Answers NCERT Solutions For Class 12 Biology http://freehomedelivery.net/ Solutions Chapter 1 Reproduction in Organisms

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Chapter 1 Reproduction in Organisms Answers NCERT Solutions For Class 12 Biology http://freehomedelivery.net/ Solutions

Question 1: Why is reproduction essential for organisms?
Answer Reproduction is a fundamental feature of all living organisms. It is a biological process through which living organisms produce offspring's similar to them. Reproduction ensures the continuance of various species on the Earth. In the absence of reproduction, the species will not be able to exist for a long time and may
soon get extinct.

Question 2: Which is a better mode of reproduction sexual or asexual? Why?
Answer Sexual reproduction is a better mode of reproduction. It allows the formation of new variants by the combination of the DNA from two different individuals, typically one of each sex. It involves the fusion of the male and the female gamete to produce variants, which are not identical to their parents and to themselves. This variation allows the individual to adapt to constantly changing and challenging environments. Also, it leads to the evolution of better suited organisms which ensures greater survival of a species. On the contrary, asexual reproduction allows very little or no variation at all. As a result, the individuals produced are exact copies of their parents and themselves.

Question 3: Why is the offspring formed by asexual reproduction referred to as clone?
Answer A clone is a group of morphologically and genetically identical individuals. In the process of asexual reproduction, only one parent is involved and there is no fusion of the male and the female gamete. As a result, the offsprings so produced are morphologically and genetically similar to their parents and are thus, called
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clones.

Question 4: Offspring formed due to sexual reproduction have better chances of survival. Why? Is this statement always true?
Answer Sexual reproduction involves the fusion of the male and the female gamete. This fusion allows the formation of new variants by the combination of the DNA from two (usually) different members of the species. The variations allow the individuals to adapt under varied environmental conditions for better chances of survival. However, it is not always necessary that the offspring produced due to sexual reproduction has better chances of survival. Under some circumstances, asexual reproduction is more advantageous for certain organisms. For example, some individuals who do not move from one place to another and are well settled in their environment. Also, asexual reproduction is a fast and a quick mode of reproduction which does not consume much time and energy as compared to sexual reproduction.

Question 5: How does the progeny formed from asexual reproduction differ from those formed by sexual reproduction?
Answer

	Progeny formed from asexual reproduction	**Progeny formed from sexual reproduction**
1.	Asexual reproduction does not involve the fusion of the male and the female gamete. Organisms undergoing this kind of reproduction produce offspring's that are morphologically and genetically identical to them.	Sexual reproduction involves the fusion of the male and the female gamete of two individuals, typically one of each sex. Organisms undergoing this kind of reproduction produce offspring's that are not identical to them.

2.	Offsprings thus produced do not show variations and are called clones.	Offspring's thus produced show variations from each other and their parents.

Question 6:

Distinguish between asexual and sexual reproduction. Why is vegetative reproduction also considered as a type of asexual reproduction?

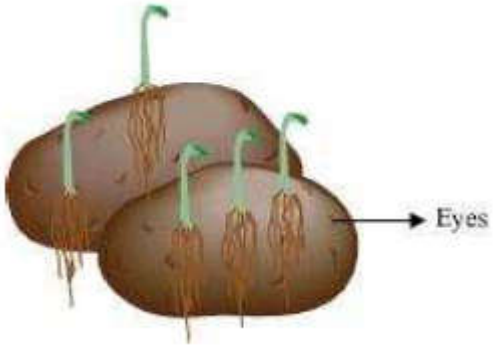
Answer

Sexual reproduction		**Asexual reproduction**
1	It involves the fusion of the male and female gamete.	It does not involves the fusion of the male and the female gamete
2.	It requires two (usually) different individuals.	It requires only one individual.
3.	The individuals produced are not identical to their parents and show variations from each other and also, from their parents.	The individuals produced are identical to the parent and are hence, called clones.
4.	Most animals reproduce sexually. Both sexual and asexual modes of reproduction are found in plants.	Asexual modes of reproduction are common in organisms having simple organizations such as algae and fungi.
5.	It is a slow process.	It is a fast process.

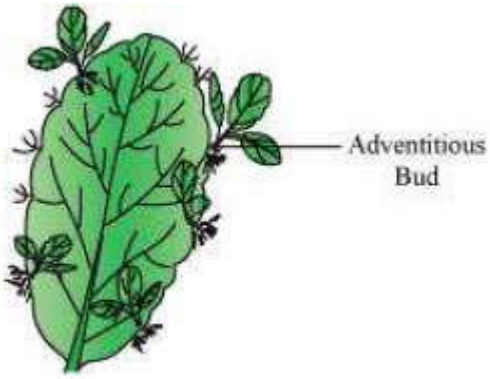
Vegetative propagation is a process in which new plants are obtained without the production of seeds or spores. It involves the propagation of plants through certain vegetative parts such as the rhizome, sucker, tuber, bulb, etc. It does not involve the fusion of the male and the female gamete and requires only one parent. Hence,
vegetative reproduction is considered as a type of asexual reproduction.

Question 7: What is vegetative propagation? Give two suitable examples.
Answer Vegetative propagation is a mode of asexual reproduction in which new plants are obtained from the vegetative parts of plants. It does not involve the production of seeds or spores for the propagation of new plants. Vegetative parts of plants such as runners, rhizomes, suckers, tubers, etc. can be used as propagules for raising new plants.
Examples of vegetative reproduction are:

1. Eyes of potato:
The surface of a potato has several buds called eyes. Each of these buds when buried in soil develops into a new plant, which is identical to the parent plant.



2. Leaf buds of Bryophyllum: The leaves of Bryophyllum plants bear several adventitious buds on their margins. These leaf buds have the ability to grow and develop into tiny plants when the leaves get detached from the plant and come in contact with moist soil.



Question 8: Define
(a) Juvenile phase,
(b) Reproductive phase,
(c) Senescent phase.
Answer (a) Juvenile phase:
It is the period of growth in an individual organism after its birth and before it reaches reproductive maturity.
(b) Reproductive phase:
It is the period when an individual organism reproduces sexually.
(c) Senescent phase:
It is the period when an organism grows old and loses the ability to reproduce.

Question 9: Higher organisms have resorted to sexual reproduction in spite of its complexity. Why?
Answer Although sexual reproduction involves more time and energy, higher organisms have resorted to sexual reproduction in spite of its complexity. This is because this mode of reproduction helps introduce new variations in progenies through the combination of the DNA from two (usually) different individuals. These variations allow the individual to cope with various environmental conditions and thus, make the organism better suited for the environment. Variations also lead to the evolution of better organisms and therefore, provide better chances of survival. On the other hand, asexual reproduction does not provide genetic differences in the individuals produced.

Question 10: Explain why meiosis and gametogenesis are always interlinked?
Answer Meiosis is a process of reductional division in which the amount of genetic material is reduced. Gametogenesis is the process of the formation of gametes. Gametes produced by organisms are haploids (containing only one set of chromosomes), while the body of an organism is diploid. Therefore, for producing haploid gametes (gametogenesis), the germ cells of an organism undergo meiosis. During the process, the meiocytes of an organism undergo two successive nuclear and cell divisions with a single cycle of DNA replication to form the haploid gametes.

Question 11: Identify each part in a flowering plant and write whether it is haploid (n) or diploid (2n).
(a) Ovary ——————————
(b) Anther ——————————
(c) Egg ——————————
(d) Pollen ——————————
(e) Male gamete ——————————
(f) Zygote ——————————
Answer(a) Ovary Diploid (2n)
(b) Anther Diploid (2n)
(c) Egg Haploid (n)
(d) Pollen Haploid (n)
(e) Male gamete Haploid (n)
(f) Zygote Diploid (2n)

Question 12: Define external fertilization. Mention its disadvantages.
Answer External fertilization is the process in which the fusion of the male and the female gamete takes place outside the female body in an external medium, generally water. Fish, frog, starfish are some organisms that exhibit external fertilization. Disadvantages of external fertilization: In external fertilization, eggs have less chances of fertilization. This can lead to the wastage of a large number of eggs produced during the process.
Further, there is an absence of proper parental care to the offspring, which results in a low rate of survival in the progenies.

Question 13: Differentiate between a zoospore and a zygote.
Answer

	Zoospore	**Zygote**
1.	A zoospore is a motile asexual spore that utilizes the flagella for movement.	A zygote is a non-motile diploid cell formed as a result of fertilization.
2.	It is an asexual reproductive structure.	It is formed as a result of sexual reproduction.

Question 14: Differentiate between gametogenesis from embryogenesis.
Answer

Gametogenesis	Embryogenesis
It is the process of the formation of haploid male and female gametes from diploid meiocytes through the process of meiosis.	It is the process of the development of the embryo from the repeated mitotic divisions of the diploid zygote.

Question 15: Describe the post-fertilization changes in a flower.
Answer Fertilization is the process of the fusion of the male and the female gamete to form a diploid zygote. After fertilization, the zygote divides several times to form an embryo. The fertilized ovule forms a seed. The seed contains an embryo, enclosed in a protective covering, called the seed coat. As the seed grows further, other floral parts wither and fall off. This leads to the growth of the ovary, which enlarges and ripens to become a fruit with a thick wall called the pericarp.
Question 16: What is a bisexual flower? Collect five bisexual flowers from your neighborhood and with the help of your teacher find out their common and scientific names.
Answer A flower that contains both the male and female reproductive structure (stamen and pistil) is called a bisexual flower. Examples of plants bearing bisexual flowers are:
(1) Water lily (Nymphaea odorata)
(2) Rose (Rosa multiflora)
(3) Hibiscus (Hibiscus Rosa-sinensis)
(4) Mustard (Brassica nigra)
(5) Petunia (Petunia hybrida)
Question 17: Examine a few flowers of any cucurbit plant and try to identify the staminate and pistillate flowers. Do you know any other plant that bears unisexual flowers?
Answer

Cucurbit plant bears unisexual flowers as these flowers have either the stamen or the pistil. The staminate flowers bear bright, yellow coloured petals along with stamens that represent the male reproductive structure. On the other hand, the pistillate flowers bear only the pistil that represents the female reproductive structure. Other examples of plants that bear unisexual flowers are corn, papaya, cucumber, etc.
Question 18: Why are offspring of oviparous animals at a greater risk as compared to offspring of viviparous animals?
Answer Oviparous animals lay eggs outside their body. As a result, the eggs of these animals are under continuous threat from various environmental factors. On the other hand, in viviparous animals, the development of the egg takes place inside the body of the female. Hence, the offspring of an egg-laying or oviparous animal is at greater risk as compared to the offspring of a viviparous animal, which gives birth to its young ones.

Answers NCERT Solutions For Class 12 Biology http://freehomedelivery.net/ Solutions Chapter 2 Sexual Reproduction in Flowering Plants

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Question 1: Name the parts of an angiosperm flower in which development of male and female gametophyte take place.
Answer The male gametophyte or the pollen grain develops inside the pollen chamber of the anther, whereas the female gametophyte (also known as the embryo sac) develops inside the nucellus of the ovule from the functional megaspore.

