle. It is hypothesised that the hormonal substance responsible for flowering is formed in the leaves, subsequently migrating to the shoot apices and modifying them into flowering apices. Therefore, in the absence of leaves, light perception would not occur, i.e., the plant would not respond to light.

Question 11: What would be expected to happen if:
(a) GA3 is applied to rice seedlings
(b) Dividing cells stop differentiating
(c) A rotten fruit gets mixed with unripe fruits
(d) You forget to add cytokinin to the culture medium.
Answer (a) If GA3 is applied to rice seedlings, then the rice seedlings will exhibit internodeelongation and increase in height.
(b) If dividing cells stop differentiating, then the plant organs such as leaves and stem will not be formed. The mass of undifferentiated cell is called callus.
(c) If a rotten fruit gets mixed with unripe fruits, then the ethylene produced from the rotten fruits will hasten the ripening of the unripe fruits.
(d) If you forget to add cytokinin to the culture medium, then cell division, growth, and differentiation will not be observed.

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 16 Digestion and Absorption

Class 11 Biology Solutions Chapter 16 Digestion and Absorption

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 16 Digestion and Absorption

Question 1: Choose the correct answer among the following:
(a) Gastric juice contains
(i) pepsin, lipase and rennin
(ii) trypsin lipase and rennin
(iii) trypsin, pepsin and lipase
(iv) trypsin, pepsin and renin
(b) Succus entericus is the name given to
(i) a junction between ileum and large intestine
(ii) intestinal juice
(iii) swelling in the gut
(iv) appendix
Answer
Answer (a): (i) Pepsin, lipase, and rennin
Gastric juice contains pepsin, lipase, and rennin. Pepsin is secreted in an inactive form as pepsinogen, which is activated by HCl. Pepsin digests proteins into peptones. Lipase breaks down fats into fatty acids. Rennin is a photolytic enzyme present in the gastric juice. It helps in the coagulation of milk.
Answer (b): (ii) Intestinal juice
Succus entericus is another name for intestinal juice. It is secreted by the intestinal gland. Intestinal juice contains a variety of enzymes such as maltase, lipases, nucleosidases, dipeptidases, etc.

Question 2:
Match column I with column II

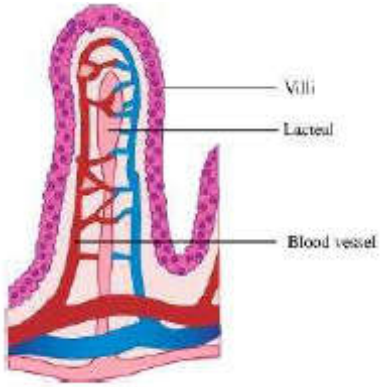
Column I		Column II	
(a)	Bilirubin and biliverdin	(i)	Parotid
(b)	Hydrolysis of starch	(ii)	Bile
(c)	Digestion of fat	(iii)	Lipases
(d)	Salivary gland	(iv)	Amylases

Answer

Column I		Column II	
(a)	Bilirubin and biliverdin	(ii)	Bile
(b)	Hydrolysis of starch	(iv)	Amylases
(c)	Digestion of fat	(iii)	Lipases
(d)	Salivary gland	(i)	Parotid

Question 3: Answer briefly:
(a) Why are villi present in the intestine and not in the stomach?
(b) How does pepsinogen change into its active form?
(c) What are the basic layers of the wall of alimentary canal?
(d) How does bile help in the digestion of fats?

Answer

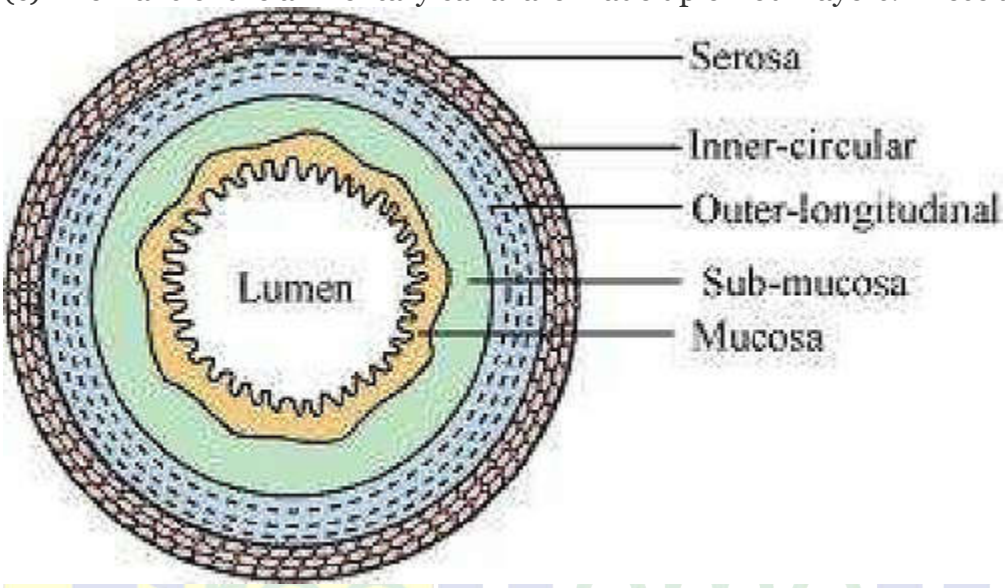


(a) The mucosal wall of the small intestine forms millions of tiny finger-like projections known as villi. These villi increase the surface area for more efficient food absorption.
Within these villi, there are numerous blood vessels that absorb the digested products of proteins and carbohydrates, carrying them to the blood stream. The villi also contain lymph vessels for absorbing the products of fat-digestion. From the blood stream, the absorbed food is finally delivered to each

and every cell of the body.
The mucosal walls of the stomach form irregular folds known as rugae. These help increase the surface area to volume ratio of the expanding stomach.
(b) Pepsinogen is a precursor of pepsin stored in the stomach walls. It is converted into pepsin by hydrochloric acid. Pepsin is the activated in the form of pepsinogen

$$\text{Pepsinogen} \xrightarrow{HCl} \text{Pepsin} + \text{Inactive peptide}$$

(Inactive) (Active)
(c) The walls of the alimentary canal are made up of four layers. These are as follows:

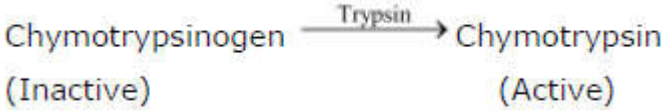


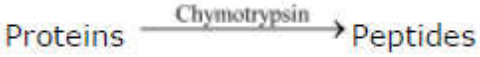
(i) Serosa is the outermost layer of the human alimentary canal. It is made up of a thin layer of secretory epithelial cells, with some connective tissues underneath.
(ii) Muscularis is a thin layer of smooth muscles arranged into an outer longitudinal layer and an inner circular layer.
(iii) Sub-mucosa is a layer of loose connective tissues, containing nerves, blood, and lymph vessels. It supports the mucosa.
(iv) Mucosa is the innermost lining of the lumen of the alimentary canal. It is mainly involved in absorption and secretion.
(d) Bile is a digestive juice secreted by the liver and stored in the gall bladder. Bile juice has bile salts such as bilirubin and biliverdin. These break down large fat globules into smaller globules so that the pancreatic enzymes can easily act on them. This process is known as emulsification of fats. Bile juice also makes the medium alkaline and activates lipase.

Question 4: State the role of pancreatic juice in digestion of proteins.
Answer Pancreatic juice contains a variety of inactive enzymes such as trypsinogen, chymotrypsinogen, and carboxypeptidases. These enzymes play an important role in the digestion of proteins.
Physiology of protein-digestion
The enzyme enterokinase is secreted by the intestinal mucosa. It activates trypsinogen into trypsin.

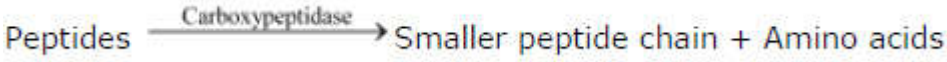
$$\text{Trypsinogen} \xrightarrow{\text{Enterokinase}} \text{Trypsin} + \text{Inactive peptide}$$

Trypsin then activates the other enzymes of pancreatic juice such as chymotrypsinogen and carboxypeptidase.
Chymotrypsinogen is a milk-coagulating enzyme that converts proteins into peptides.

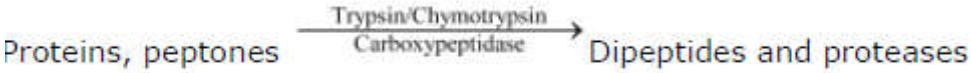




Carboxypeptidase acts on the carboxyl end of the peptide chain and helps release the last amino acids. Hence, it helps in the digestion of proteins.

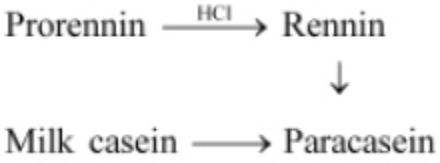


Thus, in short, we can say that the partially-hydrolysed proteins present in the chyme are acted upon by various proteolytic enzymes of the pancreatic juice for their complete digestion.



Question 5: Describe the process of digestion of protein in stomach.
Answer The digestion of proteins begins in the stomach and is completed in the small intestine. The digestive juice secreted in the gastric glands present on the stomach walls is called gastric juice. The food that enters the stomach becomes acidic on mixing with this gastric juice.
The main components of gastric juice are hydrochloric acid, pepsinogen, mucus, and rennin. Hydrochloric acid dissolves the bits of food and creates an acidic medium so that pepsinogen is converted into pepsin. Pepsin is a protein- digesting enzyme. It is secreted in its inactive form called pepsinogen, which then gets activated by hydrochloric acid. The activated pepsin then converts proteins into proteases and peptides.

Rennin is a proteolytic enzyme, released in an inactive form called prorennin. Rennin plays an important role in the coagulation of milk.



Question 6: Given the dental formula of human beings
Answer The dental formula expresses the arrangement of teeth in each half of the upper jaw and the lower jaw. The entire formula is multiplied by two to express the total number of teeth.

The dental formula for milk teeth in humans is: $\frac{2102}{2102} \times 2 = 20$
Each half of the upper jaw and the lower jaw has 2 incisors, 1 canine, and 2 molars. Premolars are absent in milk teeth.

The dental formula for permanent teeth in humans is: $\frac{2123}{2123} \times 2 = 32$
Each half of the upper jaw and the lower jaw has 2 incisors, 1 canine, 2 premolars, and 3 molars. An adult human has 32 permanent teeth.

Question 7: Bile juice contains no digestive enzymes, yet it is important for digestion. Why?
Answer Bile is a digestive juice secreted by the liver. Although it does not contain any digestive enzymes, it plays an important role in the digestion of fats. Bile juice has bile salts such as bilirubin and biliverdin. These break down large fat globules into smaller globules so that the pancreatic enzymes can easily act on them. This process is known as emulsification of fats. Bile juice also makes the medium alkaline and activates lipase.

Question 8: Describe the digestive role of chymotrypsin. What two other digestive enzymes of the same category are secreted by its source gland?
Answer The enzyme trypsin (present in the pancreatic juice) activates the inactive enzyme chymotrypsinogen into chymotrypsin.

$$\underset{\text{(Inactive)}}{\text{Chymotrypsinogen}} \xrightarrow{\text{Trypsin}} \underset{\text{(Active)}}{\text{Chymotrypsin}}$$

The activated chymotrypsin plays an important role in the further breakdown of the partially-hydrolysed proteins.

$$\text{Proteins} \xrightarrow{\text{Chymotrypsin}} \text{Peptides}$$

The other digestive enzymes of the same category are trypsinogen and carboxypeptidase. These are secreted by the same source-gland, pancreas. Trypsinogen is present in an inactive form in the pancreatic juice. The enzyme enterokinase – secreted by the intestinal mucosa – activates trypsinogen into trypsin.

$$\text{Trypsinogen} \xrightarrow{\text{Enterokinase}} \text{Trypsin + Inactive peptide}$$

The activated trypsin then further hydrolyses the remaining trypsinogen and activates other pancreatic enzymes such as chymotrypsinogen and carboxypeptidase. Trypsin also helps in breaking down proteins into peptides.

$$\text{Proteins} \xrightarrow{\text{Trypsin}} \text{Peptides}$$

Carboxypeptidases act on the carboxyl end of the peptide chain and help in releasing the last amino acids.

$$\text{Peptides} \xrightarrow{\text{Carboxypeptidase}} \text{Small peptide chain + Amino acids}$$

Question 9: How are polysaccharides and disaccharides digested?
Answer The digestion of carbohydrates takes place in the mouth and the small intestine region of the alimentary canal. The enzymes that act on carbohydrates are collectively known as carbohydrases.
Digestion in the mouth:
As food enters the mouth, it gets mixed with saliva. Saliva – secreted by the salivary glands – contains a digestive enzyme called salivary amylase. This enzyme breaks down starch into sugar at pH 6.8.

$$\text{Starch} \xrightarrow[\text{pH 6.8}]{\text{Salivary amylase}} \text{Maltose + Isomaltose + Limit dextrins}$$

Salivary amylase continues to act in the oesophagus, but its action stops in the stomach as the contents become acidic. Hence, carbohydrate-digestion stops in the stomach.
Digestion in the small intestine:

Carbohydrate-digestion is resumed in the small intestine. Here, the food gets mixed with the pancreatic juice and the intestinal juice. Pancreatic juice contains the pancreatic amylase that hydrolyses the polysaccharides into disaccharides.

$$\text{Starch (Polysaccharides)} \xrightarrow{\text{Amylase}} \text{Disaccharides}$$

Similarly, the intestinal juice contains a variety of enzymes (disaccharidases such as maltase, lactase, sucrase, etc.). These disaccharidases help in the digestion of disaccharides. The digestion of carbohydrates is completed in the small intestine.

$$\text{Maltose} \xrightarrow{\text{Maltose}} 2\text{Glucose}$$

$$\text{Lactose} \xrightarrow{\text{Lactase}} \text{Glucose} + \text{Galactose}$$

$$\text{Sucrose} \xrightarrow{\text{Sucrase}} \text{Glucose} + \text{Fructose}$$

Question 10: What would happen if HCl were not secreted in the stomach?
Answer Hydrochloric acid is secreted by the glands present on the stomach walls. It dissolves bits of food and creates an acidic medium. The acidic medium allows pepsinogen to be converted into pepsin. Pepsin plays an important role in the digestion of proteins. Therefore, if HCl were not secreted in the stomach, then pepsin would not be activated. This would affect protein digestion. A pH of about 1.8 is necessary for proteins to be digested. This pH is achieved by HCl.

Question 11: How does butter in your food gets digested and absorbed in the body?
Answer Digestion of fats:
Butter is a fat product and gets digested in the small intestine. The bile juice secreted by the liver contains bile salts that break down large fat globules into smaller globules, so as to increase their surface area for the action of lipase. This process is referred to as emulsification of fats.
After this, the pancreatic lipase present in the pancreatic juice and the intestinal lipase present in the intestinal juice hydrolyse the fat molecules into triglycerides, diglycerides, monoglycerides, and ultimately into glycerol.

$$\text{Fats} \xrightarrow{\text{Pancreatic lipase}} \text{Triglycerides} + \text{Diglycerides}$$

$$\text{Diglycerides and monoglycerides} \xrightarrow{\text{Lipases}} \text{Fatty acids} + \text{Glycerol}$$

Absorption of fats
Fat absorption is an active process. During fat digestion, fats are hydrolysed into fatty acids and glycerol. However, since these are water insoluble, they cannot be directly absorbed by the blood. Hence, they are first incorporated into small droplets called micelles and then transported into the villi of the intestinal mucosa.
They are then reformed into small microscopic particles called chylomicrons, which are small, protein-coated fat globules. These chylomicrons are transported to the lymph vessels in the villi. From the lymph vessels, the absorbed food is finally released into the blood stream and from the blood stream, to each and every cell of the body.

Question 12: Discuss the main steps in the digestion of proteins as the food passes through different parts of the alimentary canal.

Answer The digestion of proteins begins in the stomach and is completed in the small intestine. The enzymes that act on proteins are known as proteases.
Digestion in the stomach:
The digestive juice secreted in the gastric glands present on the stomach walls is called gastric juice. The main components of gastric juice are HCl, pepsinogen, and rennin. The food that enters the stomach becomes acidic on mixing with this gastric juice.
The acidic medium converts inactive pepsinogen into active pepsin. The active pepsin then converts proteins into proteases and peptides.The enzyme rennin plays an important role in the coagulation of milk.
Digestion in the small intestine:
The food from the stomach is acted upon by three enzymes present in the small intestine – pancreatic juice, intestinal juice (known as succus entericus), and bile juice.
Action of pancreatic juice
Pancreatic juice contains a variety of inactive enzymes such as trypsinogen, chymotrypsinogen, and carboxypeptidases. The enzymes are present in an inactivated state. The enzyme enterokinase secreted by the intestinal mucosa activates trypsinogen into trypsin.

$$\text{Trypsinogen} \xrightarrow{\text{Enterokinase}} \text{Trypsin + Inactive peptide}$$

The activated trypsin then activates the other enzymes of pancreatic juice. Chymotrypsinogen is a proteolytic enzyme that breaks down proteins into peptides.

$$\underset{\text{(Inactive)}}{\text{Chymotrypsinogen}} \xrightarrow{\text{Trypsin}} \underset{\text{(Active)}}{\text{Chymotrypsin}}$$

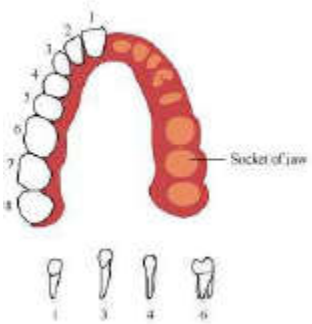
$$\text{Proteins} \xrightarrow{\text{Chymotrypsin}} \text{Peptides}$$

Carboxypeptidases act on the carboxyl end of the peptide chain and help in releasing the last amino acids.

$$\text{Peptides} \xrightarrow{\text{Carboxypeptidase}} \text{Smaller peptide chain + Amino acids}$$

Action of bile juice
Bile juice has bile salts such as bilirubin and biliverdin which break down large, fat globules into smaller globules so that pancreatic enzymes can easily act on them. This process is known as emulsification of fats. Bile juice also makes the medium alkaline and activates lipase. Lipase then breaks down fats into diglycerides and monoglycerides.
Action of intestinal juice
Intestinal juice contains a variety of enzymes. Pancreatic amylase digests polysaccharides into disaccharides. Disaccharidases such as maltase, lactase, sucrase, etc., further digest the disaccharides. The proteases hydrolyse peptides into dipeptides and finally into amino acids.Pancreatic lipase breaks down fats into diglycerides and monoglycerides. The nucleases break down nucleic acids into nucleotides and nucleosides.

Question 13: Explain the term thecodont and diphyodont.
Answer Thecodont is a type of dentition in which the teeth are embedded in the deep sockets of the jaw bone. Ankylosis is absent and the roots are cylindrical.



Examples include living crocodilians and mammals. Diphyodont is a type of dentition in which two successive sets of teeth are developed during the lifetime of the organism. The first set of teeth is deciduous and the other set is permanent. The deciduous set of teeth is replaced by the permanent adult teeth.
This type of dentition can be seen in humans.

Question 14: Name different types of teeth and their number in an adult human.
Answer There are four different types of teeth in an adult human. They are as follows:
(i) Incisors
The eight teeth in the front are incisors. There are four incisors each in the upper jaw and the lower jaw. They are meant for cutting.
(ii) Canines
The pointy teeth on either side of the incisors are canines. They are four in number, two each placed in the upper jaw and the lower jaw. They are meant for tearing.
(iii) Premolars
They are present next to the canines. They are eight in number, four each placed in the upper jaw and the lower jaw. They are meant for grinding.
(iv) Molars
They are present at the end of the jaw, next to the premolars. There are twelve molars, six each placed in the upper jaw and the lower jaw.

Hence, the dental formula in humans is $\frac{2123}{2123} \times 2 = 32$
This means each half of the upper jaw and the lower jaw has 2 incisors, 1 canine, 2 premolars, and 3 molars. Hence, an adult human has 32 permanent teeth.

Question 15: What are the functions of liver?
Answer Liver is the largest and heaviest internal organ of the body. It is not directly involved in digestion, but secretes digestive juices. It secretes bile which plays a major role in the emulsification of fats.

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 17 Breathing and Exchange of Gases

Class 11 Biology Solutions Chapter 17 Breathing and Exchange of Gases

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 17 Breathing and Exchange of Gases

Question 1: Define vital capacity. What is its significance?
Answer Vital capacity is the maximum volume of air that can be exhaled after a maximum inspiration. It is about 3.5 – 4.5 litres in the human body. It promotes the act of supplying fresh air and getting rid of foul air, thereby increasing the gaseous exchange between the tissues and the environment.

Question 2: State the volume of air remaining in the lungs after a normal breathing.
Answer The volume of air remaining in the lungs after a normal expiration is known as functional residual capacity (FRC). It includes expiratory reserve volume (ERV) and residual volume (RV). ERV is the maximum volume of air that can be exhaled after a normal expiration. It is about 1000 mL to 1500 mL. RV is the volume of air remaining in the lungs after maximum expiration. It is about 1100 mL to 1500 mL.
∴FRC = ERV + RV ≅ 1500 + 1500 ≅ 3000 mL
Functional residual capacity of the human lungs is about 2500 – 3000 mL.

Question 3: Diffusion of gases occurs in the alveolar region only and not in the other parts of respiratory system. Why?
Answer Each alveolus is made up of highly-permeable and thin layers of squamous epithelial cells. Similarly, the blood capillaries have layers of squamous epithelial cells. Oxygen-rich air enters the body through the nose and reaches the alveoli. The deoxygenated (carbon dioxide-rich) blood from the body is brought to the heart by the veins. The heart pumps it to the lungs for oxygenation. The exchange of O_2 andCO_2 takes place between the blood capillaries surrounding the alveoli and the gases present in the alveoli.
Thus, the alveoli are the sites for gaseous exchange. The exchange of gases takes place by simple diffusion because of pressure or concentration differences. The barrier between the alveoli and the capillaries is thin and the diffusion of gases takes place from higher partial pressure to lower partial pressure. The venous blood that reaches the alveoli has lower partial pressure of O_2 and higher partial pressure of CO_2 as compared to alveolar air. Hence, oxygen diffuses into blood. Simultaneously, carbon dioxide diffuses out of blood and into the alveoli.

Question 4: What are the major transport mechanisms for CO_2? Explain.
Answer Plasma and red blood cells transport carbon dioxide. This is because they are readily soluble in water.
(1) Through plasma:
About 7% of CO_2 is carried in a dissolved state through plasma. Carbon dioxide combines with water and forms carbonic acid.
$CO_2 + H_2O = H_2CO_3$
Since the process of forming carbonic acid is slow, only a small amount of carbon dioxide is carried this way.
(2) Through RBCs:

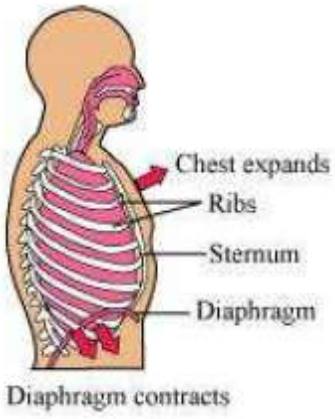
About 20 – 25% of CO_2 is transported by the red blood cells as carbaminohaemoglobin. Carbon dioxide binds to the amino groups on the polypeptide chains of haemoglobin and forms a compound known as carbaminohaemoglobin.
(3) Through sodium bicarbonate:
About 70% of carbon dioxide is transported as sodium bicarbonate. As CO_2 diffuses into the blood plasma, a large part of it combines with water to form carbonic acid in
the presence of the enzyme carbonic anhydrase. Carbonic anhydrase is a zinc enzyme that speeds up the formation of carbonic acid. This carbonic acid dissociates into bicarbonate (HCO_3^-) and hydrogen ions (H^+).

$$CO_2 + H_2O \xrightarrow{\text{Carbonic anhydrase}} H_2CO_3$$

$$H_2CO_3 \xrightarrow[\text{anhydrase}]{\text{Carbonic}} HCO_3^- + H^+$$

Question 5: What will be the pO_2 and pCO_2 in the atmospheric air compared to those in the alveolar air?
(i) pO_2 lesser, pCO_2 higher
(ii) pO_2 higher, pCO_2 lesser
(iii) pO_2 higher, pCO_2 higher
(iv) pO_2 lesser, pCO_2 lesser Answer
Answer: (ii) pO_2 higher, pCO_2 lesser
The partial pressure of oxygen in atmospheric air is higher than that of oxygen in alveolar air. In atmospheric air, pO_2 is about 159 mm Hg. In alveolar air, it is about 104 mm Hg. The partial pressure of carbon dioxide in atmospheric air is lesser than that of carbon dioxide in alveolar air. In atmospheric air, pCO_2 is about 0.3 mmHg. In alveolar air, it is about 40 mm Hg.

Question 6: Explain the process of inspiration under normal conditions.



Answer
Inspiration or inhalation is the process of bringing air from outside the body into the lungs. It is carried out by creating a pressure gradient between the lungs and the atmosphere.
When air enters the lungs, the diaphragm expands toward the abdominal cavity, thereby increasing the space in the thoracic cavity for accommodating the inhaled air. The volume of the thoracic chamber in the anteroposterior axis increases with the simultaneous contraction of the external intercostal muscles. This causes the ribs and the sternum to move out, thereby increasing the volume of the thoracic chamber in the dorsoventral axis.
The overall increase in the thoracic volume leads to a similar increase in the pulmonary volume. Now,

as a result of this increase, the intra-pulmonary pressure becomes lesser than the atmospheric pressure. This causes the air from outside the body to move into the lungs.

Question 7: How is respiration regulated?
Answer The respiratory rhythm centre present in the medulla region of the brain is primarily responsible for the regulation of respiration. The pneumotaxic centre can alter the function performed by the respiratory rhythm centre by signalling to reduce the inspiration rate.
The chemosensitive region present near the respiratory centre is sensitive to carbon dioxide and hydrogen ions. This region then signals to change the rate of expiration for eliminating the compounds.
The receptors present in the carotid artery and aorta detect the levels of carbon dioxide and hydrogen ions in blood. As the level of carbon dioxide increases, the respiratory centre sends nerve impulses for the necessary changes

Question 8: What is the effect of pCO_2 on oxygen transport?
Answer pCO_2 plays an important role in the transportation of oxygen. At the alveolus, the low pCO_2 and high pO_2 favours the formation of haemoglobin. At the tissues, the high pCO_2 and low pO_2 favours the dissociation of oxygen from oxyhaemoglobin. Hence, the affinity of haemoglobin for oxygen is enhanced by the decrease of pCO_2 in blood. Therefore, oxygen is transported in blood as oxyhaemoglobin and oxygen dissociates from it at the tissues.

Question 9: What happens to the respiratory process in a man going up a hill?
Answer As altitude increases, the oxygen level in the atmosphere decreases. Therefore, as a man goes uphill, he gets less oxygen with each breath. This causes the amount of oxygen in the blood to decline. The respiratory rate increases in response to the decrease in the oxygen content of blood. Simultaneously, the rate of heart beat increases to increase the supply of oxygen to blood.

Question 10: What is the site of gaseous exchange in an insect?
Answer In insects, gaseous exchange occurs through a network of tubes collectively known as the tracheal system. The small openings on the sides of an insect's body are known as spiracles. Oxygen-rich air enters through the spiracles. The spiracles are connected to the network of tubes. From the spiracles, oxygen enters the tracheae. From here, oxygen diffuses into the cells of the body.
The movement of carbon dioxide follows the reverse path. The CO_2 from the cells of the body first enters the tracheae and then leaves the body through the spiracles.

Question 11: Define oxygen dissociation curve. Can you suggest any reason for its sigmoidal pattern?
Answer The oxygen dissociation curve is a graph showing the percentage saturation of oxyhaemoglobin at various partial pressures of oxygen.
The curve shows the equilibrium of oxyhaemoglobin and haemoglobin at various partial pressures. In the lungs, the partial pressure of oxygen is high. Hence, haemoglobin binds to oxygen and forms oxyhaemoglobin.
Tissues have a low oxygen concentration. Therefore, at the tissues, oxyhaemoglobin releases oxygen to form haemoglobin. The sigmoid shape of the dissociation curve is because of the binding of oxygen to haemoglobin. As the first oxygen molecule binds to haemoglobin, it increases the affinity for the second molecule of oxygen to bind. Subsequently, haemoglobin attracts more oxygen.

Question 12: Have you heard about hypoxia? Try to gather information about it, and discuss with your friends.

Answer Hypoxia is a condition characterised by an inadequate or decreased supply of oxygen to the lungs. It is caused by several extrinsic factors such as reduction in pO_2, inadequate oxygen, etc. The different types of hypoxia are discussed below.

Hypoxemic hypoxia

In this condition, there is a reduction in the oxygen content of blood as a result of the low partial pressure of oxygen in the arterial blood.

Anaemic hypoxia

In this condition, there is a reduction in the concentration of haemoglobin.

Stagnant or ischemic hypoxia

In this condition, there is a deficiency in the oxygen content of blood because of poor blood circulation. It occurs when a person is exposed to cold temperature for a prolonged period of time.

Histotoxic hypoxia

In this condition, tissues are unable to use oxygen. This occurs during carbon monoxide or cyanide poisoning.

Question 13: Distinguish between

(a) IRV and ERV

(b) Inspiratory capacity and Expiratory capacity

(c) Vital capacity and Total lung capacity

Answer

(a)

Inspiratory reserve volume (IRV)	**Expiratory reserve volume (ERV)**
1. It is the maximum volume of air that can be inhaled after a normal inspiration. 2. It is about 2500 – 3500 mL in the human lungs.	1. It is the maximum volume of air that can be exhaled after a normal expiration. 2. It is about 1000 – 1100 mL in the human lungs.

(b)

Inspiratory capacity (IC)	**Expiratory capacity (EC)**

1. It is the volume of air that can be inhaled after a normal expiration. 2. It includes tidal volume and inspiratory reserve volume. IC = TV + IRV	1. It is the volume of air that can be exhaled after a normal inspiration. 2. It includes tidal volume and expiratory reserve volume. EC = TV + ERV

(c)

Vital capacity (VC)	**Total lung capacity (TLC)**
1. It is the maximum volume of air that can be exhaled after a maximum inspiration. It includes IC and ERV. 2. It is about 4000 mL in the human lungs.	1. It is the volume of air in the lungs after maximum inspiration. It includes IC, ERV, and residual volume. 2. It is about 5000 – 6000 mL in the human lungs.

Question 14: What is Tidal volume? Find out the Tidal volume (approximate value) for a healthy human in an hour.
Answer Tidal volume is the volume of air inspired or expired during normal respiration. It is about 6000 to 8000 mL of air per minute. The hourly tidal volume for a healthy human can be calculated as: Tidal volume = 6000 to 8000 mL/minute Tidal volume in an hour = 6000 to 8000 mL × (60 min) = 3.6 × 10^5 mL to 4.8 × 10^5 mL
Therefore, the hourly tidal volume for a healthy human is approximately 3.6 × 10^5 mL to 4.8 × 10^5 mL.

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 18 Body Fluids and Circulation

Class 11 Biology Solutions Chapter 18 Body Fluids and Circulation

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 18 Body Fluids and Circulation

Question 1: Name the components of the formed elements in the blood and mention one major function of each of them.
Answer The component elements in the blood are:
(1) Erythrocytes:
They are the most abundant cells and contain the red pigment called haemoglobin. They carry oxygen to all parts of the body. Red blood cells are produced continuously in some parts of the body such as the marrow of long bones, ribs, etc. There are about 4 – 6 million RBCs per cubic millimetre of blood.
(2) Leukocytes
Leucocytes are colourless cells. These cells do not contain haemoglobin. They are the largest cells of the body and are divided into two main categories.
(a) Granulocytes
These leucocytes have granules in their cytoplasm and include neutrophils, eosinophils, and basophiles. Neutrophils are phagocytic cells that protect the body against various infecting agents. Eosinophils are associated with allergic reactions, while basophiles are involved in inflammatory responses.
(b) Agranulocytes
Lymphocytes and monocytes are agranulocytes. Lymphocytes generate immune responses against infecting agents, while monocytes are phagocytic in nature.
(3) Platelets
Platelets are small irregular bodies present in blood. They contain essential chemicals that help in clotting. The main function of platelets is to promote clotting.