Question 2: Differentiate between microsporogenesis and megasporogenesis. Which type of cell division occurs during these events? Name the structures formed at the end of these two events.
Answer
(a)

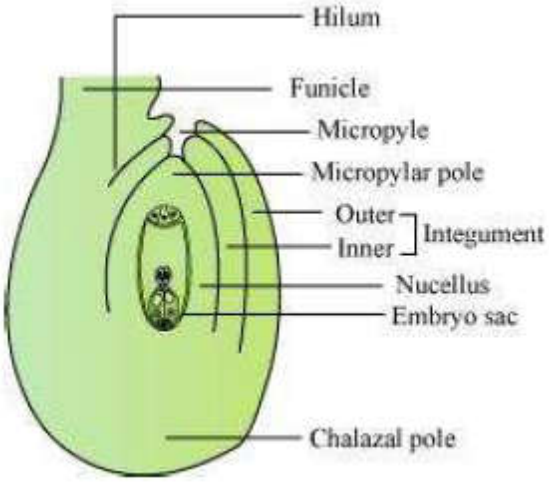
	Microsporogenesis	Megasporogenesis
1.	It is the process of the formation of microspore tetrads from a microspore mother cell through meiosis.	It is the process of the formation of the four megaspores from a megaspore mother cell in the region of the nucellus through meiosis
2.	It occurs inside the pollen sac of the anther.	It occurs inside the ovule.

(b) Both events (microsporogenesis and megasporogenesis) involve the process of meiosis or reduction division which results in the formation of haploid gametes from the microspore and megaspore mother cells.
(c) Microsporogenesis results in the formation of haploid microspores from a diploid microspore mother cell. On the other hand, megasporogenesis results in the formation of haploid megaspores from a diploid megaspore mother cell.

Question 3: Arrange the following terms in the correct developmental sequence:
Pollen grain, sporogenous tissue, microspore tetrad, pollen mother cell, male gametes
Answer The correct development sequence is as follows:
Sporogenous tissue – pollen mother cell – microspore tetrad – Pollen grain – male gamete
During the development of microsporangium, each cell of the sporogenous tissue acts as a pollen mother cell and gives rise to a microspore tetrad, containing four haploid microspores by the process

of meiosis (microsporogenesis). As the anther matures, these microspores dissociate and develop into pollen grains. The pollen grains mature and give rise to male gametes.

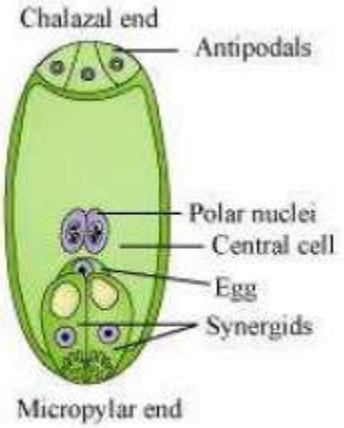
Question 4: With a neat, labelled diagram, describe the parts of a typical angiosperm ovule.
Answer An ovule is a female megasporangium where the formation of megaspores takes place.



The various parts of an ovule are –
(1) Funiculus – It is a stalk-like structure which represents the point of attachment of the ovule to the placenta of the ovary.
(2) Hilum – It is the point where the body of the ovule is attached to the funiculus.
(3) Integuments –They are the outer layers surrounding the ovule that provide protection to the developing embryo.
(4) Micropyle – It is a narrow pore formed by the projection of integuments. It marks the point where the pollen tube enters the ovule at the time of fertilization.
(5) Nucellus – It is a mass of the parenchymatous tissue surrounded by the integuments from the outside. The nucellus provides nutrition to the developing embryo. The embryo sac is located inside the nucellus.
(6) Chalazal – It is the based swollen part of the nucellus from where the integuments originate.

Question 5: What is meant by monosporic development of female gametophyte?
Answer The female gametophyte or the embryo sac develops from a single functional megaspore. This is known as monosporic development of the female gametophyte. In most flowering plants, a single megaspore mother cell present at the micropylar pole of the nucellus region of the ovule undergoes meiosis to produce four haploid megaspores. Later, out of these four megaspores, only one functional megaspore develops into the female gametophyte, while the remaining three degenerate.

Question 6: With a neat diagram explain the 7-celled, 8-nucleate nature of the female gametophyte.
Answer



The female gametophyte (embryo sac) develops from a single functional megaspore. This megaspore undergoes three successive mitotic divisions to form eight nucleate embryo sacs. The first mitotic division in the megaspore forms two nuclei. One nucleus moves towards the micropylar end while the other nucleus moves towards the chalazal end. Then, these nuclei divide at their respective ends and re-divide to form eight nucleate stages. As a result, there are four nuclei each at both the ends i.e., at the micropylar and the chalazal end in the embryo sac. At the micropylar end, out of the four nuclei only three differentiate into two synergids and one egg cell. Together they are known as the egg apparatus. Similarly, at the chalazal end, three out of four nuclei differentiates as antipodal cells. The remaining two cells (of the micropylar and the chalazal end) move towards the centre and are known as the polar nuclei, which are situated in a large central cell. Hence, at maturity, the female gametophyte appears as a 7-celled structure, though it has 8 nucleate.

Question 7: What are chasmogamous flowers? Can cross-pollination occur in cleistogamous flowers? Give reasons for your answer.
Answer There are two types of flowers present in plants namely Oxalis and Viola – chasmogamous and cleistogamous flowers. Chasmogamous flowers have exposed anthers and stigmata similar to the flowers of other species.
Cross-pollination cannot occur in cleistogamous flowers. This is because cleistogamous flowers never open at all. Also, the anther and the stigma lie close to each other in these flowers. Hence, only self-pollination is possible in these flowers.

Question 8: Mention two strategies evolved to prevent self-pollination in flowers.
Answer Self-pollination involves the transfer of pollen from the stamen to the pistil of the same flower. Two strategies that have evolved to prevent self-pollination in flowers are as follows:
(1) In certain plants, the stigma of the flower hasthecapability to prevent the germination of pollen grains and hence, prevent the growth of the pollen tube.It is a genetic mechanism to prevent self-pollination called self- incompatibility. Incompatibility may be between individuals of the same species or between individuals of different species. Thus, incompatibility prevents breeding.
(2) In some plants, the gynoecium matures before the androecium or vice-versa. This phenomenon is known as protogyny or protandry respectively. This prevents the pollen from coming in contact with the stigma of the same flower.

Question 9: What is self-incompatibility? Why does self-pollination not lead to seed formation in self-incompatible species?
Answer Self-incompatibility is a genetic mechanism in angiosperms that prevents self- pollination. It develops genetic incompatibility between individuals of the same species or between individuals of

different species.
The plants which exhibit this phenomenon have the ability to prevent germination of pollen grains and thus, prevent the growth of the pollen tube on the stigma of the flower. This prevents the fusion of the gametes along with the development of the embryo. As a result, no seed formation takes place.

Question 10: What is bagging technique? How is it useful in a plant breeding programme?
Answer Various artificial hybridization techniques (under various crop improvement programmes) involve the removal of the anther from bisexual flowers without affecting the female reproductive part (pistil) through the process of emasculation. Then, these emasculated flowers are wrapped in bags to prevent pollination by
unwanted pollen grains. This process is called bagging. This technique is an important part of the plant breeding programme as it ensures that pollen grains of only desirable plants are used for fertilization of the stigma to
develop the desired plant variety.

Question 11: What is triple fusion? Where and how does it take place? Name the nuclei involved in triple fusion.
Answer Triple fusion is the fusion of the male gamete with two polar nuclei inside the embryo sac of the angiosperm. This process of fusion takes place inside the embryo sac. When pollen grains fall on the stigma, they germinate and give rise to the pollen tube that passes through the style and enters into the ovule. After this, the pollen tube enters one of synergids and releases two male gametes there. Out of the two male gametes, one gamete fuses with the nucleus of the egg cell and forms the zygote (syngamy). The other male gamete fuses with the two polar nuclei present in the central cell to form a triploid primary endosperm nucleus. Since this process involves the fusion of three haploid nuclei, it is known as triple fusion. It results in the formation of the endosperm. One male gamete nucleus and two polar nuclei are involved in this process.

Question 12: Why do you think the zygote is dormant for sometime in a fertilized ovule?
Answer The zygote is formed by the fusion of the male gamete with the nucleus of the egg cell. The zygote remains dormant for some time and waits for the endosperm to form, which develops from the primary endosperm cell resulting from triple fusion. The endosperm provides food for the growing embryo and after the formation of the
endosperm, further development of the embryo from the zygote starts.

Question 13: Differentiate between:
(a) Hypocotyl and epicotyl;
(b) Coleoptile and coleorrhiza;
(c) Integument and testa;
(d) Perisperm and pericarp.
Answer

(a)

	Hypocotyl	Epicotyl
1.	The portion of the embryonal axis which lies below the cotyledon in a dicot embryo is known as the hypocotyl.	The portion of the embryonal axis which lies above the cotyledon in a dicot embryo is known as the epicotyl.
2.	It terminates with the radicle.	It terminates with the plumule.

(b)

	Coleoptile	Coleorrhiza
	It is a conical protective sheath that encloses the plumule in a monocot seed.	It is an undifferentiated sheath that encloses the radicle and the root cap in a monocot seed.

(c)

	Integument	Testa
	It is the outermost covering of an ovule. It provides protection to it.	It is the outermost covering of a seed.

(d)

	Perisperm	Pericarp
	It is the residual nucellus which persists. It is present in some seeds such as beet and black pepper.	It is the ripened wall of a fruit, which develops from the wall of an ovary.

Question 14: Why is apple called a false fruit? Which part(s) of the flower forms the fruit?
Answer Fruits derived from the ovary and other accessory floral parts are called false fruits. On the contrary, true fruits are those fruits which develop from the ovary, but do not consist of the thalamus or any other floral part. In an apple, the fleshy receptacle forms the main edible part. Hence, it is a false fruit.

Question 15: What is meant by emasculation? When and why does a plant breeder employ this technique?

Answer Emasculation is the process of removing anthers from bisexual flowers without affecting the female reproductive part (pistil), which is used in various plant hybridization techniques. Emasculation is performed by plant breeders in bisexual flowers to obtain the desired variety of a plant by crossing a particular plant with the desired pollen grain. To remove the anthers, the flowers are covered with a bag before they open. This ensures that the flower is pollinated by pollen grains obtained from desirable varieties only. Later, the mature, viable, and stored pollen grains are dusted on the bagged stigma by breeders to allow artificial pollination to take place and obtain the desired plant variety.

Question 16: If one can induce parthenocarpy through the application of growth substances, which fruits would you select to induce parthenocarpy and why?
Answer Parthenocarpy is the process of developing fruits without involving the process of fertilization or seed formation. Therefore, the seedless varieties of economically important fruits such as orange, lemon, water melon etc. are produced using this technique. This technique involves inducing fruit formation by the application of plant growth hormones such as auxins.

Question 17: Explain the role of tapetum in the formation pollen-grain wall.
Answer Tapetum is the innermost layer of the microsporangium. It provides nourishment to the developing pollen grains. During microsporogenesis, the cells of tapetum produce various enzymes, hormones, amino acids, and other nutritious material required for the development of pollen grains. It also produces the exine layer of the pollen grains, which is composed of the sporopollenin.

Question 18: What is apomixis and what is its importance?
Answer Apomixis is the mechanism of seed production without involving the process of meiosis and syngamy. It plays an important role in hybrid seed production. The method of producing hybrid seeds by cultivation is very expensive for farmers. Also, by sowing hybrid seeds, it is difficult to maintain hybrid characters as characters segregate during meiosis. Apomixis prevents the loss of specific characters in the hybrid. Also, it is a cost-effective method for producing seeds.

Answers NCERT Solutions For Class 12 Biology http://freehomedelivery.net/ Solutions Chapter 3 Human Reproduction

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Question 1: Fill in the blanks:
(a) Humans reproduce _____. (asexually/sexually)
(b) Humans are_____. (oviparous/viviparous/ovoviviparous)
(c) Fertilization is _____ in humans. (external/internal)
(d) Male and female gametes are _____. (diploid/haploid)
(e) Zygote is _____. (diploid/haploid)
(f) The process of release of the ovum from a mature follicle is called_____.
(g) Ovulation is induced by a hormone called the _____.
(h) The fusion of the male and the female gametes is called _____.
(i) Fertilization takes place in the _____.
(j) The zygote divides to form _____, which is implanted in uterus.
(k) The structure which provides vascular connection between the fetus and uterus is called _____.
Answer

(a) Humans reproduce sexually.