Question 2: What is the importance of plasma proteins?
AnswerPlasma is the colourless fluid of blood which helps in the transport of food, CO_2, waste products, and salts. It constitutes about 55% of blood. About 6.8% of the plasma is constituted by proteins such as fibrinogens, globulins, and albumins.
Fibrinogen is a plasma glycoprotein synthesised by the liver. It plays a role in the clotting of blood. Globulin is a major protein of the plasma. It protects the body against infecting agents. Albumin is a major protein of the plasma. It helps in maintaining the fluid volume within the vascular space.

Question 3:
Match column I with column II:

Column I			Column II
(a)	Eosinophils	(i)	Coagulation
(b)	RBC	(ii)	Universal Recipient
(c)	AB Group	(iii)	Resist Infections
(d)	Platelets	(iv)	Contraction of Heart
(e)	Systole	(v)	Gas transport

Answer

Column I			Column II
(a)	Eosinophils	(iii)	Resist infections
(b)	RBC	(v)	Gas transport
(c)	AB Group	(ii)	Universal Recipient
(d)	Platelets	(i)	Coagulation
(e)	Systole	(iv)	Contraction of heart

Question 4: Why do we consider blood as a connective tissue?
Answer Connective tissues have cells scattered throughout an extra-cellular matrix. They connect different body systems. Blood is considered as a type of connective tissue because of two reasons.
(i) Like the other connective tissues, blood is mesodermal in origin.
(ii) It connects the body systems, transports oxygen and nutrients to all the parts of the body, and removes the waste products. Blood has an extra-cellular matrix called plasma, with red blood cells, white blood cells, and platelets floating in it.

Question 5: What is the difference between lymph and blood?
Answer

	Lymph		Blood
1.	It is a colourless fluid that does not contain RBCs.	1.	It is a red-coloured fluid that contains RBCs.
2.	It contains plasma and lesser number of WBCs and platelets.	2.	It contains plasma, RBCs, WBCs, and platelets.
3.	It helps in body defence and is a part of the immune system.	3.	It is associated with the circulation of oxygen and carbon dioxide.
4.	Its plasma lacks proteins.	4.	Its plasma has proteins, calcium, and phosphorus.
5.	It transports nutrients from the tissue cells to the blood, through lymphatic vessels.	5.	It transports nutrients and oxygen from one organ to another.
6.	The flow of lymph is slow.	6.	The flow of blood in the blood vessels is fast.

Question 6: What is meant by double circulation? What is its significance?
Answer Double circulation is a process during which blood passes twice through the heart during one complete cycle. This type of circulation is found in amphibians, reptiles, birds, and mammals. However, it is more prominent in birds and mammals as in them the heart is completely divided into four chambers – the right atrium, the right ventricle, the left atrium, and the left ventricle.
The movement of blood in an organism is divided into two parts:
(i) Systemic circulation
(ii) Pulmonary circulation
Systemic circulation involves the movement of oxygenated blood from the left ventricle of the heart to the aorta. It is then carried by blood through a network of arteries, arterioles, and capillaries to the tissues. From the tissues, the deoxygenated blood is collected by the venules, veins, and vena cava, and is emptied into the left auricle.
Pulmonary circulation involves the movement of deoxygenated blood from the right ventricle to the pulmonary artery, which then carries blood to the lungs for oxygenation. From the lungs, the oxygenated blood is carried by the pulmonary veins into the left atrium.
Hence, in double circulation, blood has to pass alternately through the lungs and the tissues.
Significance of double circulation:
The separation of oxygenated and deoxygenated blood allows a more efficient supply of oxygen to the

body cells. Blood is circulated to the body tissues through systemic circulation and to the lungs through pulmonary circulation.

Question 7: Write the differences between:
(a) Blood and Lymph
(b) Open and Closed system of circulation
(c) Systole and Diastole
(d) P-wave and T-wave
Answer

(a) Blood and lymph

	Blood		**Lymph**
1.	Blood is a red-coloured fluid that contains RBCs.	**1.**	Lymph is a colourless fluid that lacks RBCs.
2.	It contains plasma, RBCs, WBCs, and platelets. It also contains proteins.	**2.**	It contains plasma and lesser number of WBCs and platelets. It lacks proteins.
3.	Blood transports nutrients and oxygen from one organ to another.	**3.**	Lymph plays a role in the defensive system of the body. It is a part of the immune system.

(b) Open and closed systems of circulation

	Open system of circulation		Closed system of circulation
1.	In this system, blood is pumped by the heart, through large vessels, into body cavities called sinuses.	**1.**	In this system, blood is pumped by the heart, through a closed network of vessels.
2.	The body tissues are in direct contact with blood.	**2.**	The body tissues are not in direct contact with blood.
3.	Blood flows at low pressure. Hence, it is a slower and less efficient system of circulation.	**3.**	Blood flows at high pressure. Hence, it is a faster and more efficient system of circulation.
4.	The flow of blood is not regulated through the tissues and organs.	**4.**	The flow of blood can be regulated by valves.
5.	This system is present in arthropods and molluscs.	**5.**	This system is present in annelids, echinoderms, and vertebrates.

(c) Systole and diastole

	Systole		Diastole
1.	It is the contraction of the heart chambers to drive blood into the aorta and the pulmonary artery.	**1.**	It is the relaxation of the heart chambers between two contractions. During diastole, the chambers are filled with blood.
2.	Systole decreases the volume of the heart chambers and forces the blood out of them.	**2.**	Diastole brings the heart chambers back into their original sizes to receive more blood.

(d) P-wave and T-wave

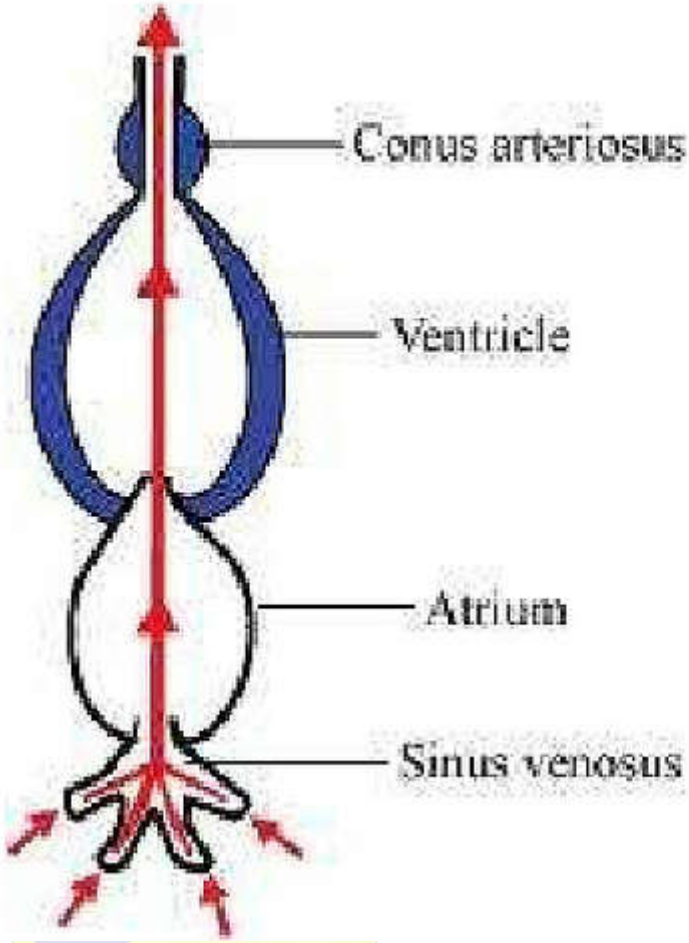
	P-wave		T-wave
1.	In an electrocardiogram (ECG), the P-wave indicates the activation of the SA node.	**1.**	In an electrocardiogram (ECG), the T-wave represents ventricular relaxation.
2.	During this phase, the impulse of contraction is generated by the SA node, causing atrial depolarisation.	**2.**	During this phase, the ventricles relax and return to their normal state.
3.	It is of atrial origin.	**3.**	It is of ventricular origin.

Answer All vertebrates possess a heart – a hollow muscular organ composed of cardiac muscle fibres. The function of the heart is to pump oxygen to all parts of the body. The evolution of the heart is based on the separation of oxygenated blood from deoxygenated blood for efficient oxygen transport.

In fishes, the heart was like a hollow tube. This evolved into the four-chambered heart in mammals.

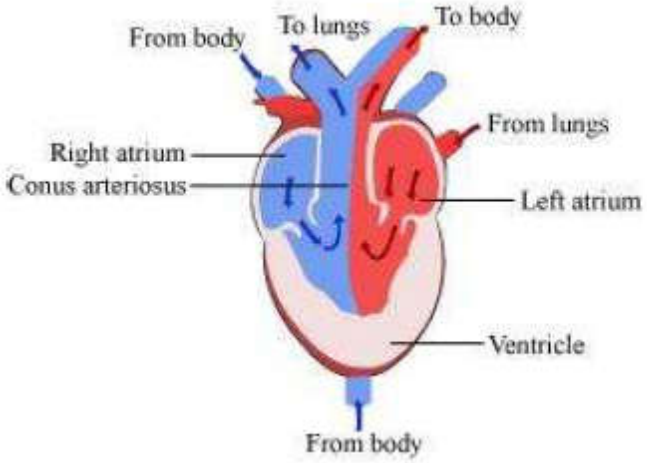
Piscean heart

Fish has only two chambers in its heart – one auricle and one ventricle. Since both the auricle and the ventricle remain undivided, only deoxygenated blood passes through it. The deoxygenated blood enters the gills for oxygenation from the ventricle. It has additional chambers such as sinus venosus and conus arteriosus.



Amphibian heart

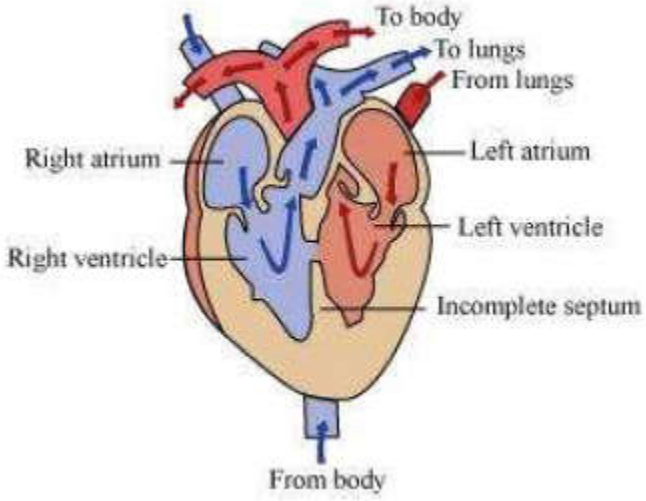
Amphibians, such as frogs, have three-chambered hearts, with two auricles and one ventricle. The auricle is divided into a right and a left chamber by an inter-auricular septum, while the ventricle remains undivided. Additional chambers such as sinus venosus and conus arteriosus are also present. The oxygenated blood from the lungs enters the left auricle and simultaneously, the deoxygenated blood from the body enters the right auricle. Both these auricles empty into the ventricle, wherein the oxygenated and deoxygenated blood get mixed to some extent.



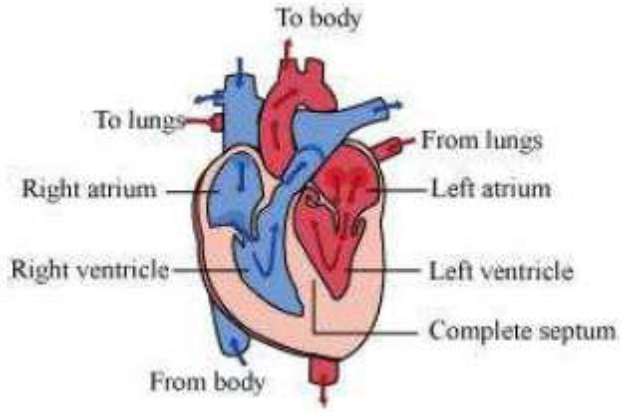
Reptilian heart

Reptiles have incomplete four-chambered hearts, except for crocodiles, alligators, and gharials. They have only one accessory chamber called sinus venosus. The reptilian heart also shows mixed blood

circulation.



Avian and mammalian hearts
They have two pairs of chambers for separating oxygenated and deoxygenated bloods. The heart is divided into four chambers. The upper two chambers are called atria and the lower two chambers are called ventricles. The chambers are separated by a muscular wall that prevents the mixing of the blood rich in oxygen with the blood rich in carbon dioxide.



Question 9: Why do we call our heart myogenic?
Answer In the human heart, contraction is initiated by a special modified heart muscle known as sinoatrial node. It is located in the right atrium. The SA node has the inherentpower of generating a wave of contraction and controlling the heart beat. Hence, it is known as the pacemaker. Since the heart beat is initiated by the SA node and the impulse of contraction originates in the heart itself, the human heart is termed myogenic. The hearts of vertebrates and molluscs are also myogenic.

Question 10: Sino-atrial node is called the pacemaker of our heart. Why?
Answer The sino-atrial (SA) node is a specialised bundle of neurons located in the upper part of the right atrium of the heart. The cardiac impulse originating from the SA node triggers a sequence of electrical events in the heart, thereby controlling the sequence of muscle contraction that pumps blood out of the heart. Since the SA node initiates and maintains the rhythmicity of the heart, it is known as the natural pacemaker of the human body.

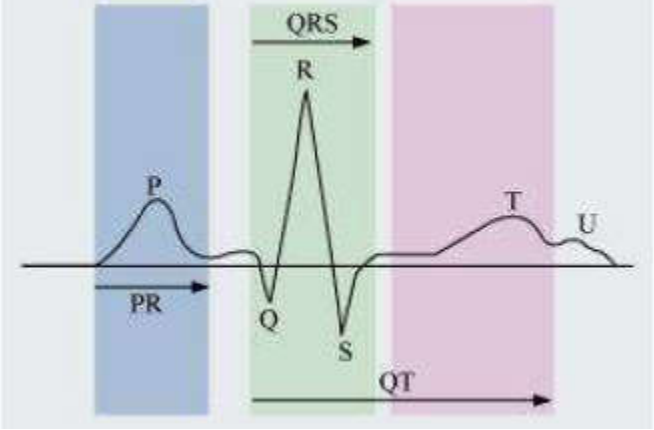
Question 11: What is the significance of atrio-ventricular node and atrio-ventricular bundle in the functioning of heart?
Answer The atrioventricular (AV) node is present in the right atrium, near the base of the inter-

auricular septum that separates the right auricle from the ventricle. It gives rise to the bundle of His that conducts the cardiac impulses from the auricles to the ventricles. As the bundle of His passes the ventricle along the inter-ventricular septum, it divides into two branches – the right ventricle and the left ventricle.
The end branches of this conducting system then forms a network of Purkinje fibres that penetrate into the myocardium. The auricular contraction initiated by the wave of excitation from the sino-atrial node (SA node) stimulates the atrio-ventricular node, thereby leading to the contraction of ventricles through the bundle of His and Purkinje fibres. Hence, the atrio-ventricular node and the atrioventricular bundle play a role in the contraction of ventricles.

Question 12: Define a cardiac cycle and the cardiac output.
Answer Cardiac cycle is defined as the complete cycle of events in the heart from the beginning of one heart beat to the beginning of the next. It comprises three stages – atrial systole, ventricular systole, and complete cardiac diastole. Cardiac output is defined as the amount of blood pumped out by the ventricles in a minute.

Question 13: Explain heart sounds.
Answer Heart sounds are noises generated by the closing and opening of the heart valves. In a healthy individual, there are two normal heart sounds called lub and dub. Lub is the first heart sound. It is associated with the closure of the tricuspid and bicuspid valves at the beginning of systole. The second heart sound dub is associated with the closure of the semilunar valves at the beginning of diastole. These sounds provide important information about the condition and working of the heart.

Question 14: Draw a standard ECG and explain the different segments in it.
Answer Electrocardiogram is a graphical representation of the cardiac cycle produced by an electrograph. The diagrammatic representation of a standard ECG is shown below.



A typical human electrocardiogram has five waves – P, Q, R, S, and T. The P, R, and T-waves are above the base line and are known as positive waves. The Q and S-waves are below the base line and are known as negative waves. The P-wave is of atrial origin, while the Q, R, S, and T-waves are of ventricular origin.
(a) The P-wave indicates atrial depolarisation. During this wave, the impulse of contraction is generated by the SA node. The PQ-wave represents atrial contraction.
(b) The QR-wave is preceded by ventricular contraction. It represents the spread of the impulse of contraction from the AV node to the wall of the ventricle. It leads to ventricular depolarisation.
(c) The RS-wave represents ventricular contraction of about 0.3 sec.
(d) The ST-wave represents ventricular relaxation of about 0.4 sec. During this phase, the ventricles relax and return to their normal state.
(e) The T-wave represents ventricular relaxation.

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 19 Excretory Products and their Elimination

Class 11 Biology Solutions Chapter 19 Excretory Products and their Elimination

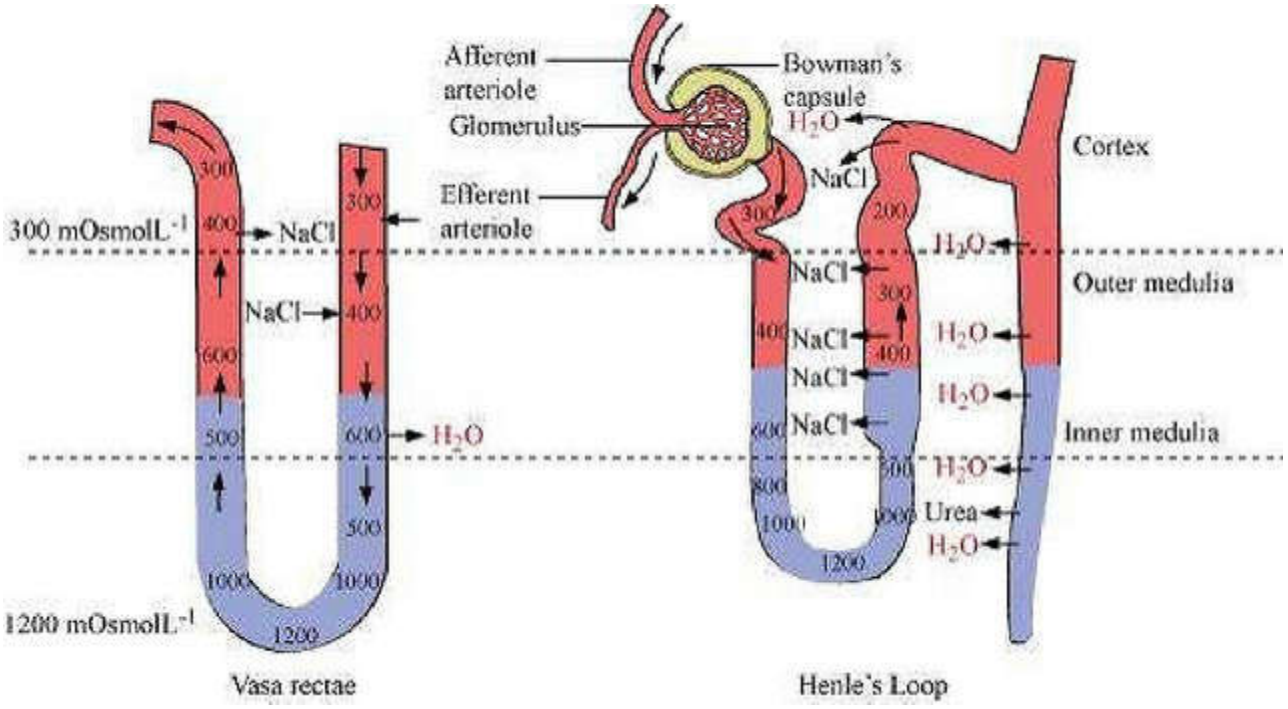
Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 19 Excretory Products and their Elimination

Question 1: Define Glomerular Filtration Rate (GFR)
Answer Glomerular filtration rate is the amount of glomerular filtrate formed in all the nephrons of both the kidneys per minute. In a healthy individual, it is about 125 mL/minute. Glomerular filtrate contains glucose, amino acids, sodium, potassium, urea, uric acid, ketone bodies, and large amounts of water.

Question 2: Explain the autoregulatory mechanism of GFR.
Answer The mechanism by which the kidney regulates the glomerular filtration rate is autoregulative. It is carried out by the juxtaglomerular apparatus. Juxtaglomerular apparatus is a microscopic structure located between the vascular pole of the renal corpuscle and the returning distal convoluted tubule of the same nephron.
It plays a role in regulating the renal blood flow and glomerular filtration rate. When there is a fall in the glomerular filtration rate, it activates the juxtaglomerular cells to release renin. This stimulates the glomerular blood flow, thereby bringing the GFR back to normal. Renin brings the GFR back to normal by the activation of the renin-angiotensin mechanism.

Question 3: Indicate whether the following statements are true or false:
(a) Micturition is carried out by a reflex.
(b) ADH helps in water elimination, making the urine hypotonic.
(c) Protein-free fluid is filtered from blood plasma into the Bowman's capsule.
(d) Henle's loop plays an important role in concentrating the urine.
(e) Glucose is actively reabsorbed in the proximal convoluted tubule.
Answer (a) True
(b) False
(c) True
(d) True
(e) True

Question 4: Give a brief account of the counter current mechanism.
Answer The counter current mechanism operating inside the kidney is the main adaptation for the conservation of water. There are two counter current mechanisms inside the kidneys. They are Henle's loop and vasa rectae. Henle's loop is a U-shaped part of the nephron. Blood flows in the two limbs of the tube in opposite directions and this gives rise to counter currents. The Vasa recta is an efferent arteriole, which forms a capillary network around the tubules inside the renal medulla. It runs parallel to Henley's loop and is U-shaped. Blood flows in opposite directions in the two limbs of vasa recta. As a result, blood entering the renal medulla in the descending limb comes in close contact with the outgoing blood in the ascending limb.



The osmolarity increases from 300 mOsmolL -1 in the cortex to 1200 mOsmolL -1 in the inner medulla by counter current mechanism. It helps in maintaining the concentration gradient, which in turn helps in easy movement of water from collecting tubules. The gradient is a result of the movement of NaCl and urea.

Question 5: Describe the role of liver, lungs and skin in excretion.
Answer Liver, lungs, and skin also play an important role in the process of excretion. Role of the liver: Liver is the largest gland in vertebrates. It helps in the excretion of cholesterol, steroid hormones, vitamins, drugs, and other waste materials through bile. Urea is formed in the liver by the ornithine cycle. Ammonia – a toxic substance – is quickly changed into urea in the liver and thence eliminated from the body. Liver also changes the decomposed haemoglobin pigment into bile pigments called bilirubin and biliverdin.
Role of the lungs:
Lungs help in the removing waste materials such as carbon dioxide from the body. Role of the skin: Skin has many glands which help in excreting waste products through pores. It has two types of glands – sweat and sebaceous glands.
Sweat glands are highly vascular and tubular glands that separate the waste products from the blood and excrete them in the form of sweat. Sweat excretes excess salt and water from the body.
Sebaceous glands are branched glands that secrete an oily secretion called sebum.

Question 6: Explain micturition.
AnswerMicturition is the process by which the urine from the urinary bladder is excreted. As the urine accumulates, the muscular walls of the bladder expand. The walls stimulate the sensory nerves in the bladder, setting up a reflex action. This reflex stimulates the urge to pass out urine. To discharge urine, the urethral sphincter relaxes and the smooth muscles of the bladder contract. This forces the urine out from the bladder. An adult human excretes about 1 – 1.5 litres of urine per day.

Question 7:
Match the items of column I with those of column II:

Column I		Column II	
(a)	Ammonotelism	(i)	Birds
(b)	Bowman's capsule	(ii)	Water reabsorption
(c)	Micturition	(iii)	Bony fish
(d)	Uricotelism	(iv)	Urinary bladder
(d)	ADH	(v)	Renal tubule

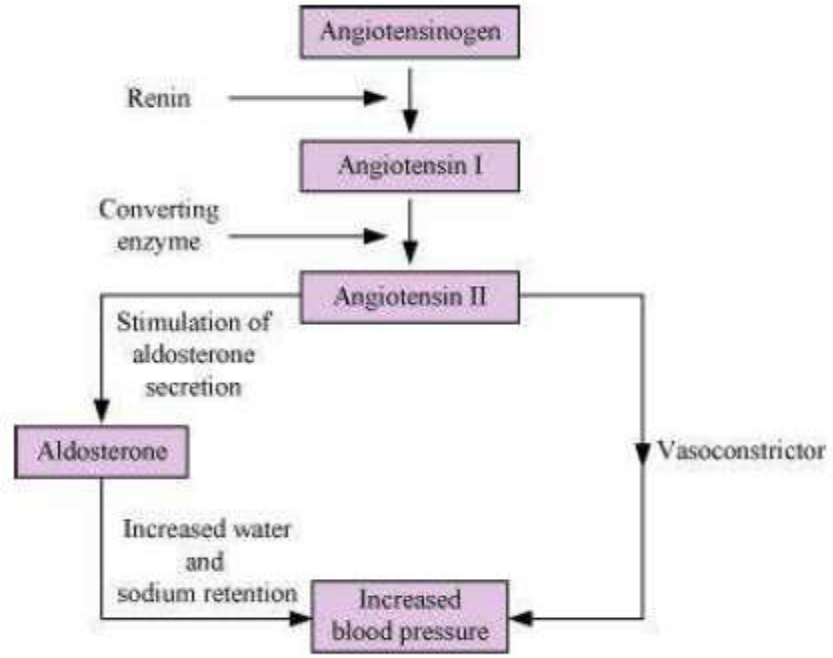
Answer

Column I		Column II	
(a)	Ammonotelism	**(iii)**	Bony fish
(b)	Bowman's capsule	**(v)**	Renal tubule
(c)	Micturition	**(iv)**	Urinary bladder
(d)	Uricotelism	**(i)**	Birds
(d)	ADH	**(ii)**	Water reabsorption

Question 8: What is meant by the term osmoregulation?
Answer Osmoregulation is a homeostatic mechanism that regulates the optimum temperature of water and salts in the tissues and body fluids. It maintains the internal environment of the body by water and ionic concentration.

Question 9: Terrestrial animals are generally either ureotelic or uricotelic, not ammonotelic, why?
Answer Terrestrial animals are either ureotelic or uricotelic, and not ammonotelic. This is because of the following two main reasons:
(a) Ammonia is highly toxic in nature. Therefore, it needs to be converted into a less toxic form such as urea or uric acid.
(b) Terrestrial animals need to conserve water. Since ammonia is soluble in water, it cannot be eliminated continuously. Hence, it is converted into urea or uric acid. These forms are less toxic and also insoluble in water. This helps terrestrial animals conserve water.

Question 10: What is the significance of juxtaglomerular apparatus (JGA) in kidney function?
Answer Juxtaglomerular apparatus (JGA) is a complex structure made up of a few cells of glomerulus, distal tubule, and afferent and efferent arterioles. It is located in a specialised region of a nephron, wherein the afferent arteriole and the distal convoluted tubule (DLT) come in direct contact with each other. The juxtaglomerular apparatus contains specialised cells of the afferent arteriole known as juxtaglomerular cells. These cells contain the enzyme renin that can sense blood pressure. When glomerular blood flow (or glomerular blood pressure orglomerular filtration rate) decreases, it activates juxtaglomerular cells to release renin.
Renin converts the angiotensinogen in blood into angiotensin I and further into angiotensin II. Angiotensin II is a powerful vasoconstrictor that increases the glomerular blood pressure and filtration rate. Angiotensin II also stimulates the adrenal cortex of the adrenal gland to produce aldosterone. Aldosterone increases the rate of absorption of sodium ions and water from the distal convoluted tubule and the collecting duct. This also leads to an increase in blood pressure and glomerular filtration rate. This mechanism, known as renin-angiotensin mechanism, ultimately leads to an increased blood pressure.



Question 11: Name the following:
(a) A chordate animal having flame cells as excretory structures
(b) Cortical portions projecting between the medullary pyramids in the human kidney
(c) A loop of capillary running parallel to the Henle's loop.
Answer (a) Amphioxus is an example of a chordate that has flame cells as excretory structures. Flame cell is a type of excretory and osmoregulatory system.
(b) The cortical portions projecting between the medullary pyramids in the human kidney are the columns of Bertini. They represent the cortical tissues present within the medulla.
(c) A loop of capillary that runs parallel to Henle's loop is known as vasa rectae. Vasa rectae, along with Henle's loop, helps in maintaining a concentration gradient in the medullary interstitium.

Question 12: Fill in the gaps:
(a) Ascending limb of Henle's loop is _____to water whereas the descending limb is_____to it.
(b) Reabsorption of water from distal parts of the tubules is facilitated by hormone_____.

(c) Dialysis fluid contains all the constituents as in plasma except _____.
(d) A healthy adult human excretes (on an average) _____ gm of urea/day.

Answer

(a) Ascending limb of Henle's loop is impermeable to water, whereas the descending limb is permeable to it.

(b) Reabsorption of water from distal parts of the tubules is facilitated by the hormone vasopressin.

(c) Dialysis fluid contains all the constituents as in plasma, except the nitrogenous wastes.

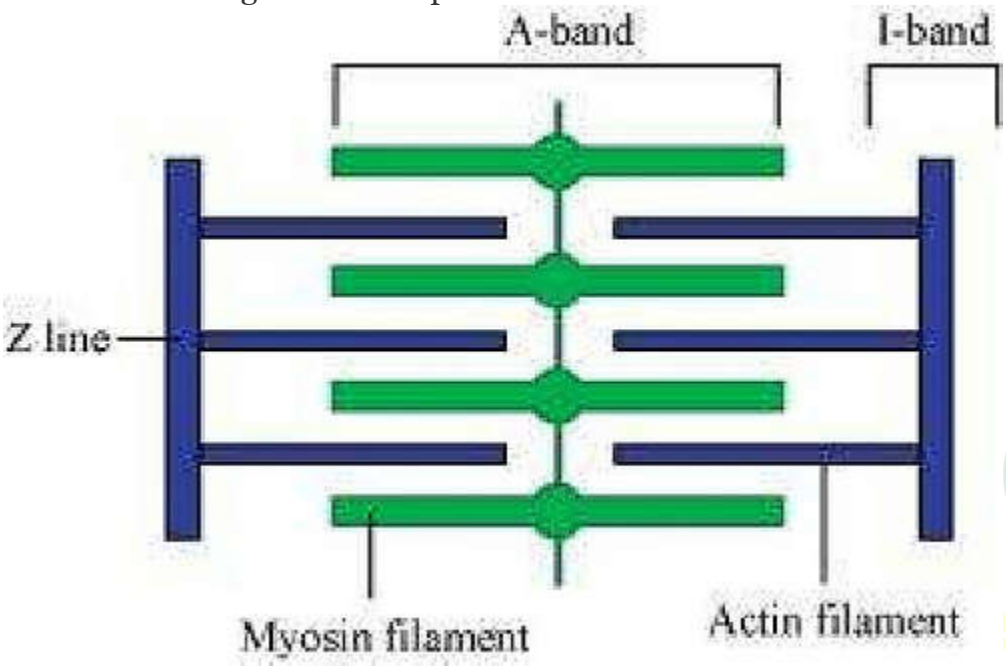
(d) A healthy adult human excretes (on an average) 25 – 30 gm of urea/day.