(b) Humans are viviparous.

(c) Fertilization is internal in humans.

(d) Male and female gametes are haploid.

(e) Zygote is diploid.

(f) The process of release of the ovum from a mature follicle is called ovulation.

(g) Ovulation is induced by a hormone called the luteinizing hormone.

(h) The fusion of the male and the female gametes is called fertilization.

(i) Fertilization takes place in the fallopian tube.

(j) The zygote divides to form blastocyst, which is implanted in uterus.

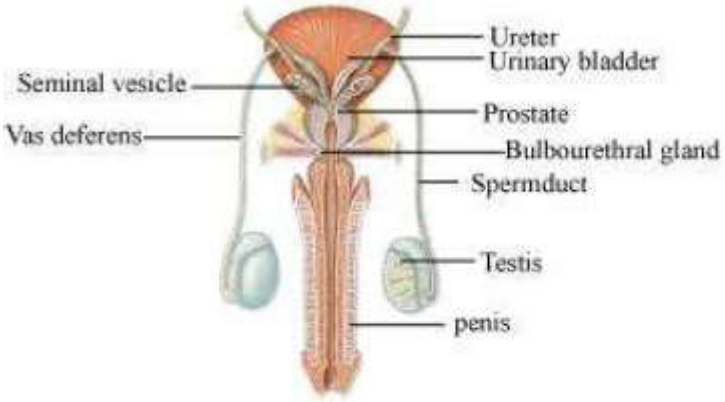
(k) The structure which provides vascular connection between the fetus and uterus is called placenta.

Question 2: Draw a labeled diagram of male reproductive system.
Answer

Question 2:

Draw a labeled diagram of male reproductive system.

Answer

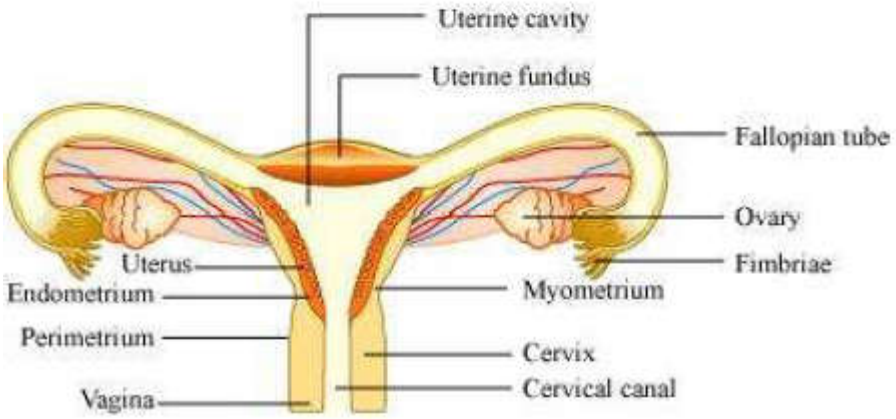


The male reproductive system

Question 3:

Draw a labeled diagram of female reproductive system.

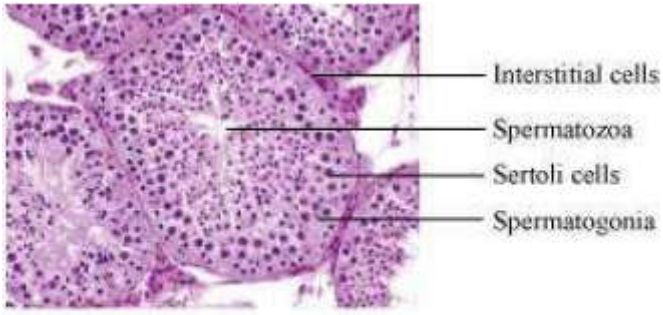
Answer



The female reproductive system

Question 4: Write two major functions each of testis and ovary.
Answer Functions of the Testis:
(a) They produce male gametes called spermatozoa by the process of spermatogenesis.
(b) The leydig cells of the seminiferous tubules secrete the male sex hormone called testosterone. Testosterone aids the development of secondary sex characteristics in males.
Functions of the ovary:
(a) They produce female gametes called ova by the process of oogenesis.
(b) The growing Graffian follicles secrete the female sex hormone called estrogen. Estrogen aids the development of secondary sex characteristics in females.

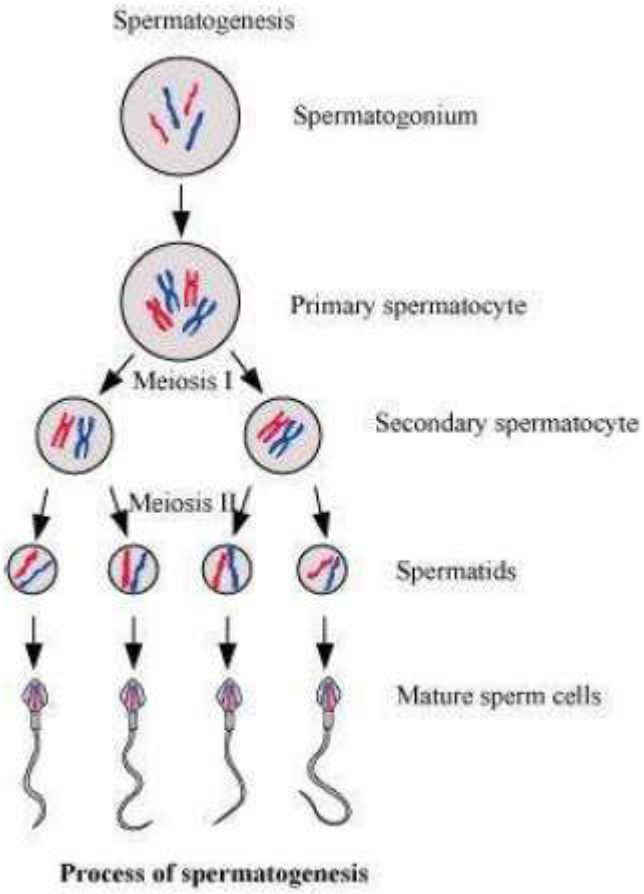
Question 5: Describe the structure of a seminiferous tubule.
Answer The production of sperms in the testes takes place in a highly coiled structure called the seminiferous tubules. These tubules are located in the testicular lobules. Each seminiferous tubule is lined by germinal epithelium. It is lined on its inner side by two types of cells namely spermatogonia and sertoli cells respectively. Spermatogonia are male germ cells which produce primary spermatocytes by meiotic divisions. Primary spermatocytes undergo further meiotic division to form secondary spermatocytes and finally, spermatids. Spermatids later metamorphoses into male gametes called spermatozoa. Sertoli cells are known as nurse cells of the testes as
they provide nourishment to the germ cells. There are large polygonal cells known as interstitial cells or leydig cells just adjacent to seminiferous tubules. These cells secrete the male hormone called testosterone.



Transverse section of seminiferous tubules

Question 6: What is spermatogenesis? Briefly describe the process of spermatogenesis.
Answer Spermatogenesis is the process of the production of sperms from the immature germ cells in males. It takes place in seminiferous tubules present inside the testes. During spermatogenesis, a diploid spermatogonium (male germ cell) increases its size to form a diploid primary spermatocyte. This diploid primary spermatocyte undergoes first meiotic division (meiosis I), which is a reductional division to form two equal
haploid secondary spermatocytes. Each secondary spermatocyte then undergoes second meiotic division (meiosis II) to form two equal haploid spermatids. Hence, a diploid spermatogonium produces four haploid spermatids. These spermatids are transformed into spermatozoa (sperm) by

the process called spermiogenesis.

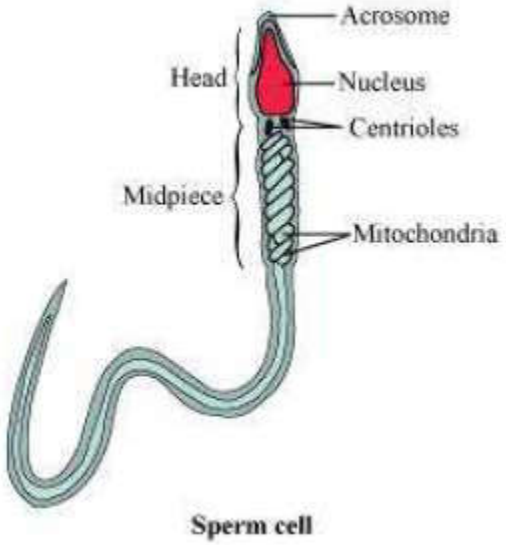


Process of spermatogenesis

Question 7: Name the hormones involved in regulation of spermatogenesis.
Answer Follicle-stimulating hormones (FSH) and luteinizing hormones (LH) are secreted by gonadotropin releasing hormones from the hypothalamus .These hormones are involved in the regulation of the process of spermatogenesis. FSH acts on sertoli cells, whereas LH acts on leydig cells of the testis and stimulates the process of spermatogenesis.

Question 8: Define spermiogenesis and spermiation.
Answer Spermiogenesis: It is the process of transforming spermatids into matured spermatozoa or sperms.
Spermiation: It is the process when mature spermatozoa are released from the sertoli cells into the lumen of seminiferous tubules.

Question 9: Draw a labeled diagram of sperm.



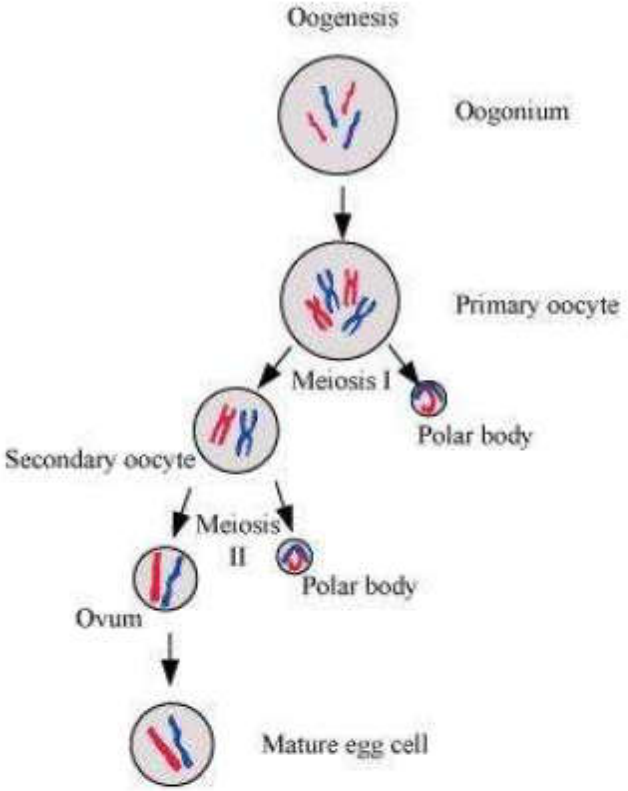
Sperm cell

Question 10: What are the major components of seminal plasma?
Answer Semen (produced in males) is composed of sperms and seminal plasma. The major components of the seminal plasma in the male reproductive system are mucus, spermatozoa, and various secretions of accessory glands. The seminal plasma is rich in fructose, calcium, ascorbic acid, and certain enzymes. It provides nourishment and protection to sperms.