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 20 Locomotion and Movement

Class 11 Biology Solutions Chapter 20 Locomotion and Movement

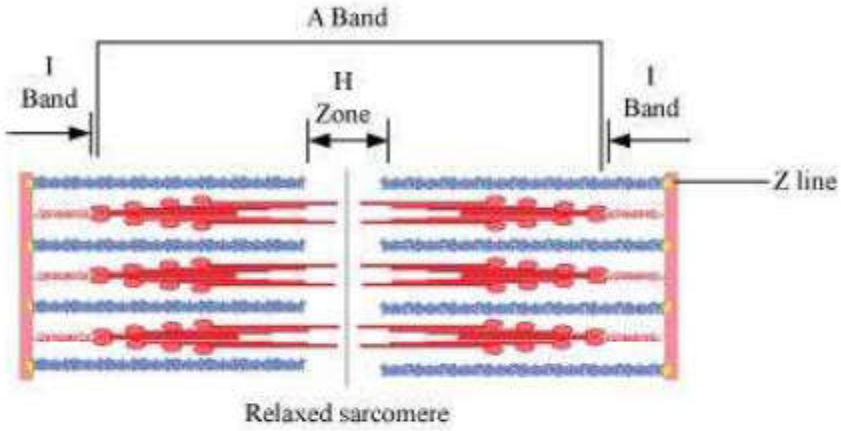
Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 20 Locomotion and Movement

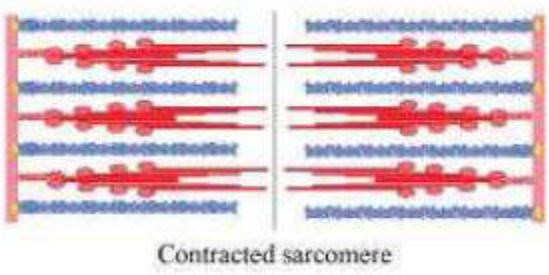
Question 1: Draw the diagram of a sarcomere of skeletal muscle showing different regions.
Answer The diagrammatic representation of a sarcomere is as follows:



Question 2: Define sliding filament theory of muscle contraction.
Answer The sliding filament theory explains the process of muscle contraction during which the thin filaments slide over the thick filaments, which shortens the myofibril. Each muscle fibre has an alternate light and dark band, which contains a special contractile protein, called actin and myosin respectively. Actin is a thin contractile protein present in the light band and is known as the I-band, whereas myosin is a thick contractile protein present in the dark band and is known as the A-band. There is an elastic fibre called z line that bisects each I-band. The thin filament is firmly anchored to the z line. The central part of the thick filament that is not overlapped by the thin filament is known as the H-zone. During muscle contraction, the myosin heads or cross bridges come in close contact with the thin filaments. As a result, the thin filaments are pulled towards the middle of the sarcomere. The Z line attached to the actin filaments is also pulled leading to the shortening of the sarcomere. Hence, the length of the band remains constant as its original length and the I-band shortens and the H-zone

disappears.





Question 3: Describe the important steps in muscle contraction.
Answer During skeletal muscle contraction, the thick filament slides over the thin filament by a repeated binding and releases myosin along the filament. This whole process occurs in a sequential manner.
Step 1: Muscle contraction is initiated by signals that travel along the axon and reach the neuromuscular junction or motor end plate. Neuromuscular junction is a junction between a neuron and the sarcolemma of the muscle fibre. As a result, Acetylcholine (a neurotransmitter) is released into the synaptic cleft by generating an action potential in sarcolemma.
Step 2: The generation of this action potential releases calcium ions from the sarcoplasmic reticulum in the sarcoplasm
Step 3: The increased calcium ions in the sarcoplasm leads to the activation of actin sites. Calcium ions bind to the troponin on actin filaments and remove the tropomyosin, wrapped around actin filaments. Hence, active actin sites are exposed and this allows myosin heads to attach to this site.
Step 4: In this stage, the myosin head attaches to the exposed site of actin and forms cross bridges by utilizing energy from ATP hydrolysis. The actin filaments are pulled. As a result, the H-zone reduces. It is at this stage that the contraction of the muscle occurs.
Step 5: After muscle contraction, the myosin head pulls the actin filament and releases ADP along with inorganic phosphate. ATP molecules bind and detach myosin and the cross bridges are broken.
Stage 6: This process of formation and breaking down of cross bridges continues until there is a drop in the stimulus, which causes an increase in calcium. As a result, the concentration of calcium ions decreases, thereby masking the actin filaments and leading to muscle relaxation.

Question 4: Write true or false. If false change the statement so that it is true.
(a) Actin is present in thin filament
(b) H-zone of striated muscle fibre represents both thick and thin filaments.
(c) Human skeleton has 206 bones.

(d) There are 11 pairs of ribs in man.
(e) Sternum is present on the ventral side of the body.
Answer (a) Answer: True
(b) Answer: False
H -zone of striated muscle fibre is the central part of the thick filament that is not overlapped by the thin filament.
(c) Answer: True
(d) Answer: False
There are 12 pairs of ribs in a man.
(e) Answer: True

Question 5: Write the difference between:
(a) Actin and Myosin
(b) Red and White muscles
(c) Pectoral and Pelvic girdle
Answer

(a) Actin and Myosin

	Actin		**Myosin**
1	Actin is a thin contractile protein.	1	Myosin is a thick contractile protein.
2.	It is present in light bands and is called an isotropic band.	2	It is present in dark bands and is called an anisotropic band.

(b) Red and White muscles

	Red muscle fibre		**White muscle fibre**
1	Red muscle fibres are thin and smaller in size.	1	White muscle fibres are thick and larger in size.
2	They are red in colour as they contain large amounts of myoglobin.	2	They are white in colour as they contain small amounts of myoglobin
3	They contain numerous mitochondria.	3	They contain less number of mitochondria.
4	They carry out slow and sustained contractions for a long period.	4	They carry out fast work for short duration.
5	They provide energy by aerobic respiration.	5	They provide energy by anaerobic respiration.

(c) Pectoral and Pelvic girdle

	Pectoral girdle		**Pelvic girdle**
1	It is a skeletal support from where the forelimbs of vertebrates are attached.	1	It is a skeletal support form where the hind limbs of vertebrates are attached.
2	It is composed of two Bones namely, clavicle or collar bones and scapula or shoulder bone.	2	It is composed of three bones, upper ileum, inner pubic, and ischium.

Question 6:
Match Column I with Column II :

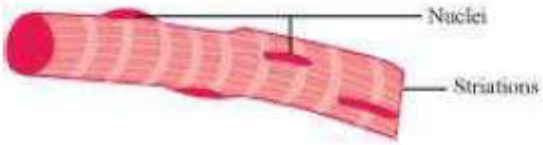
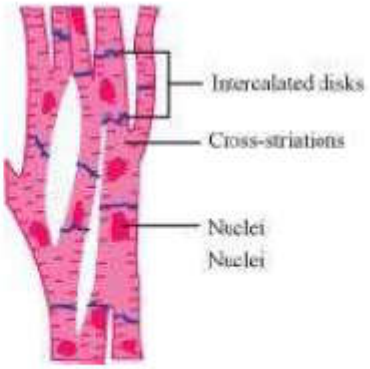
	Column I		**Column II**
(a)	Smooth muscle	(i)	Myoglobin
(b)	Tropomyosin	(ii)	Thin filament
(c)	Red muscle	(iii)	Sutures
(d)	Skull	(iv)	Involuntary

Answer

	Column I		**Column II**
(a)	Smooth muscle	(iv)	Involuntary
(b)	Tropomyosin	(ii)	Thin filament
(c)	Red muscle	(i)	Myoglobin
(d)	Skull	(iii)	Sutures

Question 7: What are the different types of movements exhibited by the cells of human body?
Answer Movement is a characteristic feature of living organisms. The different types of movement exhibited by cells of the human body are:
• Amoeboid movement: Leucocytes present in the blood show amoeboid movement. During tissue damage, these blood cells move from the circulatory system towards the injury site to initiate an immune response.
• Ciliary movement: Reproductive cells such as sperms and ova show ciliary movement. The passage of ova through the fallopian tube towards the uterus is facilitated by this movement.
• Muscular movement: Muscle cells show muscular movement.

Question 8: How do you distinguish between a skeletal muscle and a cardiac muscle?
Answer

	Skeletal muscle		Cardiac muscle
1.	The cells of skeletal muscles are unbranched.	1.	The cells of cardiac muscles are branched.
2.	Intercalated disks are absent.	2.	The cells are joined with one another by intercalated disks that help in coordination or synchronization of the heart beat.
3.	Alternate light and dark bands are present.	3.	Faint bands are present.
4.	They are voluntary muscles.	4.	They are involuntary muscles.
5.	They contract rapidly and get fatigued in a short span of time.	5.	They contract rapidly but do not get fatigued easily.
6.	They are present in body parts such as the legs, tongue, hands, etc. 	6.	These muscles are present in the heart and control the contraction and relaxation of the heart. 

Question 9: Name the type of joint between the following:-
(a) atlas/axis
(b) carpal/metacarpal of thumb
(c) between phalanges
(d) femur/acetabulum

(e) between cranial bones
(f) between pubic bones in the pelvic girdle
Answer(a) atlas/axis: Pivotal joint
(b) carpal/metacarpal of thumb: Saddle joint
(c) between phalanges: Hinge joint
(d) femur/acetabulum: Ball and socket joint
(e) between cranial bones: Fibrous joint
(f) between pubic bones in the pelvic girdle: Ball and socket joint

Question 10: Fill in the blank spaces:
(a) All mammals (except a few) have _____ cervical vertebra.
(b) The number of phalanges in each limb of human is _____
(c) Thin filament of myofibril contains 2 'F' actins and two other proteins namely _____ and _____.
(d) In a muscle fibre Ca++ is stored in _____
(e) _____ and _____ pairs of ribs are called floating ribs.
(f) The human cranium is made of _____ bones.
Answer

(a) All mammals (except a few) have seven cervical vertebra.

(b) The number of phalanges in each limb of a human is 14.

(c) Thin filament of myofibril contains 2 'F' actins and two other proteins, namely troponin and tropomyosin.

(d) In a muscle fibre, Ca^{++} is stored in the sarcoplasmic reticulum.

(e) 11^{th} And 12^{th} pairs of ribs are called floating ribs.

(f) The human cranium is made up of eight bones.

Answers NCERT Solutions For Class 11 Biology http://freehomedelivery.net/Solutions Chapter 21 Neural Control and Coordination

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Question 1: Briefly describe the structure of the following:
(a) Brain (b) Eye (c) Ear
Answer
(A) Brain: Brain is the main coordinating centre of the body. It is a part of nervous system that controls and monitors every organ of the body. It is well protected by cranial meninges that are made up of an outer layer called dura mater, a thin middle layer called arachnoid, and an inner layer called pia mater.
It is divided into three regions – forebrain, midbrain, and hindbrain.
Forebrain: It is the main thinking part of the brain. It consists of cerebrum, thalamus, and hypothalamus.
(a) Cerebrum:
Cerebrum is the largest part of the brain and constitutes about four-fifth of its weight. Cerebrum is divided into two cerebral hemispheres by a deep longitudinal cerebral fissure. These hemispheres are joined by a tract of nerve fibre known as corpus callosum. The cerebral hemispheres are covered by a layer of cells known as cerebral cortex or grey matter. Cerebrum has sensory regions known as association areas that receive sensory impulses from various receptors as well as from motor regions that control the movement of various muscles. The innermost part of cerebrum gives an opaque white appearance to the layer and is known as the white matter.
(b) Thalamus:
Thalamus is the main centre of coordination for sensory and motor signalling. It is wrapped by cerebrum.
(c) Hypothalamus:
It lies at the base of thalamus and contains a number of centres that regulate body temperature and the urge for eating and drinking. Some regions of cerebrum, along with hypothalamus, are involved in the regulation of sexual behaviour and expression of emotional reactions such as excitement, pleasure, fear, etc.
Midbrain:
It is located between the thalamus region of the forebrain and pons region of hindbrain. The dorsal surface of midbrain consists of superior and inferior corpora bigemina and four round lobes called corpora quadrigemina. A canal known as cerebral aqueduct passes through the midbrain. Midbrain is concerned with the sense of sight and hearing.
Hindbrain:
It consists of three regions – pons, cerebellum, and medulla oblongata.
(a) Pons is a band of nerve fibre that lies between medulla oblongata and midbrain. It connects the lateral parts of cerebellar hemisphere together.
(b) Cerebellum is a large and well developed part of hindbrain. It is located below the posterior sides of cerebral hemispheres and above medulla oblongata. It is responsible for maintaining posture and equilibrium of the body.

(c) Medulla oblongata is the posterior and simplest part of the brain. It is located beneath the cerebellum. Its lower end extends in the form of spinal cord and leaves the skull through foramen magnum.
(B) Eye: Eyes are spherical structures that consist of three layers.
(a) The outer layer is composed of sclera and cornea.
(i) Sclera is an opaque tissue that is usually known as white of the eye. It is composed of a dense connective tissue.
(ii) Cornea is a transparent anterior portion of eye that lacks blood vessels and is nourished by lymph from the nearby area. It is slightly bulged forward and helps in focusing light rays with the help of lens.
(b) The middle layer of eye is vascular in nature and contains choroid, ciliary body, and iris.
(i) Choroid lies next to the sclera and contains numerous blood vessels that provide nutrients and oxygen to the retina and other tissues.
(ii) Ciliary body: The choroid layer is thin over posterior region and gets thickened in the anterior portion to form ciliary body. It contains blood vessels, ciliary muscles, and ciliary processes.
(iii) Iris: At the junction of sclera and cornea, the ciliary body continues forward to form thin coloured partition called iris. It is the visible coloured portion of eye.
The eye contains a transparent, biconvex, and elastic structure just behind the iris. It is known as lens. The lens is held in position by suspensory ligaments attached to the ciliary body. The lens divides the eye ball into two chambers – an anterior aqueous and posterior vitreous chamber.
(c) The innermost nervous coat of eye contains retina. Retina is the innermost layer. It contains three layers of cells – inner ganglion cells, middle bipolar cells, and outermost photoreceptor cells. The receptor cells present in the retina are of two types – rod cells and cone cells.
(a) Rod cells –The rods contain the rhodopsin pigment (visual purple) that is highly sensitive to dim light. It is responsible for twilight vision.
(b) Cone cells –The cones contain the iodopsin pigment (visual violet) and are highly sensitive to high intensity light. They are responsible for daylight and colour visions. The innermost ganglionic cells give rise to optic nerve fibre that forms optic nerve in each eye and is connected with the brain.
(C) Ear: Ear is the sense organ for hearing and equilibrium. It consists of three portions – external ear, middle ear, and internal ear.
1. External ear:
It consists of pinna, external auditory meatus, and a tympanic membrane.
(a) Pinna is a sensitive structure that collects and directs the vibrations into the ear to produce sound.
(b) External auditory meatus is a tubular passage supported by cartilage in external ear.
(c) Tympanic membrane is a thin membrane that lies close to the auditory canal. It separates the middle ear from external ear.
2. Middle ear:
It is an air-filled tympanic cavity that is connected with pharynx through eustachian tube. Eustachian tube helps to equalize air pressure in both sides of tympanic membrane. The middle ear contains a flexible chain of three middle bones called ear ossicles. The three ear ossicles are malleus, incus, and stapes that are attached to each other.
3. Internal ear:
It is also known as labyrinth. Labyrinth is divided into bony labyrinth and a membranous labyrinth. Bony labyrinth is filled with perilymph while membranous labyrinth is filled with endolymph. Membranous labyrinth is divided into 2 parts.
(a) Vestibular apparatus
Vestibular apparatus is a central sac-like part that is divided into utriculus and sacculus. A special group of sensory cells called macula are present in sacculus and utriculus.
Vestibular apparatus also contains three semi-circular canals. The lower end of each semi-circular canal contains a projecting ridge called crista ampularis. Each ampulla has a group of sensory cells

called crista. Crista and macula are responsible for maintaining the balance of body and posture.
(b) Cochlea:
Cochlea is a long and coiled outgrowth of sacculus. It is the main hearing organ. Cochlea consists of three membranes. The organ of corti, a hearing organ, is located on the basilar membrane that has hair cells.

Question 2: Compare the following:
(a) Central neural system (CNS) and Peripheral neural system (PNS)
(b) Resting potential and action potential
(c) Choroid and retina

Answer

(a) Central neural system (CNS) and Peripheral neural system (PNS)

	Central neural system		**Peripheral neural system**
1.	It is the main coordinating centre of the body.	**1.**	It is not the main coordinating centre of the body.
2.	It includes brain and spinal cord.	**2.**	It includes cranial and spinal nerves that connect central nervous system to different parts of the body.

(b) Resting potential and action potential

	Resting potential		**Action potential**
1.	It is the potential difference across the nerve fibre when there is no conduction of nerve impulse.	**1.**	It is the potential difference across nerve fibre when there is conduction of nerve impulse.
2.	The membrane is more permeable to K^+ ions than to Na^+ ions.	**2.**	The membrane is more permeable to Na^+ ions than to K^+ ions.

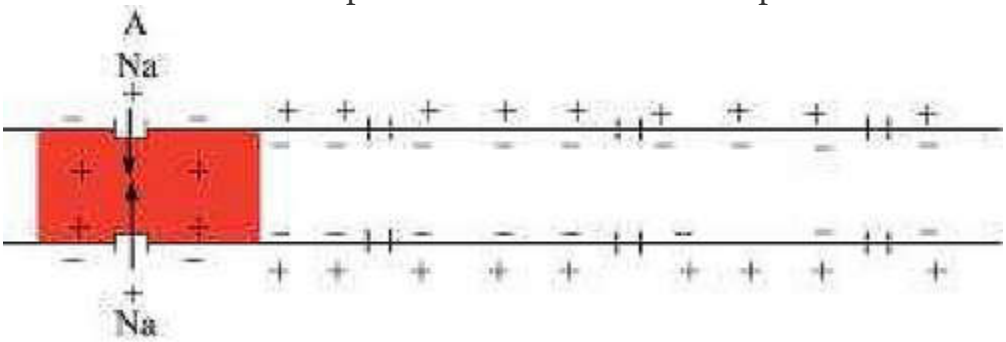
(c) Choroid and retina

	Choroid		**Retina**
1.	Choroid is the middle vascular layer of eye.	**1.**	Retina is the innermost nervous coat of eye.
2.	It contains numerous blood vessels that provide nutrients and oxygen to retina and other tissues.	**2.**	It contains photoreceptor cells, rods and cones that are associated with twilight and colour vision respectively.

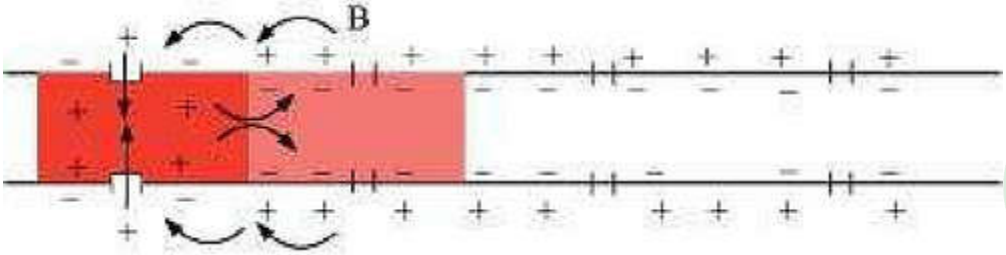
Question 3:
Explain the following processes:
(a) Polarisation of the membrane of a nerve fibre
(b) Depolarisation of the membrane of a nerve fibre

(c) Conduction of a nerve impulse along a nerve fibre
(d) Transmission of a nerve impulse across a chemical synapse

Answer (a) Polarisation of the membrane of a nerve fibre During resting condition, the concentration of K+ ions is more inside the axoplasm while the concentration of Na+ ions is more outside the axoplasm. As a result, the potassium ions move faster from inside to outside as compared to sodium ions. Therefore, the membrane becomes positively charged outside and negatively charged inside. This is known as polarization of membrane or polarized nerve.

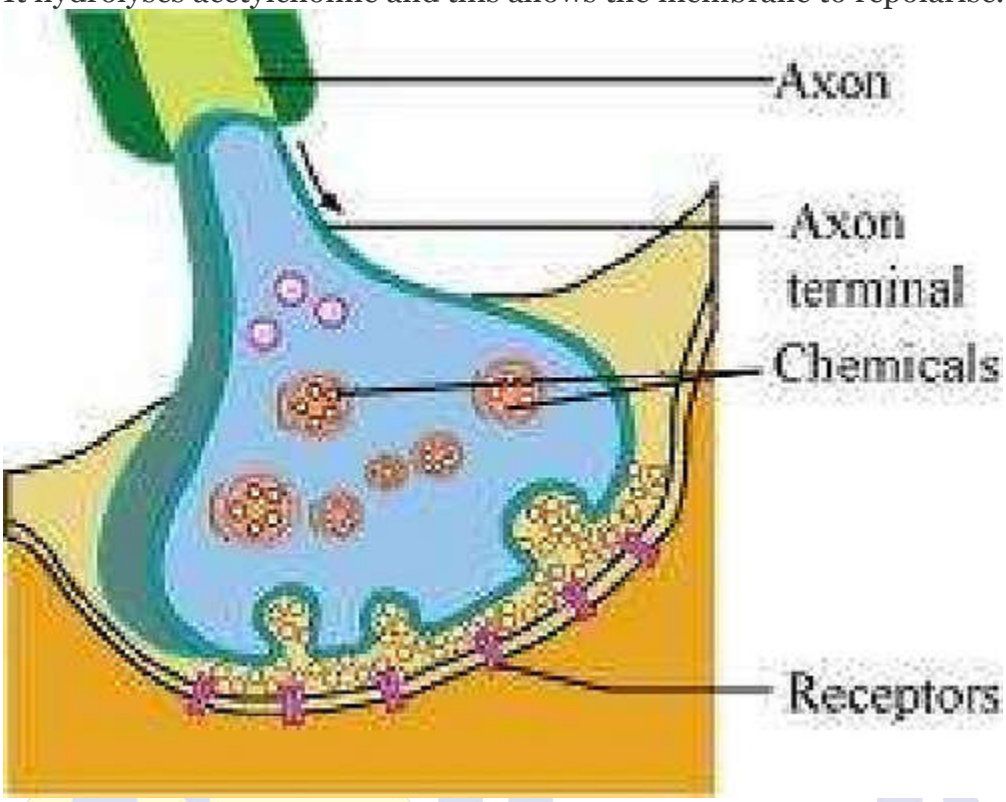


(b) Depolarisation of the membrane of a nerve fibre
When an electrical stimulus is given to a nerve fibre, an action potential is generated. The membrane becomes permeable to sodium ions than to potassium ions. This results into positive charge inside and negative charge outside the nerve fibre. Hence, the membrane is said to be depolarized.

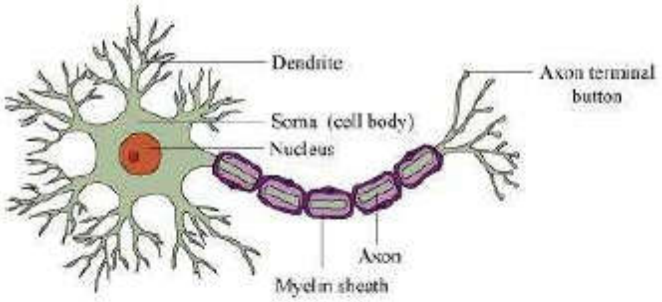


(c) Conduction of a nerve impulse along a nerve fibre
There are two types of nerve fibres – myelinated and non-myelinated. In myelinated nerve fibre, the action potential is conducted from node to node in jumping manner. This is because the myelinated nerve fibre is coated with myelin sheath. The myelin sheath is impermeable to ions. As a result, the ionic exchange and depolarisation of nerve fibre is not possible along the whole length of nerve fibre. It takes place only at some point, known as nodes of Ranvier, whereas in non-myelinated nerve fibre, the ionic exchange and depolarization of nerve fibre takes place along the whole length of the nerve fibre. Because of this ionic exchange, the depolarized area becomes repolarised and the next polarized area becomes depolarized.
(d) Transmission of a nerve impulse across a chemical synapse
Synapse is a small gap that occurs between the last portion of the axon of one neuron and the dendrite of next neuron. When an impulse reaches at the end plate of axon, vesicles consisting of chemical substance or neurotransmitter, such as acetylcholine, fuse with the plasma membrane. This chemical moves across the cleft and attaches to chemo-receptors present on the membrane of the dendrite of next neuron. This binding of chemical with chemo-receptors leads to the depolarization of membrane and generates a nerve impulse across nerve fibre. The chemical, acetylcholine, is inactivated by enzyme acetylcholinestrase. The enzyme is present in the post synaptic membrane of the dendrite.

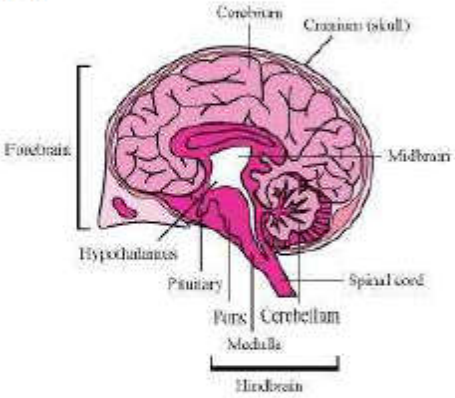
It hydrolyses acetylcholine and this allows the membrane to repolarise.



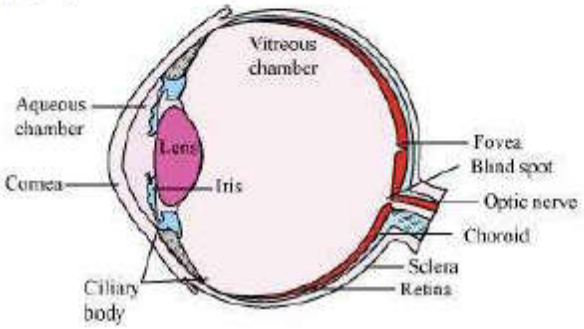
Question 4: Draw labelled diagrams of the following:
(a) Neuron (b) Brain (c) Eye (d) Ear
Answer (a) Neuron



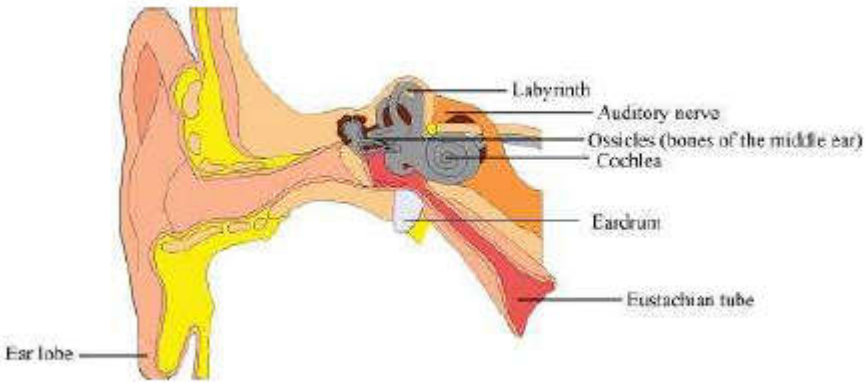
(b) Brain



(c) Eye



(d) Ear



Question 5: Write short notes on the following:
(a) Neural coordination (b) Forebrain (c) Midbrain (d) Hindbrain (e) Retina (f) Ear ossicles (g) Cochlea (h) Organ of Corti (i) Synapse
Answer (a) Neural coordination
The neural system provides rapid coordination among the organs of the body. This coordination is in

the form of electric impulses and is quick and short lived. All the physiological processes in the body are closed linked and dependent upon each other. For example, during exercise, our body requires more oxygen and food. Hence, the breathing rate increases automatically and the heart beats faster. This leads to a faster supply of oxygenated blood to the muscles. Moreover, the cellular functions require regulation continuously. These functions are carried out by the hormones. Hence, the neural system along with the endocrine system control and coordinate the physiological processes.

(b) Forebrain

It is the main thinking part of the brain. It consists of cerebrum, thalamus, and hypothalamus.

(i) Cerebrum:

Cerebrum is the largest part of the brain and constitutes about four-fifth of its weight. Cerebrum is divided into two cerebral hemispheres by a deep longitudinal cerebral fissure. These hemispheres are joined by a tract of nerve fibres known as corpus callosum. The cerebral hemispheres are covered by a layer of cells known as cerebral cortex or grey matter. Cerebrum has sensory regions known as association areas that receive sensory impulses from various receptors as well as from motor regions that control the movement of various muscles. The innermost part of cerebrum gives an opaque white appearance to the layer and is known as the white matter.

(ii) Thalamus:

Thalamus is the main centre of coordination for sensory and motor signalling. It is wrapped by cerebrum.

(iii) Hypothalamus:

It lies at the base of thalamus and contains a number of centres that regulate body temperature and the urge for eating and drinking. Some regions of cerebrum, along with hypothalamus, are involved in the regulation of sexual behaviour and expression of emotional reactions such as excitement, pleasure, fear, etc.

(c) Midbrain

It is located between the thalamus region of the forebrain and pons region of hindbrain. The dorsal surface of midbrain consists of superior and inferior corpora bigemina and four round lobes called corpora quadrigemina. A canal known as cerebral aqueduct passes through the midbrain. Midbrain is concerned with the sense of sight and hearing.

(d) Hindbrain

It consists of three regions – pons, cerebellum, and medulla oblongata.

(i) Pons is a band of nerve fibres that lies between medulla oblongata and midbrain. It connects the lateral parts of cerebellar hemisphere together.

(ii) Cerebellum is a large and well developed part of hindbrain. It is located below the posterior sides of cerebral hemispheres and above the medulla oblongata. It is responsible for maintaining posture and equilibrium of the body.

(iii) Medulla oblongata is the posterior and simplest part of the brain. It is located beneath the cerebellum. Its lower end extends in the form of spinal cord and leaves the skull through foramen magnum.

(e) Retina

Retina is the innermost layer. It contains three layers of cells – inner ganglion cells, middle bipolar cells, and outermost photoreceptor cells. The receptor cells present in the retina are of two types – rod cells and cone cells.

(i) Rod cells –The rods contain rhodopsin pigment (visual purple), which is highly sensitive to dim light. It is responsible for twilight vision.

(ii) Cone cells –The cones contain iodopsin pigment (visual violet) and are highly sensitive to high intensity light. They are responsible for daylight and colour visions. The innermost ganglionic cells give rise to optic nerve fibre that forms optic nerve in each eye and is connected with the brain. In this region, the photoreceptor cells are absent. Hence, it is known as the blind spot. At the posterior part, lateral to blind spot, there is a pigmented spot called macula lutea. This spot has a shallow depression

at its middle known as fovea. Fovea has only cone cells. They are devoid of rod cells. Hence, it is the place of most distinct vision.

(f) Ear ossicles

The middle ear contains a flexible chain of three middle bones called ear ossicles. The three ear ossicles are as follows.

(i) Malleus

(ii) Incus

(iii) Stapes

The malleus is attached to tympanic membrane on one side and to incus on the other side. The incus is connected with stapes. Stapes, in turn, are attached with an oval membrane, fenestra ovalis, of internal ear. The ear ossicles act as a lever that transmits sound waves from external ear to internal ear.