Question 11: What are the major functions of male accessory ducts and glands?
Answer The male accessory ducts are vasa efferentia, epididymis, vas deferens, and rete testis. They play an important role in the transport and temporary storage of sperms. On the contrary, male accessory glands are seminal vesicles, prostate glands, and bulbourethral glands. These glands secrete fluids that lubricate the reproductive system and sperms. The sperms get dispersed in the fluid which makes their transportation into the female body easier. The fluid is rich in fructose, ascorbic acid, and certain enzymes. They also provide nutrients and activate the sperm.

Question 12: What is oogenesis? Give a brief account of oogenesis.
Answer Oogenesis is the process of the formation of a mature ovum from the oogonia in females. It takes place in the ovaries. During oogenesis, a diploid oogonium or egg mother cell increases in size and gets transformed into a diploid primary oocyte. This diploid primary oocyte undergoes first meiotic division i.e., meiosis I or reductional division to form two unequal haploid cells. The smaller cell is known as the first polar body, while the larger cell is known as the secondary oocyte. This secondary oocyte undergoes second meiotic division i.e., meiosis II or equational division and gives rise to a second polar body and an ovum. Hence, in the process of oogenesis, a diploid oogonium

produces a single haploid ovum while two or three polar bodies are produced.

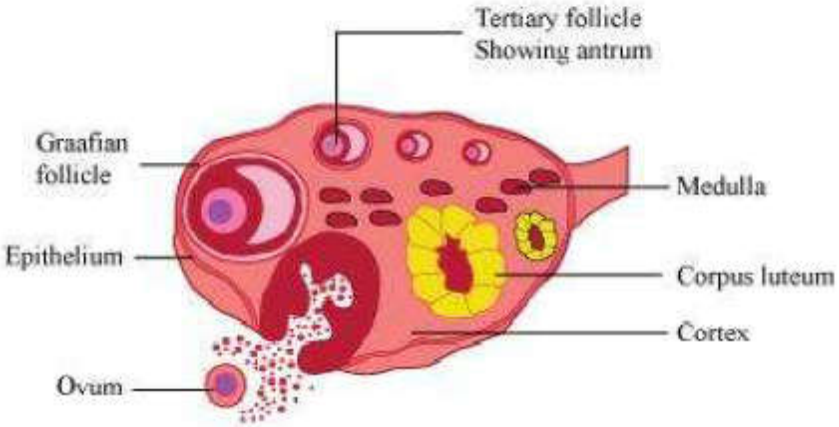


Process of oogenesis

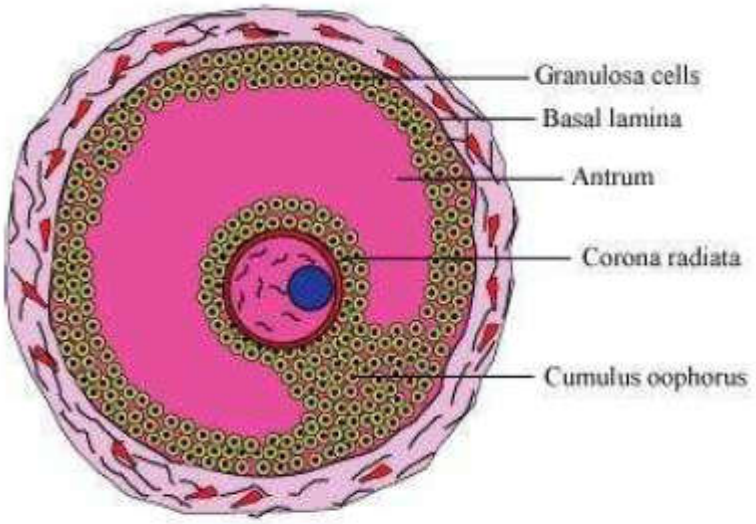
Question 13:

Draw a labeled diagram of a section through ovary.

Answer



Question 14: Draw a labeled diagram of a Graafian Follicle?
Answer



Structure of the Graafian follicle

Question 15: Name the functions of the following.
(a) Corpus luteum
(b) Endometrium
(c) Acrosome
(d) Sperm tail
(e) Fimbriae
Answer (a) Corpus luteum – Corpus luteum is formed from the ruptured Grafiaan follicle. It secretes progesterone hormone during the luteal phase of the menstrual cycle. A high level of progesterone inhibits the secretions of FSH and LH, thereby preventing ovulation. It also allows the endometrium of the uterus to proliferate and to prepare itself for implantation.
(b) Endometrium – It is the innermost lining of the uterus. It is rich in glands and undergoes cyclic changes during various phases of the menstrual cycle to prepare itself for the implantation of the embryo.
(c) Acrosome – It is a cap-like structure present in the anterior part of the head of the sperm. It contains hyaluronidase enzyme, which hydrolyses the outer membrane of the egg, thereby helping the sperm to penetrate the egg at the time of fertilization.
(d) Sperm tail – It is the longest region of the sperm that facilitates the movement of the sperm inside the female reproductive tract.
(e) Fimbriae – They are finger-like projections at the ovarian end of the fallopian tube. They help in the collection of the ovum (after ovulation), which is facilitated by the beating of the cilia.

Question 16: Identify True/False statements. Correct each false statement to make it true.
(a) Androgens are produced by Sertoli cells. (True/False)
(b) Spermatozoa get nutrition from Sertoli cells. (True/False)
(c) Leydig cells are found in ovary. (True/False)
(d) Leydig cells synthesise androgens. (True/False)
(e) Oogenesis takes place in corpus luteum. (True/False)
(f) Menstrual cycle ceases during pregnancy. (True/False)
(g) Presence or absence of hymen is not a reliable indicator of virginity or sexual experience. (True/False)

Answer
(a) Androgens are produced by Sertoli cells. (False) Androgens are produced by Leydig cells found in seminiferous tubules of the testis.
(b) Spermatozoa get nutrition from Sertoli cells. (True)
(c) Leydig cells are found in ovary. (False) Leydig cells are found in the seminiferous tubules of the testis.
(d) Leydig cells synthesise androgens. (True)
(e) Oogenesis takes place in corpus luteum. (False) Oogenesis takes place in the ovary.
(f) Menstrual cycle ceases during pregnancy. (True)
(g) Presence or absence of the hymen is not a reliable indicator of virginity or sexual experience. (True)

Question 17: What is menstrual cycle? Which hormones regulate menstrual cycle?
Answer The menstrual cycle is a series of cyclic physiologic changes that take place inside the female reproductive tract in primates. The whole cycle takes around 28 days to complete. The end of the cycle is accompanied by the breakdown of uterine endothelium, which gets released in the form of blood and mucous through the
vagina. This is known as menses. The follicle stimulating hormone (FSH), luteinizing hormone (LH), estrogen, and
progesterone are the various hormones that regulate the menstrual cycle. The level of FSH and LH secreted from the anterior pituitary gland increases during the follicular phase. FSH secreted under the influence of RH (releasing hormone) from the hypothalamus stimulates the conversion of a primary follicle into a graafian follicle. The level of LH increases gradually leading to the growth of follicle and secretion of estrogen. Estrogen inhibits the secretion of FSH and stimulates the secretion of luteinizing hormone. It also causes the thickening of the uterine endometrium. The increased level of LH causes the rupturing of the graafian follicle and release the ovum into the fallopian tube. The ruptured graafian follicle changes to corpus luteum and starts secreting progesterone hormone during the luteal phase.
Progesterone hormone helps in the maintenance and preparation of endometrium for the implantation of the embryo. High levels of progesterone hormone in the blood decrease the secretion of LH and FSH, therefore inhibiting further ovulation.

Question 18: What is parturition? Which hormones are involved in induction of parturition?
Answer Parturition is the process of giving birth to a baby as the development of the foetus gets completed in the mother's womb. The hormones involved in this process are oxytocin and relaxin. Oxytocin leads to the contraction of smooth muscles of myometrium of the uterus, which directs the full term foetus towards the birth canal.
On the other hand, relaxin hormone causes relaxation of the pelvic ligaments and prepares the uterus for child birth.

Question 19: In our society the women are often blamed for giving birth to daughters. Can you explain why this is not correct?
Answer All human beings have 23 pairs of chromosomes. Human males have 22 pairs of autosomes and contain one or two types of sex chromosome. They are either X or Y. On the contrary, human females have 22 pairs of autosomes and contain only the X sex chromosome. The sex of an individual is determined by the type of the male
gamete (X or Y), which fuses with the X chromosome of the female. If the fertilizing sperm is X, then the baby will be a girl and if it is Y, then the baby will be a boy. Hence, it is incorrect to blame a woman for the gender of the child.

Question 20: How many eggs are released by a human ovary in a month? How many eggs do you think would have been released if the mother gave birth to identical twins? Would your answer change if the twins born were fraternal?
Answer An ovary releases an egg every month. When two babies are produced in succession, they are called twins. Generally, twins are produced from a single egg by the separation of early blastomeres resulting from the first zygotic cleavage. As a result, the young ones formed will have the same genetic make- up and are thus, called identical twins.
If the twins born are fraternal, then they would have developed from two separate eggs. This happens when two eggs (one from each ovary) are released at the same time and get fertilized by two separate sperms. Hence, the young ones developed will have separate genes and are therefore, called non-identical or fraternal twins.

Question 21: How many eggs do you think were released by the ovary of a female dog which gave birth to 6 puppies?
Answer Dogs and rodents are polyovulatory species. In these species, more than one ovum is released from the ovary at the time of ovulation. Hence, six eggs were released by the ovary of a female dog to produce six puppies.

Answers NCERT Solutions For Class 12 Biology http://freehomedelivery.net/ Solutions Chapter 4 Reproductive Health

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Question 1: What do you think is the significance of reproductive health in a society?
Answer Reproductive health is the total well being in all aspects of reproduction. It includes physical, emotional, behavioural, and social well being. Sexually transmitted diseases such as AIDS, gonorrhoea, etc. are transferred from one individual to another through sexual contact. It can also lead to unwanted pregnancies. Hence, it is necessary to create awareness among people, especially the youth, regarding various reproduction related aspects as the young individuals are the future of the country and they are most susceptible of acquiring sexually transmitted diseases. Creating awareness about the available birth control methods, sexually transmitted diseases and their preventive measures, and gender equality will help in bringing up a socially conscious healthy family. Spreading awareness regarding uncontrolled population growth and social evils among young individuals will help in building up a
reproductively healthy society.

Question 2: Suggest the aspects of reproductive health which need to be given special attention in the present scenario.
Answer Reproductive health is the total well being in all aspects of reproduction. The aspects which have to be given special attention in the present scenarios are
(1)Counselling and creating awareness among people, especially the youth, about various aspects of reproductive health, such as sexually transmitted diseases, available contraceptive methods, case of pregnant mothers, adolescence, etc.
(2)Providing support and facilities such as medical assistance to people during pregnancy, STDs, abortions, contraceptives, infertility, etc. for building a reproductively healthy society

Question 3: Is sex education necessary in schools? Why?
Answer Yes, introduction of sex education in schools is necessary. It would provide right information to young individuals at the right time about various aspects of reproductive health such as reproductive organs, puberty, and adolescence related changes, safe sexual practices, sexually transmitted diseases, etc. The young individual or adolescents are more susceptible in acquiring various sexually transmitted diseases. Hence, providing information to them at the right time would help them to lead a reproductively healthy life and also protect them from the myths and misconceptions about various sex related issues.

Question 4: Do you think that reproductive health in our country has improved in the past 50 years? If yes, mention some such areas of improvement.
Answer Yes, the reproductive health has tremendously improved in India in the last 50 years. The areas of improvement are as follows.