(g) Cochlea

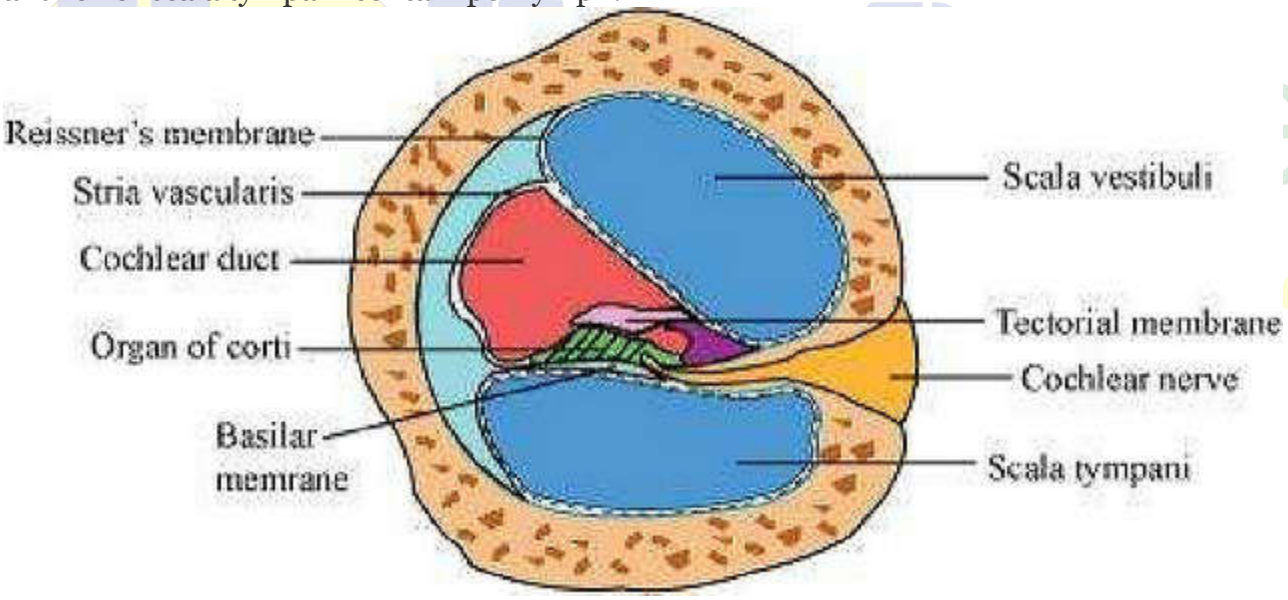
Cochlea is a long, coiled outgrowth of sacculus. It is the main hearing organ. The cochlea forms three chambers.

(i) Upper – scala vestibule

(ii) Middle – scala media

(iii) Lower – scale tympani

The floor of the scala media is basilar membrane while its roof is Reissner's membrane. Reissner's membrane gives out a projection called tectorial membrane. The organ of corti, a hearing organ, is located on the basilar membrane. Organ of corti contains receptor hair cells. The upper scala vestibule and lower scala tympani contain perilymph.



(h) Organ of corti

Organ of corti is the hearing organ. It is located on the basilar membrane that contains hair cells. Hair cells act as auditory receptors. They are present on the internal side of organ of corti.

i) Synapse

Synapse is a junction between the axon terminal of one neuron and the dendrite of next neuron. It is separated by a small gap known as synaptic cleft.

There are two types of synapses.

(a) Electrical synapse

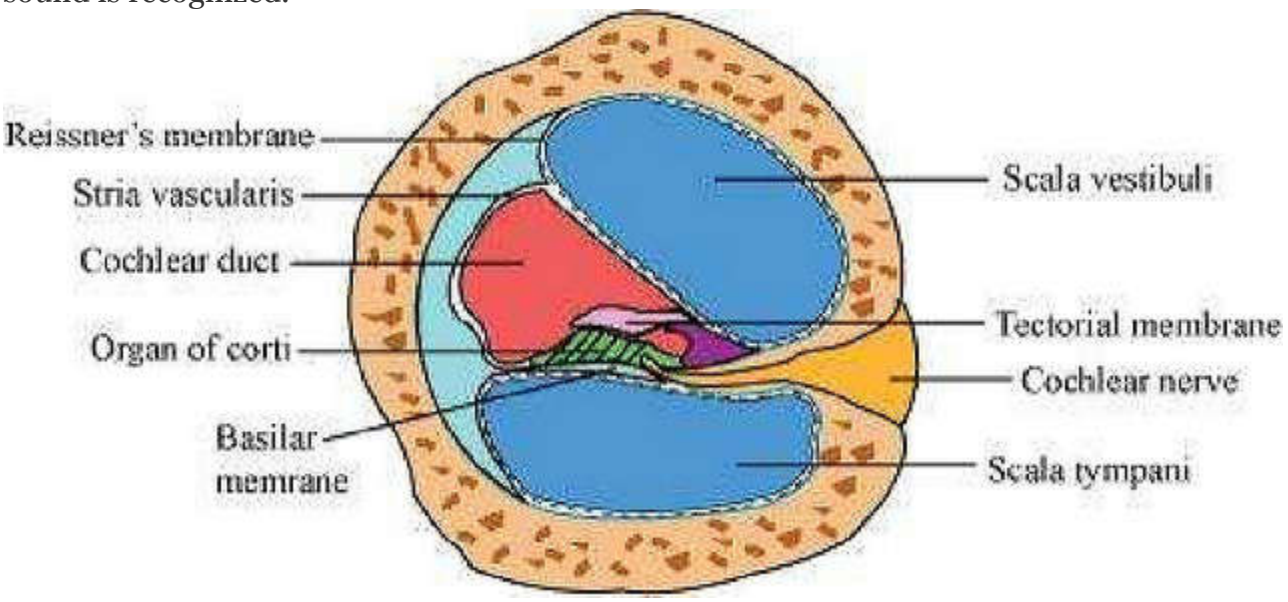
(b) Chemical synapse

In electrical synapses, the pre and post synaptic neurons lie in close proximity to each other. Hence, the impulse can move directly from one neuron to another across the synapse. This represents a faster method of impulse transmission.

In chemical synapses, the pre and post synaptic neurons are not in close proximity. They are separated by a synaptic cleft. The transmission of nerve impulses is carried out by chemicals such as neurotransmitters.

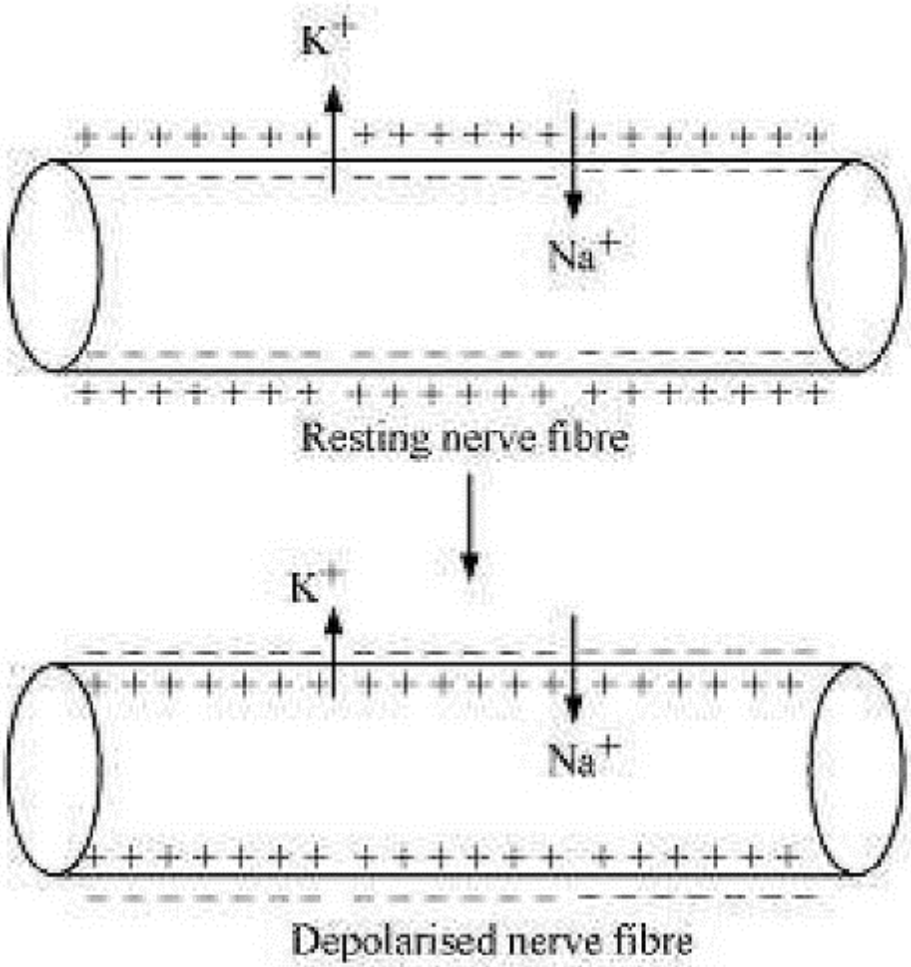
Question 6: Give a brief account of:
(a) Mechanism of synaptic transmission
(b) Mechanism of vision
(c) Mechanism of hearing
Answer (a) Mechanism of synaptic transmission
Synapse is a junction between two neurons. It is present between the axon terminal of one neuron and the dendrite of next neuron separated by a cleft.
There are two ways of synaptic transmission.
(1) Chemical transmission
(2) Electrical transmission
1. Chemical transmission – When a nerve impulse reaches the end plate of axon, it releases a neurotransmitter (acetylcholine) across the synaptic cleft. This chemical is synthesized in cell body of the neuron and is transported to the axon terminal. The acetylcholine diffuses across the cleft and binds to the receptors present on the membrane of next neuron. This causes depolarization of membrane and initiates an action potential.
2. Electrical transmission – In this type of transmission, an electric current is formed in the neuron. This electric current generates an action potential and leads to transmission of nerve impulse across the nerve fibre. This represents a faster method of nerve conduction than the chemical method of transmission.
(b) Mechanism of vision
Retina is the innermost layer of eye. It contains three layers of cells – inner ganglion cells, middle bipolar cells, and outermost photoreceptor cells. A photoreceptor cell is composed of a protein called opsin and an aldehyde of vitamin A called retinal. When light rays are focused on the retina through cornea, it leads to the dissociation of retinal from opsin protein. This changes the structure of opsin. As the structure of opsin changes, the permeability of membrane changes, generating a potential difference in the cells. This generates an action potential in the ganglionic cells and is transmitted to the visual cortex of the brain via optic nerves. In the cortex region of brain, the impulses are analysed and image is formed on the retina.
(c) Mechanism of hearing
The pinna of the external region collects the sound waves and directs it towards ear drum or external auditory canal. These waves strike the tympanic membrane and vibrations are created. Then, these vibrations are transmitted to the oval window, fenestra ovalis, through three ear ossicles, named as malleus, incus, and stapes. These ear ossicles act as lever and transmit the sound waves to internal ear. These vibrations from fenestra ovalis are transmitted into cochlear fluid. This generates sound waves in the lymph. The formation of waves generates a ripple in the basilar membrane. This movement bends the sensory hair cells present on the organ of corti against tectorial membrane. As a result of this, sound waves are converted into nerve impulses. These impulses are then carried to auditory cortex of brain via auditory nerves. In cerebral cortex of brain, the impulses are analysed and

sound is recognized.



Question 7: Answer briefly:
(a) How do you perceive the colour of an object?
(b) Which part of our body helps us in maintaining the body balance?
(c) How does the eye regulate the amount of light that falls on the retina?
Answer (a) Photoreceptors are cells that are sensitive to light. They are of two types – rods and cones. These are present in the retina. Cones help in distinguishing colours. There are three types of cone cells – those responding to green light, those responding to blue light, and those responding to red light. These cells are stimulated by different lights, from different sources. The combinations of the signals generated help us see the different colours.
(b) Vestibular apparatus is located in the internal ear, above the cochlea and helps in maintaining body balance. Crista and macula are the sensory spots of the vestibular apparatus controlling dynamic equilibrium.
(c) Pupil is the small aperture in the iris that regulates the amount of light entering the eye. Cornea, aqueous humour, lens, and vitreous humour act together and refract light rays, focussing them onto the photoreceptor cells of the retina.

Question 8: Explain the following:
(a) Role of Na+ in the generation of action potential.
(b) Mechanism of generation of light-induced impulse in the retina.
(c) Mechanism through which a sound produces a nerve impulse in the inner ear.
Answer (a) Sodium ions play an important role in the generation of action potential. When a nerve fibre is stimulated, the membrane potential decreases. The membrane becomes more permeable to Na+ ions than to K+ ions. As a result, Na+ diffuses from the outside to the inside of the membrane. This causes the inside of the membrane to become positively-charged, while the outer membrane gains a negatively charge. This reversal of polarity across the membrane is known as depolarisation. The rapid inflow of Na+ ions causes the membrane potential to increase, thereby generating an action potential.



(b) Retina is the innermost layer of the eye. It contains three layers of cells – inner ganglion cells, middle bipolar cells, and outermost photoreceptor cells. Photoreceptor cells are composed of a protein called opsin and an aldehyde of vitamin A calledretinal. When light rays are focused on the retina through the cornea, retinal gets dissociated from opsin. As a result, the structure of opsin gets changed. This in turn causes the permeability of the membrane to change, thereby generating a potential difference in the cells. Consequently, an action potential is generated in the ganglion cells and is transmitted to the visual cortex of the brain via the optic nerves. In the cortex region of the brain, the impulses are analysed and the image is formed on the retina.
(c) The pinna of the external ear collects the sound waves and directs them to the tympanic membrane (ear drum) via the external auditory canal. The ear drum then vibrates the sound waves and conducts them to the internal ear through the ear ossicles. The ear ossicles increase the intensity of the sound waves. These vibrating sound waves are conducted through the oval window to the fluid in the cochlea. Consequently, a movement is created in the lymph. This movement produces vibrations in the basilar membrane, which in turn stimulate the auditory hair cells. These cells generate a nerve impulse, conducting it to the auditory cortex of the brain via afferent fibres. The auditory cortex region interprets the nerve impulse and sound is recognised.

Question 9: Differentiate between:
(a) Myelinated and non-myelinated axons
(b) Dendrites and axons
(c) Rods and cones
(d) Thalamus and Hypothalamus
(e) Cerebrum and Cerebellum

Answer

(a) Myelinated and non-myelinated axons

	Myelinated axons		**Non-myelinated axons**
1.	Transmission of nerve impulse is faster	**1.**	Transmission of nerve impulse is slower
2.	Myelinated axon has a myelin sheath.	**2.**	Myelin sheath is absent
3.	Node of Ranvier is present between adjacent myelin sheaths.	**3.**	Node of Ranvier is absent
4.	Found in the brain, the spinal cord, the cranial and spinal nerves	**4.**	Found in autonomous and somatic neural systems
5.	Schwann cells are observed inside the myelin sheath	**5.**	Schwann cells are not observed inside the myelin sheath

(b) Dendrites and axons

	Dendrites		**Axons**
1.	Dendrite is a small projection arising from the neuron. It conducts the nerve impulse toward the cell body.	**1.**	Axon is a single, long projection that conducts the nerve impulse away from cell body to the next neuron.
2.	Nissl's granules are present in dendrites.	**2.**	Nissl's granules are absent from axons.
3.	Dendrites are always non-	**3.**	Axons can be myelinated or non-

	myelinated.		myelinated.

(c) Rods and cones

	Rods		Cones
1.	Rods help in twilight vision.	**1.**	Cones help in colour vision.
2.	They have visual purple pigment called rhodopsin.	**2.**	They have visual violet pigment called iodopsin.
3.	Rods are the photoreceptor cells of the retina that are sensitive to dim light.	**3.**	Cones are the photoreceptor cells of the retina that are sensitive to bright light.

(d) Thalamus and Hypothalamus

Thalamus	Hypothalamus
Thalamus is the part of the forebrain that receives nerve impulses of pain, temperature, touch, etc., and conducts them to the cerebral hemisphere.	Hypothalamus is the part of the forebrain that controls involuntary functions such as hunger, thirst, sweating, sleep, fatigue, sexual desire, temperature regulation, etc.

(e) Cerebrum and Cerebellum

Cerebrum	Cerebellum
It is the part of the forebrain that controls voluntary functions. It is the place where intelligence, will power, memory, etc., reside.	It is the part of the hindbrain that controls voluntary functions and controls the equilibrium.