(1) Massive child immunization programme, which has lead to a decrease in the infant mortality rate
(2) Maternal and infant mortality rate, which has been decreased drastically due to better post natal care
(3) Family planning, which has motivated people to have smaller families
(4) Use of contraceptive, which has resulted in a decrease in the rate of sexually transmitted diseases and unwanted pregnancies

Question 5: What are the suggested reasons for population explosion?
Answer The human population is increasing day by day, leading to population explosion. It is because of the following two major reasons.
(a) Decreased death rate
(b) Increased birth rate and longevity
The death rate has decreased in the past 50 years. The factor leading to decreased death rate and increased birth rate are control of diseases, awareness and spread of education, improvement in medical facilities, ensured food supply in emergency situation, etc. All this has also resulted in an increase in the longevity of an individual.

Question 6: Is the use of contraceptives justified? Give reasons.
AnswerYes, the use of contraceptives is absolutely justified. The human population is increasing tremendously. Therefore, to regulate the population growth by regulating reproduction has become a necessary demand in the present times. Various contraceptive devices have been devised to reduce unwanted pregnancies, which
help in bringing down the increased birth rate and hence, in checking population explosion.

Question 7: Removal of gonads cannot be considered as a contraceptive option. Why?
Answer Contraceptive devices are used to prevent unwanted pregnancy and to prevent the spreading of STDs. There are many methods, such as natural, barrier, oral, and surgical methods, that prevent unwanted pregnancy. However, the complete removal of gonads cannot be a contraceptive option because it will lead to infertility and
unavailability of certain hormones that are required for normal functioning of accessory reproductive parts. Therefore, only those contraceptive methods can be used that prevent the chances of fertilization rather than making the person infertile forever.

Question 8: Amniocentesis for sex determination is banned in our country. Is this ban necessary? Comment.
Answer Amniocentesis is a pre-natal diagnostic technique that is used to determine the sex and metabolic disorders of the developing foetus in the mother's uterus through the observation of the chromosomal patterns. This method was developed so as to determine any kind of genetic disorder present in the foetus. However,
unfortunately, this technique is being misused to detect the sex of the child before birth and the female foetus is then aborted. Thus, to prevent the increasing female foeticides, it is necessary to ban the usage of amniocentesis technique for determining the sex of a child.

Question 9: Suggest some methods to assist infertile couples to have children.
Answer Infertility is the inability of a couple to produce a baby even after unprotected intercourse. It might be due to abnormalities present in either male or female, or might be even both the partners. The techniques used to assist infertile couples to have children are as follows.
(a) Test tube babies

This involves in-vitro fertilization where the sperms meet the egg outside the body of a female. The zygote, hence produced, is then transferred in the uterus or fallopian tube of a normal female. The babies produced from this method are known as test tube babies.
(b) Gamete Intra fallopian transfer (GIFT)
It is a technique that involves the transfer of gamete (ovum) from a donor into the fallopian tube of the recipient female who is unable to produce eggs, but has the ability to conceive and can provide right conditions for the development of an embryo.
(c) Intra Cytoplasmic sperm injection (ICSI)
It is a method of injecting sperm directly into the ovum to form an embryo in laboratory.
(d) Artificial insemination
Artificial insemination is a method of transferring semen (sperm) from a healthy male donor into the vagina or uterus of the recipient female. It is employed when the male partner is not able to inseminate the female or has low sperm counts.

Question 10: What are the measures one has to take to prevent from contracting STDs?
Answer Sexually transmitted diseases (STDs) get transferred from one individual to the other through sexual contact. Adolescents and young adults are at the greatest risk of acquiring these sexually transmitted diseases. Hence, creating awareness among the adolescents regarding its after-effects can prevent them from contracting STDs. The use of contraceptives, such as condoms, etc. while intercourse, can prevent the transfer of these diseases. Also, sex with unknown partners or multiple partners should be avoided as they may have such diseases. Specialists should be consulted immediately in case of doubt so as to assure early detection and cure of the disease.

Question 11: State True/False with explanation
(a) Abortions could happen spontaneously too. (True/False)
(b) Infertility is defined as the inability to produce a viable offspring and is always due to abnormalities/defects in the female partner. (True/False)
(c) Complete lactation could help as a natural method of contraception. (True/False)
(d) Creating awareness about sex related aspects is an effective method to improve reproductive health of the people. (True/False)
Answer (a) Abortions could happen spontaneously too. True
(b) Infertility is defined as the inability to produce a viable offspring and is always due to abnormalities/defects in the female partner.False
Infertility is defined as the inability of the couple to produce baby even after unprotected coitus. It might occur due to abnormalities/defects in either male or female or both.
(c) Complete lactation could help as a natural method of contraception. False
Complete lactation or lactational amenorrhea is a natural method of contraception. However, it is limited till lactation period, which continues till six months after parturition.
(d) Creating awareness about sex related aspects is an effective method to improve reproductive health of the people.
True

Question 12: Correct the following statements:
(a) Surgical methods of contraception prevent gamete formation.
(b) All sexually transmitted diseases are completely curable.
(c) Oral pills are very popular contraceptives among the rural women.
(d) In E. T. techniques, embryos are always transferred into the uterus.
Answer
(a) Surgical methods of contraception prevent gamete formation.Correction
Surgical methods of contraception prevent the flow of gamete during intercourse.

(b) All sexually transmitted diseases are completely curable. Correction
Some of the sexually transmitted diseases are curable if they are detected early and treated properly. AIDS is still an incurable disease.
(c) Oral pills are very popular contraceptives among the rural women.Correction
Oral pills are very popular contraceptives among urban women.
(d) In E. T. techniques, embryos are always transferred into the uterus. Correction
In embryo transfer technique, 8 celled embryos are transferred into the fallopian tube while more than 8 celled embryos are transferred into the uterus.

Answers NCERT Solutions For Class 12 Biology http://freehomedelivery.net/ Solutions Chapter 5 Principles of Inheritance and Variation

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Question 1: Mention the advantages of selecting pea plant for experiment by Mendel.
Answer Mendel selected pea plants to carry out his study on the inheritance of characters from parents to offspring. He selected a pea plant because of the following features.
(a) Peas have many visible contrasting characters such as tall/dwarf plants, round/wrinkled seeds, green/yellow pod, purple/white flowers, etc.
(b) Peas have bisexual flowers and therefore undergo self pollination easily. Thus, pea plants produce offsprings with same traits generation after generation.
(c) In pea plants, cross pollination can be easily achieved by emasculation in which the stamen of the flower is removed without affecting the pistil.
(d) Pea plants have a short life span and produce many seeds in one generation.

Question 2: Differentiate between the following –
(a) Dominance and Recessive
(b) Homozygous and Heterozygous
(c) Monohybrid and Dihybrid.
Answer(a) Dominance and Recessive

	Dominance	Recessive
1.	A dominant factor or allele expresses itself in the presence or absence of a recessive trait.	A recessive trait is able to express itself only in the absence of a dominant trait.
2.	For example, tall plant, round seed, violet flower, etc. are dominant characters in a pea plant.	For example, dwarf plant, wrinkled seed, white flower, etc. are recessive traits in a pea plant.

(b) Homozygous and Heterozygous

	Homozygous	Heterozygous
1.	It contains two similar alleles for a particular trait.	It contains two different alleles for a particular trait.
2.	Genotype for homozygous possess either dominant or recessive, but never both the alleles. For example, RR or rr	Genotype for heterozygous possess both dominant and recessive alleles. For example, Rr
3.	It produces only one type of gamete.	It produces two different kinds of gametes.

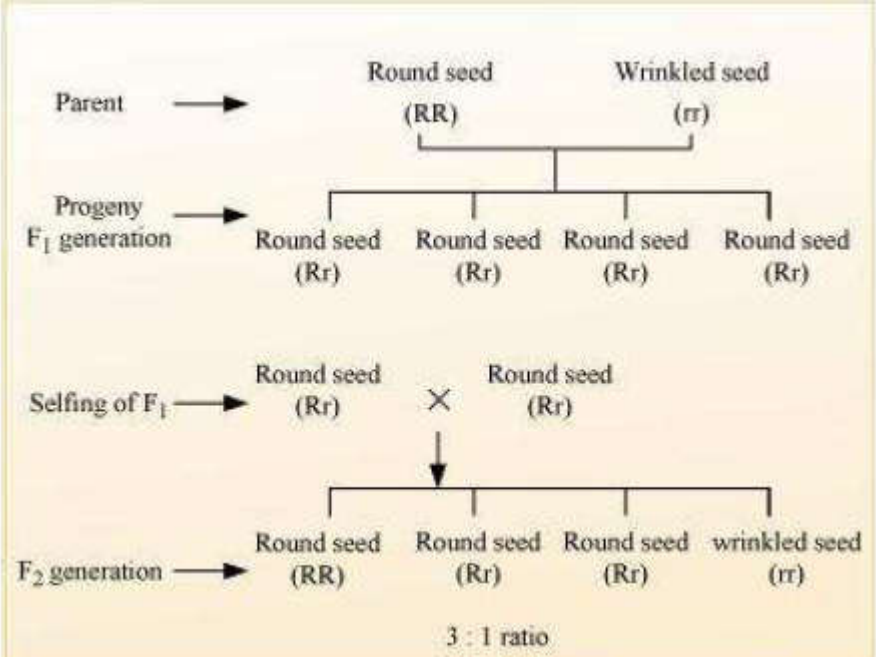
(c) Monohybrid and Dihybrid

	Monohybrid	Dihybrid
1.	Monohybrid involves cross between parents, which differs in only one pair of contrasting characters.	Dihybrid involves cross between parents, which differs in two pairs of contrasting characters.
2.	For example, the cross between tall and dwarf pea plant is a monohybrid cross.	For example, the cross between pea plants having yellow wrinkled seed with those having green round seeds is a dihybrid cross.

Question 3: A diploid organism is heterozygous for 4 loci, how many types of gametes can be produced?

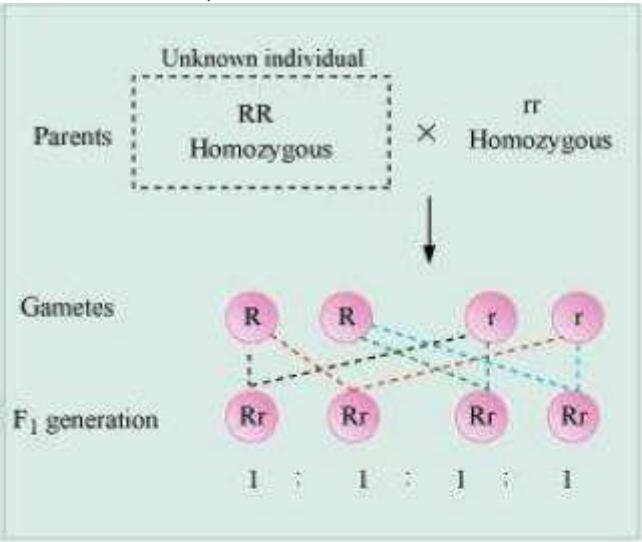
Answer Locus is a fixed position on a chromosome, which is occupied by a single or more genes. Heterozygous organisms contain different alleles for an allelic pair. Hence, a diploid organism, which is heterozygous at four loci, will have four different contrasting characters at four different loci. For example, if an organism is heterozygous at four loci with four characters, say Aa, Bb, Cc, Dd, then during meiosis, it will segregate to form 8 separate gametes. If the genes are not linked, then the diploid organism will produce 16 different gametes. However, if the genes are linked, the gametes will reduce their number as the genes might be linked and the linked genes will be inherited together during the process of meiosis.

Question 4: Explain the Law of Dominance using a monohybrid cross.
Answer Mendel's law of dominance states that a dominant allele expresses itself in a monohybrid cross and suppresses the expression of recessive allele. However, this recessive allele for a character is not lost and remains hidden or masked in the progenies of F1 generation and reappears in the next generation. For example, when pea plants with round seeds (RR) are crossed with plants with wrinkled seeds (rr), all seeds in F1 generation were found to be round (Rr). When these round seeds were self fertilized, both the round and wrinkled seeds appeared in F2 generation in 3: 1 ratio. Hence, in F1 generation, the dominant character (round seeds) appeared and the recessive character (wrinkled seeds) got suppressed, which reappeared in F2 generation.

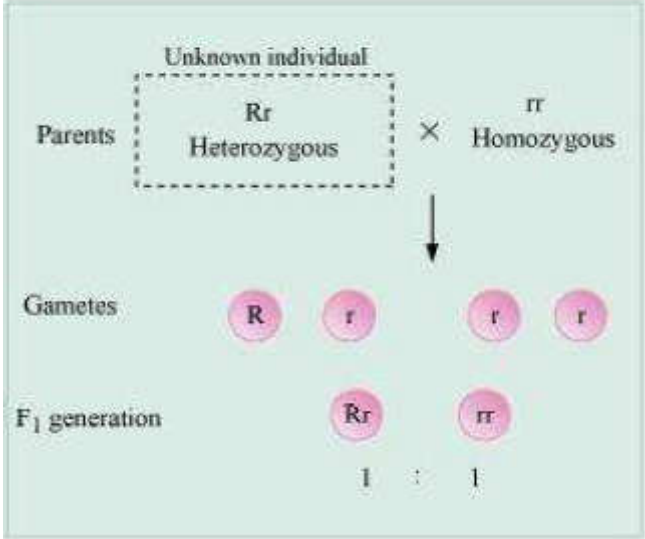


Question 5: Define and design a test – cross?
Answer Test cross is a cross between an organism with unknown genotype and a recessive parent. It is used to determine whether the individual is homozygous or heterozygous for a trait. If the progenies produced by a test cross show 50% dominant trait and 50% recessive trait, then the unknown individual is heterozygous for a trait. On the other hand, if the progeny produced shows

dominant trait, then the unknown individual is homozygous for a trait.



Cross between homozygous (unknown) individual and homozygous recessive individual

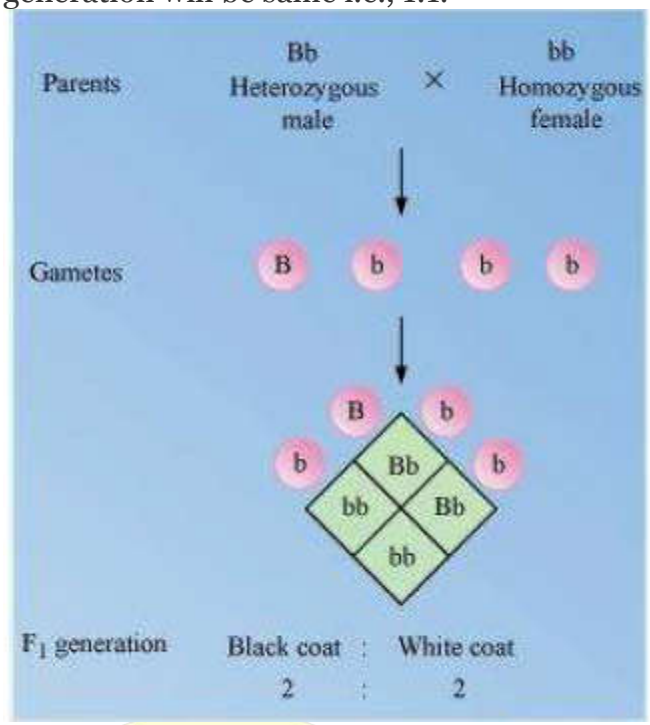


Cross between homozygous (unknown) individual and homozygous recessive individual

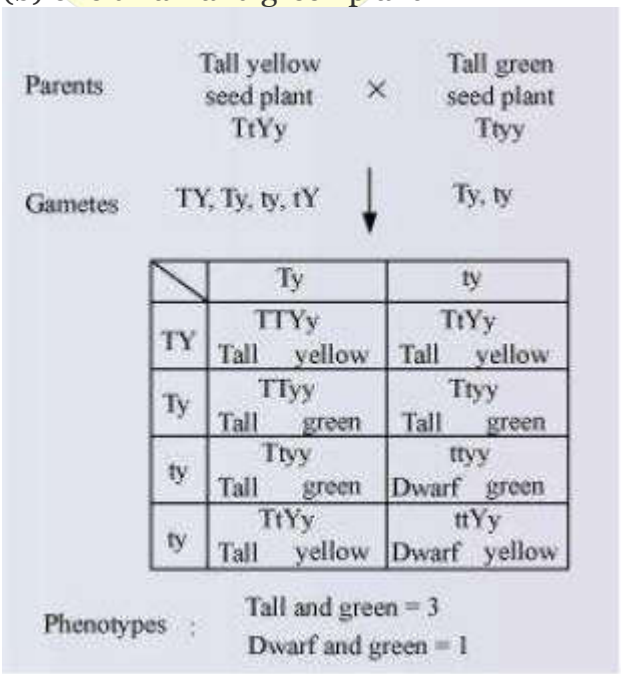
Question 6: Using a Punnett square, work out the distribution of phenotypic features in the first filial generation after a cross between a homozygous female and a heterozygous male for a single locus.

Answer In guinea pigs, heterozygous male with black coat colour (Bb) is crossed with the female having white coat colour (bb). The male will produce two types of gametes, B and b, while the female will produce only one kind of gamete, r. The genotypic and phenotypic ratio in the progenies of F1

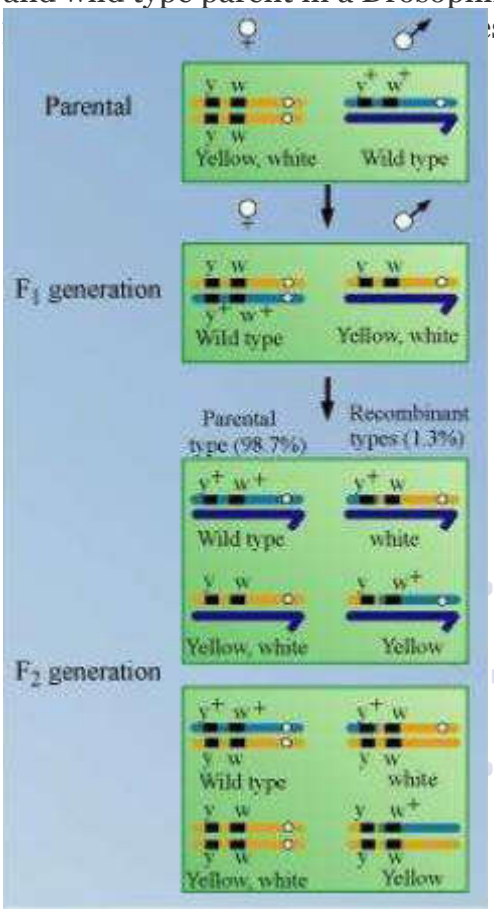
generation will be same i.e., 1:1.



Question 7: When a cross in made between tall plants with yellow seeds (TtYy) and tall plant with green seed (TtYy), what proportions of phenotype in the offspring could be expected to be
(a) Tall and green.
(b) Dwarf and green.
AnswerA cross between tall plant with yellow seeds and tall plant with green seeds will produce
(a) three tall and green plants
(b) one dwarf and green plant



Question 8: Two heterozygous parents are crossed. If the two loci are linked what would be the distribution of phenotypic features in F1 generation for a dihybrid cross?
Answer Linkage is defined as the coexistence of two or more genes in the same chromosome. If the genes are situated on the same chromosome and lie close to each other, then they are inherited together and are said to be linked genes. For example, a cross between yellow body and white eyes and wild type parent in a Drosophila will produce wild type and yellow white progenies. It is because ...s are linked. Therefore, they are inherited together in progenies.

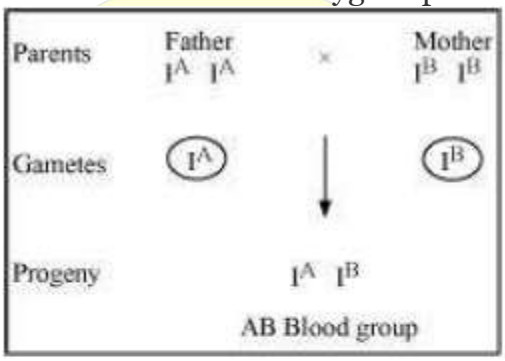


Question 9: Briefly mention the contribution of T.H. Morgan in genetics.
Answer Morgan's work is based on fruit flies (Drosophila melanogaster). He formulated the chromosomal theory of linkage. He defined linkage as the co-existence of two or more genes in the same chromosome and performed dihybrid crosses in Drosophila to show that linked genes are inherited together and are located on X-chromosome. His experiments have also proved that tightly linked genes show very low recombination while loosely linked genes show higher recombination.

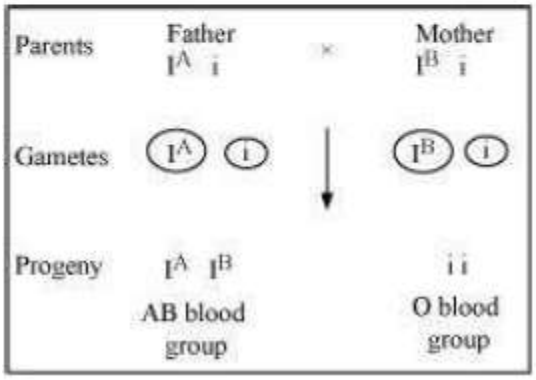
Question 10: What is pedigree analysis? Suggest how such an analysis, can be useful.
Answer Pedigree analysis is a record of occurrence of a trait in several generations of a family. It is based on the fact that certain characteristic features are heritable in a family, for example, eye colour, skin colour, hair form and colour, and other facial characteristics. Along with these features, there are other genetic disorders such as Mendelian disorders that are inherited in a family, generation after generation. Hence, by using pedigree analysis for the study of specific traits or disorders, generation after generation, it is possible to trace the pattern of inheritance. In this analysis, the inheritance of a trait is represented as a tree, called family tree. Genetic counselors use pedigree chart for analysis of various traits and diseases in a family and predict their inheritance patterns. It is useful in preventing hemophilia, sickle cell anemia, and other genetic disorders in the future generations.

Question 11: How is sex determined in human beings?
Answer Human beings exhibit male heterogamy. In humans, males (XY) produce two different types of gametes, X and Y. The human female (XX) produces only one type of gametes containing X chromosomes. The sex of the baby is determined by the type of male gamete that fuses with the female gamete. If the fertilizing sperm contains X chromosome, then the baby produced will be a girl and if the fertilizing sperm contains Y chromosome, then the baby produced will be a boy. Hence, it is a matter of chance that determines the sex of a baby. There is an equal probability of the fertilizing sperm being an X or Y chromosome. Thus, it is the genetic make up of the sperm that determines the sex of the baby.

Question 12: A child has blood group O. If the father has blood group A and mother blood group B, work out the genotypes of the parents and the possible genotypes of the other offsprings.
Answer The blood group characteristic in humans is controlled by three set of alleles, namely, IA, IB, and i. The alleles, IA and IB, are equally dominant whereas allele, i, is recessive to the other alleles. The individuals with genotype, IA IA and IA i, have blood group A whereas the individuals with genotype, IB IB and IB i, have blood group B. The persons with genotype IA IB have blood group AB while those with blood group
O have genotype ii. Hence, if the father has blood group A and mother has blood group B, then the possible genotype of the parents will be Father Mother
IA IA or IA i IB IB or IB i
A cross between homozygous parents will produce progeny with AB blood group.