Question 10: Answer the following:
(a) Which part of the ear determines the pitch of a sound?
(b) Which part of the human brain is the most developed?
(c) Which part of our central neural system acts as a master clock?
Answer
(a) Cochlea determines the pitch of a sound.
(b) Forebrain is largest and the most developed part of the human brain.
(c) Hypothalamus acts as a master clock in the human body.

Question 11: The region of the vertebrate eye, where the optic nerve passes out of the retina, is called the
(a) fovea
(b) iris
(c) blind spot
(d) optic chaisma Answer
Answer: (c) Blind spot

Blind spot is the part where the optic nerve passes out of the retina. Photoreceptors are absent from this region.

Question 12: Distinguish between:
(a) afferent neurons and efferent neurons
(b) impulse conduction in a myelinated nerve fibre and unmyelinated nerve fibre
(c) aqueous humor and vitreous humor
(d) blind spot and yellow spot
(f) cranial nerves and spinal nerves.
Answer

(a) Afferent neurons and efferent neurons

Afferent neurons	Efferent neurons
Afferent neuron conducts nerve impulses toward the brain or the spinal cord.	Efferent neuron conducts nerve impulses from the brain or spinal cord to the effector organs such as muscles or glands.

(b) Impulse conduction in a myelinated nerve fibre and an unmyelinated nerve fibre

	Impulse conduction in a myelinated nerve fibre		Impulse conduction in an unmyelinated nerve fibre
1.	In a myelinated nerve fibre, the action potential is conducted from one node to another.	**1.**	In an unmyelinated nerve fibre, the action potential is not conducted from node to node. It is carried along the whole length of the nerve fibre.
2.	The conduction of impulses is faster.	**2.**	The conduction of impulses is slower.

(c) Aqueous humour and vitreous humour

Aqueous humour	Vitreous humour
It is a thin, watery fluid present between the cornea and the lens.	It is a transparent gel present between the lens and the retina.

(d) Blind spot and yellow spot

	Blind spot		Yellow spot
1.	Blind spot is a spot on the retina present at the point of origin of the optic nerve.	**1.**	Yellow spot is a small area on the retina present at the posterior pole of the eye, lateral to the blind spot.
2.	Photoreceptor cells are absent from this region.	**2.**	Only cones are present in this region.
3.	They are insensitive to light as both rods and cones are absent.	**3.**	They are sensitive to bright light as cones are present.

(f) Cranial nerves and spinal nerves

	Cranial nerves		Spinal nerves
1.	Cranial nerves arise from the brain.	**1.**	Spinal nerves arise from the spinal cord.
2.	There are 12 pairs of cranial nerves.	**2.**	There are 31 pairs of spinal nerves.

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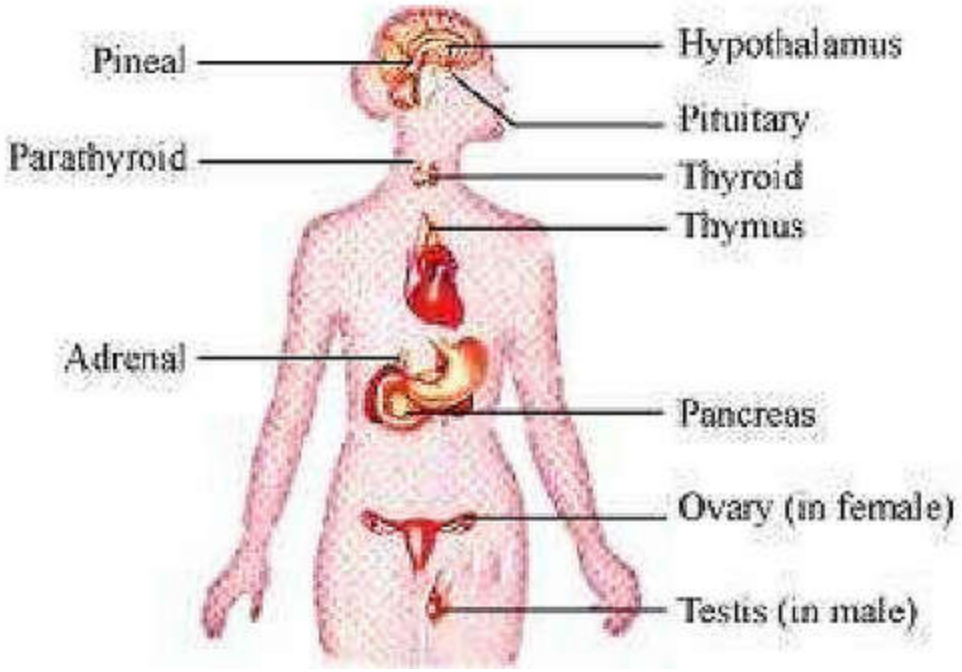
Question 1: Define the following:
(a) Exocrine gland
(b) Endocrine gland
(c) Hormone Answer
Answer a) Exocrine glands: Glands that discharge secretions into ducts are known as exocrine glands. Sebaceous gland in the skin, salivary gland in the buccal cavity, etc. are examples of exocrine glands.
(b) Endocrine glands: Glands that do not discharge their secretions into ducts are known as endocrine glands. Instead, these glands discharge their secretions directly into the blood. Pituitary gland, thyroid gland, adrenal gland, etc. are examples of endocrine glands.
(c) Hormones: Hormones are chemical messengers that regulate physiological processes in living organisms. They act upon specific cells/tissues/organs which are called target cells/tissues/organs.

Question 2: Diagrammatically indicate the location of the various endocrine glands in our body.
Answer The location of various endocrine glands in the human body can be illustrated as follows:



Question 3: List the hormones secreted by the following:
(a) Hypothalamus (b) Pituitary (c) Thyroid (d) Parathyroid (e) Adrenal (f) Pancreas (g) Testis (h) Ovary (i) Thymus
(j) Atrium (k) Kidney (l) G-I Tract

Answer a) Hypothalamus: Hormones secreted by the hypothalamus include:
(1) Releasing hormones: These hormones stimulate the secretions of the pituitary hormone. Examples of these hormones are:
(i) Gonadotrophin-releasing hormone
(ii) Thyrotrophin-releasing hormone
(iii) Somatotropin-releasing hormone
(iv) Adrenocorticotrophin-releasing hormone
(2) Inhibiting hormones: These hormones inhibit the secretions of the pituitary hormone. Examples of these hormones are:
(i) Somatostatin
(ii) Growth-inhibiting hormone
(iii) Melanocyte-inhibiting hormone
(b) Pituitary: The pituitary gland has two components i.e., adenohypophysis and neurohypophysis.
Hormones secreted by the adenohypophysis are:
(i) Growth hormone (GH)
(ii) Prolactin
(iii) Thyroid-stimulating hormone (TSH)
(iv) Adrenocorticotrophic hormone (ACTH)
(v) Luteinizing hormone (LH)
(vi) Follicle-stimulating hormone (FSH)
(vii) Melanocyte-stimulating hormone (MSH)
Hormones secreted by the neurohypophysis are:
(i) Oxytocin
(ii) Vasopressin
(c) Thyroid: The thyroid gland secretes three hormones namely, thyroxin, triiodothyronin, and calcitonin.
(d) Parathyroid: The parathyroid gland secretes a hormone known as the parathyroid hormone.
(e) Adrenal: The adrenal gland is divided into two parts, the outer adrenal cortex and the inner adrenal medulla.
Hormones of adrenal cortex include the following:
(i) Mineralocorticoids: The hormone secreted is known as aldosterone.
(ii) Glucocorticoids: The hormone secreted is cortisol. Hormones of adrenal medulla are adrenaline and nor-adrenalin.
(f) Pancreas: Hormones secreted by the pancreas are insulin and glucagon.
(g) Testis: The hormone secreted by the testis is testosterone.
(h) Ovary: The hormone secreted by the ovary includes estrogen and progesterone.
(i) Thymus: Hormones secreted by the thymus are thymosins.
(j) Atrium: The walls of the atrium secrete atrial natriuretic factor.
(k) Kidney: The hormone secreted by kidney is erythropoietin.
(l) G-I tract: The hormones secreted by the G-I tract are Gastrin, secretin, cholecystokinin (CCK), and gastric inhibitory peptide (GIP).

Question 4: Fill in the blanks:
Hormones Target gland
(a) Hypothalamic hormones _____
(b) Thyrotrophin (TSH) _____
(c) Corticotrophin (ACTH) _____
(d) Gonadotrophins (LH, FSH) _____
(e) Melanotrophin (MSH) _____

Answer Hormones Target gland

Hormones	Target gland
(a) Hypothalamic hormones	Pituitary
(b) Thyrotrophin (TSH)	Thyroid
(c) Corticotrophin (ACTH)	Adrenal
(d) Gonadotrophins (LH, FSH)	Ovary, Testis
(e) Melanotrophin (MSH)	melanocyte

Question 5: Write short notes on the functions of the following hormones,
(a) Parathyroid hormone (PTH)
(b) Thyroid hormones
(c) Thymosins
(d) Androgens
(e) Estrogens
(f) Insulin and Glucagon

Answer (a) Parathyroid hormone (PTH) – The parathyroid hormone is secreted by the parathyroid gland. Its main function is to increase the level of calcium in blood. It promotes the reabsorption of calcium from nephrons and also, promotes the absorption of calcium from digested food. Hence, it plays an important role in maintaining calcium balance in the body.
(b) Thyroid hormones – Thyroid hormones such as thyroxine, triiodothyronin, and thyrocalcitonin are secreted by the thyroid gland. Thyroxine maintains the basal metabolic rate of the body and regulates the carbohydrate, fat, and protein metabolism. Water and electrolyte balance is also maintained by thyroid hormones. Thyrocalcitonin or calcitonin lowers calcium level in blood plasma. It plays a significant role in calcium levels along with parathyroid hormone.
(c) Thymosins – Thymosin is secreted by the thymus gland. It plays a major role in protecting the body against infectious agents. It helps in the differentiation of T-lymphocytes and also promotes the reproduction of antibodies. Hence, it provides both cell-mediated and humoral immunity. Thymosins also help in the development of sex glands.
(d) Androgens – The leydig cells of testis produce androgens such as testosterone. Testosterone is a male sex hormone that regulates the development of secondary sex characteristics such as facial hair, hoarse voice, development of reproductive organ, etc. Androgens also regulate the development, maturation, and functions of various male accessory organs such as epididymis and prostate glands. It stimulates spermatogenesis and formation of mature sperms. It also influences male sexual behaviour.
(e) Estrogens- Estrogen is the female sex hormone that controls the development of secondary sex characteristics such as enlargement of breasts and development of female reproductive organs. It plays a role in the development, growth and maturation of female secondary characteristics. It also helps in the development of growing ovarian follicles. It influences female sexual behaviour.
(f) Insulin and glucagon – Glucagon and insulin are secreted by cells of pancreas. They regulate the blood glucose level in the body. α-cells secrete glucagon that maintain a normal blood glucose level in the body, whereas β-cells secrete insulin that regulates the storage of glycogen in the liver.
Function of insulin – Insulin stimulates glycogenesis (conversion of glucose to glycogen). The rapid conversion of glucose from the blood to glycogen in hepatocytes and adipocytes results into a

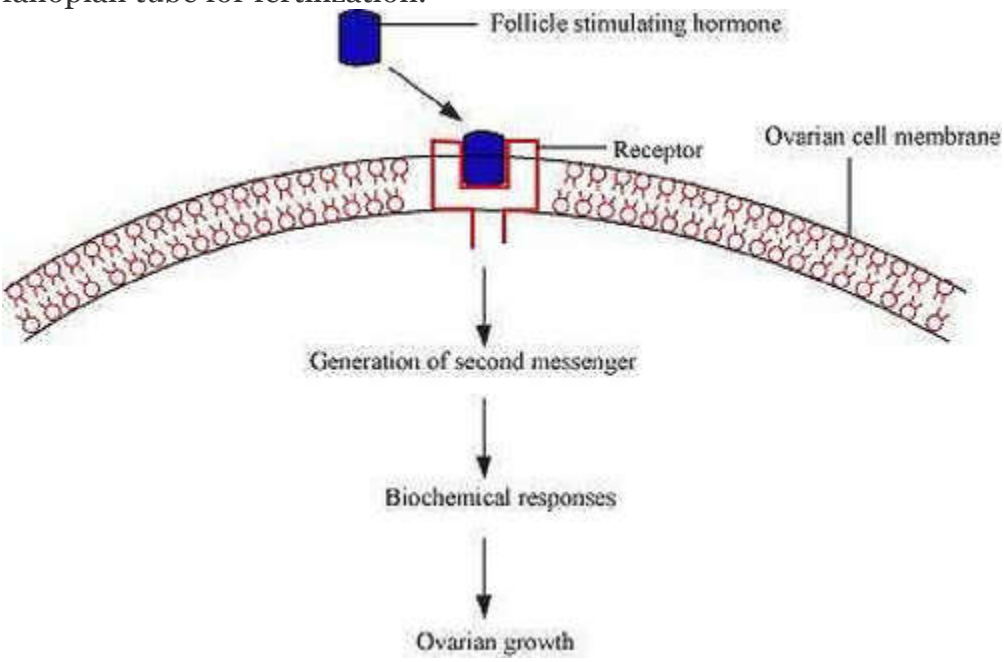
decreased glucose level. Insulin also prevents the formation of glucose from non-carbohydrate substances such as proteins and fats. Hence, it acts as a regulator of carbohydrate metabolism. Function of glucagon – The main function of the glucagon is to increase the level of glucose when there is a deficiency of glucose in the body. This process is known as glycogenolysis.

Question 6: Give example(s) of:
(a) Hyperglycemic hormone and hypoglycemic hormone
(b) Hypercalcemic hormone
(c) Gonadotrophic hormones
(d) Progestational hormone
(e) Blood pressure lowering hormone
(f) Androgens and estrogens
Answer (a) Hyperglycemic hormone and hypoglycemic hormone: Hyperglycemic hormone is glucagon, while hypoglycemic hormone is insulin.
(b) Hypercalcemic hormone: Parathyroid hormone (PTH) is hypercalcemic hormone.
(c) Gonadotrophic hormones: Luteinizing hormone and follicle stimulating hormones are examples of gonadotrophic hormone.
(d) Progestational hormone: Progesterone is a progestational hormone.
(e) Blood pressure lowering hormone: Nor-adrenalin is a blood pressure lowering hormone.
(f) Androgens and estrogens: Testosterone is an example of androgen, while an example of estrogen is estradiol.

Question 7: Which hormone deficiency is responsible for the following?
(a) Diabetes mellitus
(b) Goitre
(c) Cretinism
Answer (a) Diabetes mellitus is characterized by abnormally high glucose levels in the blood due to the deficiency of hormone, called insulin.
(b) Goitre is characterised by an abnormal enlargement of the thyroid gland due to the deficiency of thyroxin hormone in the body.
(c) Cretinism is characterized by stunted growth in the baby due to the deficiency of thyroid hormone in the body.

Question 8: Briefly mention the mechanism of action of FSH.
Answer Follicle stimulating hormone (FSH) is secreted by the pars distalis region of the anterior pituitary. It regulates the development, growth, and reproductive processes of the human body. In the ovary, FSH stimulates the growth and maturation of ovarian follicle. As the follicle grows and matures, it releases an inhibitory hormone known as inhibin that ends the process of FSH production. Action of FSH: Follicle stimulating hormone produces its effect by binding to its specific receptors present on the ovarian cell membrane. Binding of FSH hormone to its receptor leads to the formation of hormone receptor complex. The formation of this complex leads to biochemical changes in the ovarian follicle, present in the ovarian. The ovarian follicles mature and release a mature ovum in the

fallopian tube for fertilization.



Question 9: Match the following:

Column I		Column II	
a	T_4	**i**	Hypothalamus
b	PTH	**ii**	Thyroid
c	GnRH	**iii**	Pituitary
d	LH	**iv**	Parathyroid

Answer

Column I		Column II	
a	T_4	**ii**	Thyroid
b	PTH	**iv**	Parathyroid
c	GnRH	**i**	Hypothalamus
d	LH	**iii**	Pituitary