A cross between heterozygous parents will produce progenies with AB blood group (I^AI^B) and O blood group (ii).

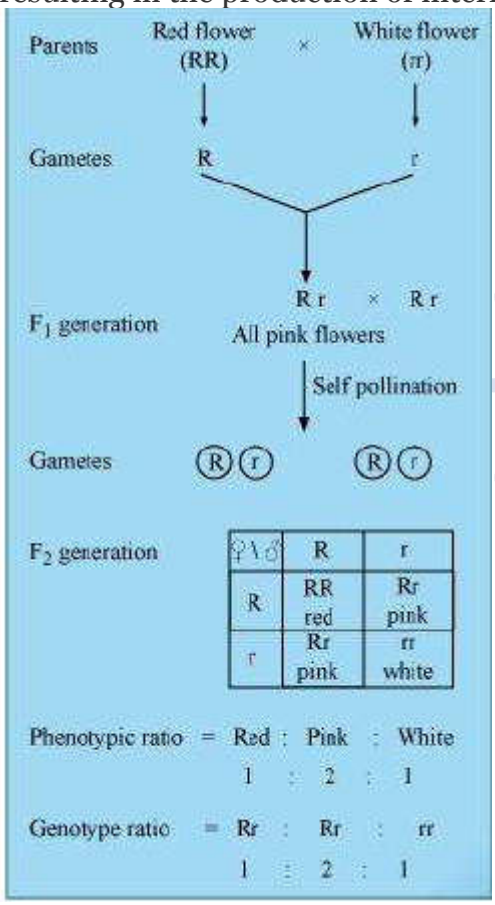


Question 13: Explain the following terms with example
(a) Co-dominance
(b) Incomplete dominance
Answer (a) Co-dominance

Co-dominance is the phenomenon in which both the alleles of a contrasting character are expressed in heterozygous condition. Both the alleles of a gene are equally dominant. ABO blood group in human beings is an example of co-dominance. The blood group character is controlled by three sets of alleles, namely, IA, IB, and i. The alleles, IA and IB, are equally dominant and are said to be co-dominant as they are expressed in AB blood group. Both these alleles do not interfere with the expression of each other and produce their respective antigens. Hence, AB blood group is an example of co-dominance.

2. Incomplete dominance

Incomplete dominance is a phenomenon in which one allele shows incomplete dominance over the other member of the allelic pair for a character. For example, a monohybrid cross between the plants having red flowers and white flowers in Antirrhinum species will result in all pink flower plants in F1 generation. The progeny obtained in F1 generation does not resemble either of the parents and exhibits intermediate characteristics. This is because the dominant allele, R, is partially dominant over the other allele, r. Therefore, the recessive allele, r, also gets expressed in the F1 generation resulting in the production of intermediate pink flowering progenies with Rr genotype.



Question 14: What is point mutation? Give one example.
Answer Point mutation is a change in a single base pair of DNA by substitution, deletion, or insertion of a single nitrogenous base. An example of point mutation is sickle cell anaemia. It involves mutation in a single base pair in the beta-globin chain of haemoglobin pigment of the blood. Glutamic acid in short arm of hromosome II gets replaced with valine at the sixth position.

Question 15: Who had proposed the chromosomal theory of inheritance?
Answer Sutton and Boveri proposed the chromosomal theory of inheritance in 1902. They linked the inheritance of traits to the chromosomes.

Question 16: Mention any two autosomal genetic disorders with their symptoms.
Answer Two autosomal genetic disorders are as follows.
1. Sickle cell Anaemia
It is an autosomal linked recessive disorder, which is caused by point mutation in the beta-globin chain of haemoglobin pigment of the blood. The disease is characterized by sickle shaped red blood cells, which are formed due to the mutant haemoglobin molecule. The disease is controlled by HbA and HbS allele. The homozygous individuals with genotype, HbS HbS, show the symptoms of this disease while the heterozygous individuals with genotype, HbA HbS, are not affected. However, they act as carriers of the disease.
Symptoms
Rapid heart rate, breathlessness, delayed growth and puberty, jaundice, weakness, fever, excessive thirst, chest pain, and decreased fertility are the major symptoms of sickle cell anaemia disease.
(b) Down's syndrome
It is an autosomal disorder that is caused by the trisomy of chromosome 21.
Symptoms
The individual is short statured with round head, open mouth, protruding tongue, short neck, slanting eyes, and broad short hands. The individual also shows retarded mental and physical growth.

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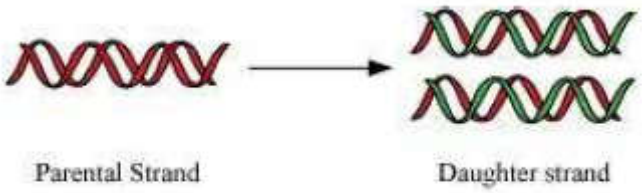
Question 1: Group the following as nitrogenous bases and nucleosides: Adenine, Cytidine, Thymine, Guanosine, Uracil and Cytosine.
Answer Nitrogenous bases present in the list are adenine, thymine, uracil, and cytosine. Nucleosides present in the list are cytidine and guanosine.

Question 2: If a double stranded DNA has 20 per cent of cytosine, calculate the per cent of adenine in the DNA.
Answer According to Chargaff's rule, the DNA molecule should have an equal ratio of pyrimidine (cytosine and thymine) and purine (adenine and guanine). It means that the number of adenine molecules is equal to thymine molecules and the number of guanine molecules is equal to cytosine molecules. % A = % T and % G = % C
If dsDNA has 20% of cytosine, then according to the law, it would have 20% of guanine. Thus, percentage of G + C content = 40% The remaining 60% represents both A + T molecule. Since adenine and guanine are always present in equal numbers, the percentage of adenine molecule is 30%.

Question 3: If the sequence of one strand of DNA is written as follows:
5′-ATGCATGCATGCATGCATGCATGCATGC-3′
Write down the sequence of complementary strand in 5'→3′ direction
Answer The DNA strands are complementary to each other with respect to base sequence. Hence, if the sequence of one strand of DNA is 5′- ATGCATGCATGCATGCATGCATGCATGC – 3' Then, the sequence of complementary strand in
3′- TACGTACGTACGTACGTACGTACGTACG – 5' direction will be Therefore, the sequence of nucleotides on DNA polypeptide in direction is 5′- GCATGCATGCATGCATGCATGCATGCAT– 3'

Question 4: If the sequence of the coding strand in a transcription unit is written as follows:
5′-ATGCATGCATGCATGCATGCATGCATGC-3′ Write down the sequence of mRNA.
Answer If the coding strand in a transcription unit is
5'– ATGCATGCATGCATGCATGCATGCATGC-3'
Then, the template strand in 3' to 5' direction would be
3' – TACGTACGTACGTACGTACGTACGTACG-5'
It is known that the sequence of mRNA is same as the coding strand of DNA. However, in RNA, thymine is replaced by uracil. Hence, the sequence of mRNA will be
5' – AUGCAUGCAUGCAUGCAUGCAUGCAUGC-3'

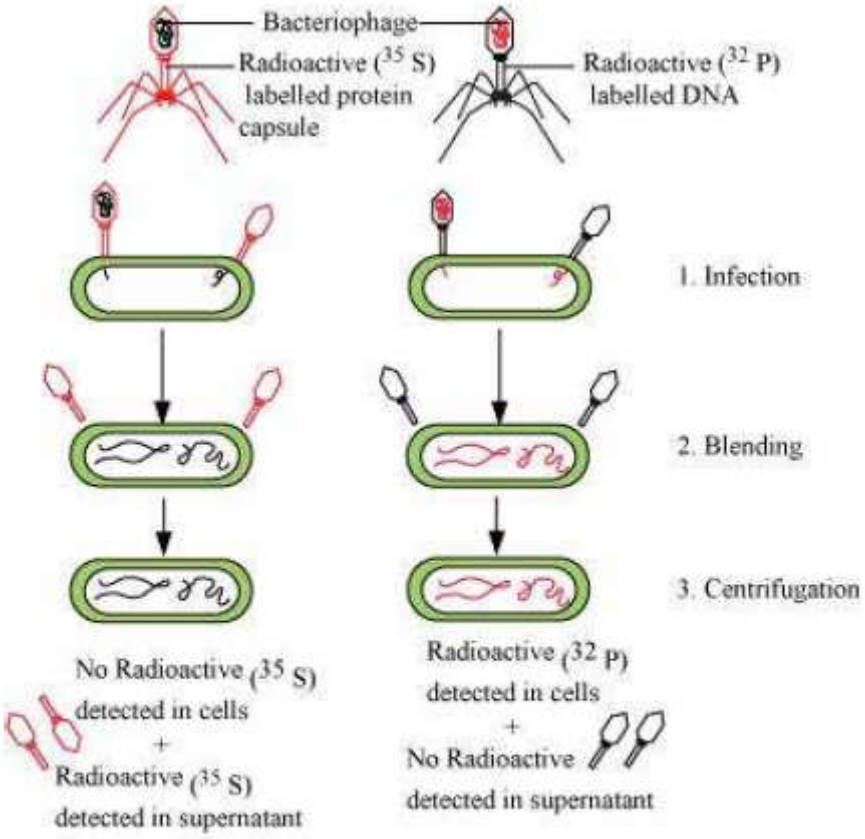
Question 5: Which property of DNA double helix led Watson and Crick to hypothesise semi-conservative mode of DNA replication? Explain.
Answer Watson and Crick observed that the two strands of DNA are anti-parallel and complementary to each other with respect to their base sequences. This type of arrangement in DNA molecule led to the hypothesis that DNA replication is semi- conservative. It means that the double stranded DNA molecule separates and then, each of the separated strand acts as a template for the synthesis of a new complementary strand. As a result, each DNA molecule would have one parental strand and a newly synthesized daughter strand. Since only one parental strand is conserved in each daughter molecule, it is known as semi-conservative mode of replication.



Question 6: Depending upon the chemical nature of the template (DNA or RNA) and the nature of nucleic acids synthesised from it (DNA or RNA), list the types of nucleic acid polymerases.
Answer There are two different types of nucleic acid polymerases.
(1) DNA-dependent DNA polymerases
(2) DNA-dependent RNA polymerases
The DNA-dependent DNA polymerases use a DNA template for synthesizing a new strand of DNA, whereas DNA-dependent RNA polymerases use a DNA template strand for synthesizing RNA.

Question 7: How did Hershey and Chase differentiate between DNA and protein in their experiment while proving that DNA is the genetic material?
Answer Hershey and Chase worked with bacteriophage and E.coli to prove that DNA is the genetic material. They used different radioactive isotopes to label DNA and protein coat of the bacteriophage. They grew some bacteriophages on a medium containing radioactive phosphorus (32P) to identify DNA and some on a medium containing radioactive sulphur (35S) to identify protein. Then, these radioactive labelled phages were allowed to infect E.coli
bacteria. After infecting, the protein coat of the bacteriophage was separated from the bacterial cell by blending and then subjected to the process of centrifugation. Since the protein coat was lighter, it was found in the supernatant while the infected bacteria got settled at the bottom of the centrifuge tube.

Hence, it was proved that DNA is the genetic material as it was transferred from virus to bacteria.



Hershey and Chase experiment

Question 8: Differentiate between the followings:
(a) Repetitive DNA and Satellite DNA
(b) mRNA and tRNA
(c) Template strand and Coding strand

Answer

(a) Repetitive DNA and satellite DNA

	Repetitive DNA	**Satellite DNA**
1.	Repetitive DNA are DNA sequences that contain small segments, which are repeated many times.	Satellite DNA are DNA sequences that contain highly repetitive DNA.

(b) mRNA and tRNA

	mRNA	**tRNA**
1.	mRNA or messenger RNA acts as a template for the process of transcription.	tRNA or transfer RNA acts as an adaptor molecule that carries a specific amino acid to mRNA for the synthesis of polypeptide.
2.	It is a linear molecule.	It has clover leaf shape.

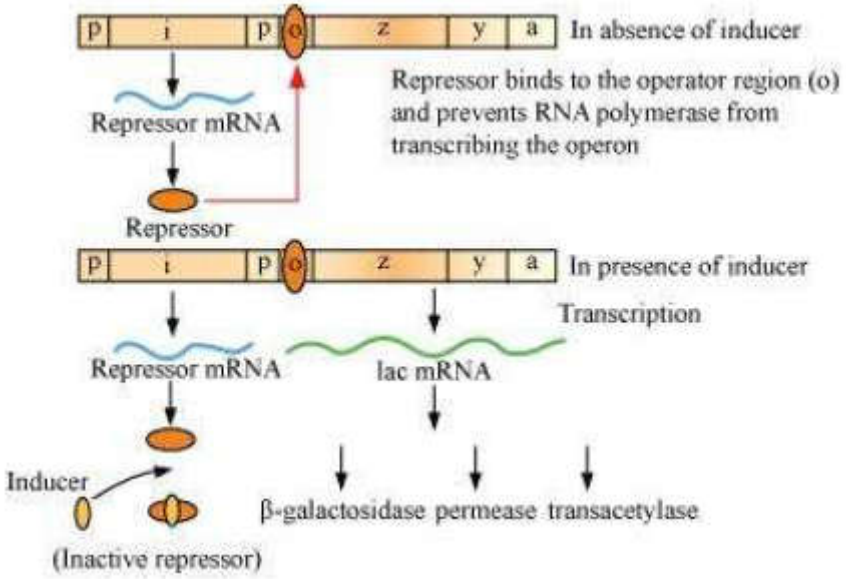
(c) Template strand and coding strand

	Template strand	**Coding strand**
1.	Template strand of DNA acts as a template for the synthesis of mRNA during transcription.	Coding strand is a sequence of DNA that has the same base sequence as that of mRNA (except thymine that is replaced by uracil in DNA).
2.	It runs from 3′ to 5′.	It runs from 5′to 3′.

Question 9: List two essential roles of ribosome during translation.
Answer The important functions of ribosome during translation are as follows.
(a) Ribosome acts as the site where protein synthesis takes place from individual amino acids. It is made up of two subunits. The smaller subunit comes in contact with mRNA and forms a protein synthesizing complex whereas the larger subunit acts as an amino acid binding site.
(b) Ribosome acts as a catalyst for forming peptide bond. For example, 23s r-RNA in bacteria acts as a ribozyme.

Question 10: In the medium where E. coli was growing, lactose was added, which induced the lac operon. Then, why does lac operon shut down some time after addition of lactose in the medium?
Answer Lac operon is a segment of DNA that is made up of three adjacent structural genes, namely,

an operator gene, a promoter gene, and a regulator gene. It works in a coordinated manner to metabolize lactose into glucose and galactose. In lac operon, lactose acts as an inducer. It binds to the repressor and inactivates it.
Once the lactose binds to the repressor, RNA polymerase binds to the promoter region. Hence, three structural genes express their product and respective enzymes are produced. These enzymes act on lactose so that lactose is metabolized into glucose and galactose. After sometime, when the level of inducer decreases as it is completely metabolized
by enzymes, it causes synthesis of the repressor from regulator gene. The repressor binds to the operator gene and prevents RNA polymerase from transcribing the operon. Hence, the transcription is stopped. This type of regulation is known as negative regulation.

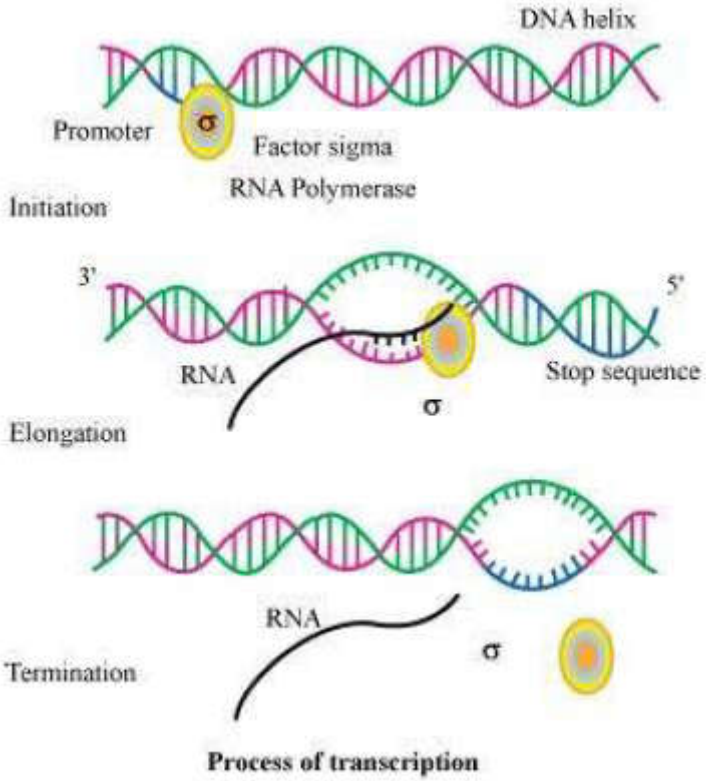


Question 11: Explain (in one or two lines) the function of the followings:
(a) Promoter
(b) tRNA
(c) Exons
Answer
(a) Promoter
Promoter is a region of DNA that helps in initiating the process of transcription. It serves as the binding site for RNA polymerase.
(b) tRNA
tRNA or transfer RNA is a small RNA that reads the genetic code present on mRNA. It carries specific amino acid to mRNA on ribosome during translation of proteins.
(c) Exons
Exons are coding sequences of DNA in eukaryotes that transcribe for proteins.

Question 12: Why is the Human Genome project called a mega project?
Answer Human genome project was considered to be a mega project because it had a specific goal to sequence every base pair present in the human genome. It took around 13 years for its completion and got accomplished in year 2006. It was a large scale project, which aimed at developing new technology and generating new information in the field of genomic studies. As a result of it, several new areas and avenues have opened up in the field of genetics, biotechnology, and medical sciences. It provided clues regarding the understanding of human biology.

Question 13: What is DNA fingerprinting? Mention its application.
Answer DNA fingerprinting is a technique used to identify and analyze the variations in various individuals at the level of DNA. It is based on variability and polymorphism in DNA sequences.
Application
(1) It is used in forensic science to identify potential crime suspects.
(2) It is used to establish paternity and family relationships.
(3) It is used to identify and protect the commercial varieties of crops and livestock.
(4) It is used to find out the evolutionary history of an organism and trace out the linkages between groups of various organisms.

Question 14:
Briefly describe the following:
(a) Transcription
(b) Polymorphism
(c) Translation
(d) Bioinformatics
Answer
(a) Transcription
Transcription is the process of synthesis of RNA from DNA template. A segment of DNA gets copied into mRNA during the process. The process of transcription starts at the promoter region of the template DNA and terminates at the terminator region. The segment of DNA between these two regions is known as transcription unit. The transcription requires RNA polymerase enzyme, a DNA template, four types of ribonucleotides, and certain cofactors such as Mg^{2+}.
The three important events that occur during the process of transcription are as follows.
(i) Initiation
(ii) Elongation
(iii) Termination
The DNA-dependent RNA polymerase and certain initiation factors (σ) bind at the double stranded DNA at the promoter region of the template strand and initiate the process of transcription. RNA polymerase moves along the DNA and leads to the unwinding of DNA duplex into two separate strands. Then, one of the strands, called sense strand, acts as template for mRNA synthesis. The enzyme, RNA polymerase, utilizes nucleoside triphosphates (dNTPs) as raw material and polymerizes them to form mRNA according to the complementary bases present on the template DNA. This process of opening of helix and elongation of polynucleotide chain continues until the enzyme reaches the terminator region. As RNA polymerase reaches the terminator region, the newly synthesized mRNA transcripted along with enzyme is released. Another factor called terminator factor (ρ) is required for the termination of the transcription.



Process of transcription

(b) Polymorphism

Polymorphism is a form of genetic variation in which distinct nucleotide sequence can exist at a particular site in a DNA molecule. This heritable mutation is observed at a high frequency in a population. It arises due to mutation either in somatic cell or in the germ cells. The germ cell mutation can be transmitted from parents to their offsprings. This results in accumulation of various mutations in a population, leading to variation and polymorphism in the population. This plays a very important role in the process of evolution and speciation.

(c) Translation

Translation is the process of polymerizing amino acid to form a polypeptide chain. The triplet sequence of base pairs in mRNA defines the order and sequence of amino acids in a polypeptide chain.

The process of translation involves three steps.

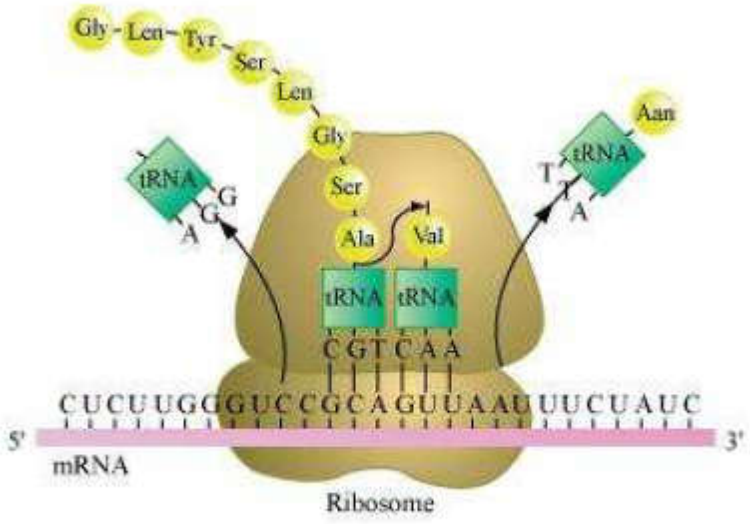
(i) Initiation

(ii) Elongation

(iii) Termination

During the initiation of the translation, tRNA gets charged when the amino acid binds to it using ATP. The start (initiation) codon (AUG) present on mRNA is recognized only by the charged tRNA. The ribosome acts as an actual site for the process of translation and contains two separate sites in a large subunit for the attachment of subsequent amino acids. The small subunit of ribosome binds to mRNA at the initiation codon (AUG) followed by the large subunit. Then, it initiates the process of translation. During the elongation process, the ribosome moves one codon downstream along with mRNA so as to leave the space for binding of another charged tRNA. The amino acid brought by tRNA gets linked with the previous amino acid through a peptide bond and this process continues resulting in the formation of a polypeptide chain. When the ribosome reaches one or more STOP codon (VAA, UAG, and UGA), the process of translation gets terminated. The polypeptide chain is released and the ribosomes get

detached from mRNA.



Translation of proteins

(d) Bioinformatics

Bioinformatics is the application of computational and statistical techniques to the field of molecular biology. It solves the practical problems arising from the management and analysis of biological data. The field of bioinformatics developed after the completion of human genome project (HGP). This is because enormous amount of data has been generated during the process of HGP that has to be managed and stored for easy access and interpretation for future use by various scientists. Hence, bioinformatics involves the creation of biological databases that store the vast information of biology. It develops certain tools for easy and efficient access to the information and its utilization. Bioinformatics has developed new algorithms and statistical methods to find out the relationship between the data, to predict protein structure and their functions, and to cluster the protein sequences into their related families.