CBSE Class 12

Biology

Ch 01 – Reproduction in Organisms

1. Why is reproduction essential for organisms?

Ans. 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.

2. Which is a better mode of reproduction sexual or asexual? Why?

Ans. 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.

3. Why is the offspring formed by asexual reproduction referred to as clone?

Ans. 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 off springs so produced are morphologically and genetically similar to their parents and are thus, called clones.

4. Offspring formed due to sexual reproduction have better chances of survival. Why? Is this statement always true?

Ans. 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.

5. How does the progeny formed from asexual reproduction differ from those formed by sexual reproduction?

Ans.

SL.	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.

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

Ans.

SL.	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.
	The individuals produced are not identical to	The individuals produced are identical

3	their parents and show variations from each other and also, from their parents.	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.

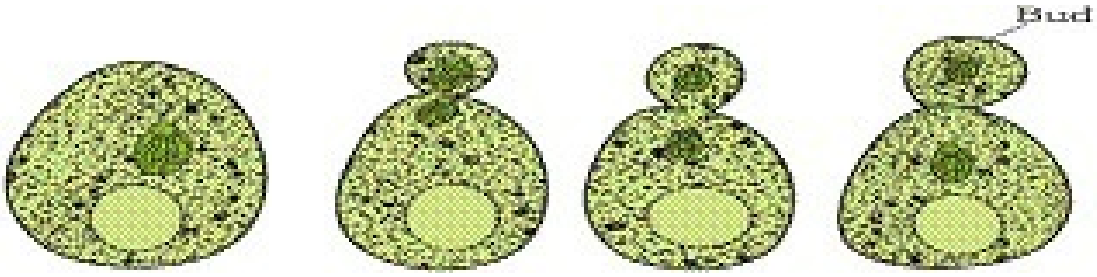
Vegetative propagation is a process in which new plants are obtained without the production of seeds or spores. It involves the propagation of plants through certain vegetative parts such as the rhizome, sucker, tuber, bulb, etc. It does not involve the fusion of the male and the female gamete and requires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

7. What is vegetative propagation? Give two suitable examples.

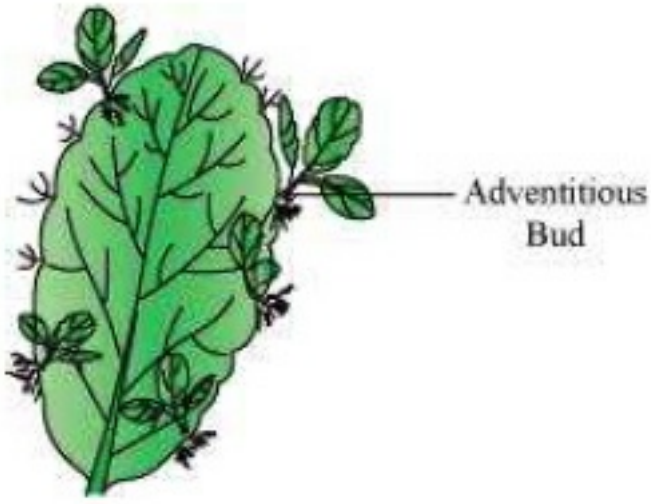
Ans. Vegetative propagation is a mode of asexual reproduction in which new plants are obtained from the vegetative parts of plants. It does not involve the production of seeds or spores for the propagation of new plants. Vegetative parts of plants such as runners, rhizomes, suckers, tubers, etc. can 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.



8. Define
(a) Juvenile phase,
(b) Reproductive phase,
(c) Senescent phase.

Ans. (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.

9. Higher organisms have resorted to sexual reproduction in spite of its complexity. Why?

Ans. 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.

10. Explain why meiosis and gametogenesis are always interlinked?

Ans. Meiosis is a process of reductional division in which the amount of genetic material is reduced to half. 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.

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 ——————————

Ans. (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)

12. Define external fertilization. Mention its disadvantages.

Ans. 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.

13. Differentiate between a zoospore and a zygote.

Ans.

SL.	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.

14. Differentiate between gametogenesis from embryogenesis.
Ans.

SL.	Gametogenesis	Embryogenesis
1	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.

15. Describe the post-fertilization changes in a flower.

Ans. 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.

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.

Ans. 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 (Nymphaeaodorata)

(2) Rose (Rosa multiflora)
(3) Hibiscus (Hibiscus Rosa-sinensis)
(4) Mustard (Brassica nigra)
(5) Petunia (Petunia hybrida)

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?

Ans.

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.

18. Why are offspring of oviparous animals at a greater risk as compared to offspring of viviparous animals?

Ans. 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.

CBSE Class 12

Biology

Ch 02 – SEXUAL REPRODUCTION IN FLOWERING PLANTS

1. Name the parts of an angiosperm flower in which development of male and female gametophyte take place.

Ans. The male gametophyte or the pollen grain develops inside the pollen chamber of the anther, whereas the female gametophyte develops inside the nucellus of the ovule from the functional megaspore.

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.

Ans. (a)

SL	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 the 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.

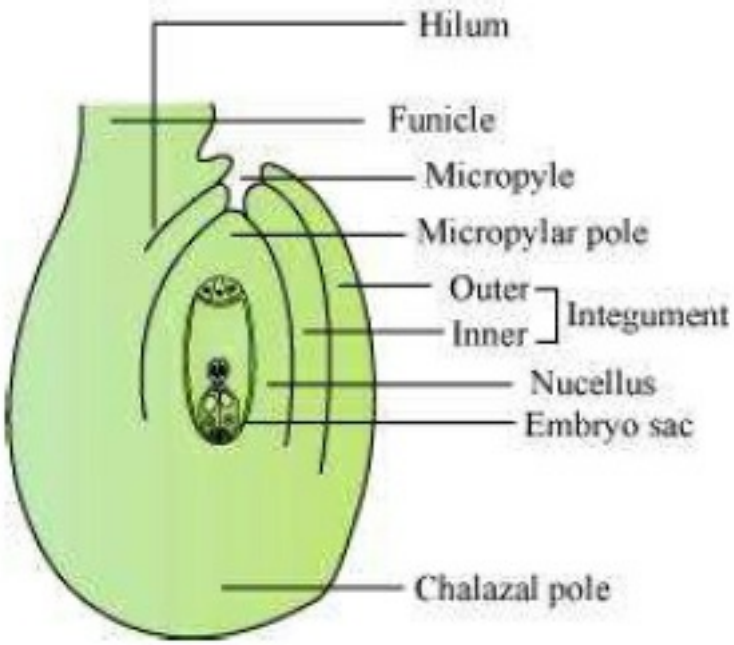
(c) Microsporogenesis results in the formation of haploid microspores from a diploid microspore mother cell. On the other hand, megasporogenesis results in the formation of haploid megaspores from a diploid megaspore mother cell.

3. Arrange the following terms in the correct developmental sequence:

Pollen grain, sporogenous tissue, microspore tetrad, pollen mother cell, male gametes

Ans. The correct development sequence is as follows:
Sporogenous tissue – pollen mother cell – microspore tetrad – Pollen grain – male gamete

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



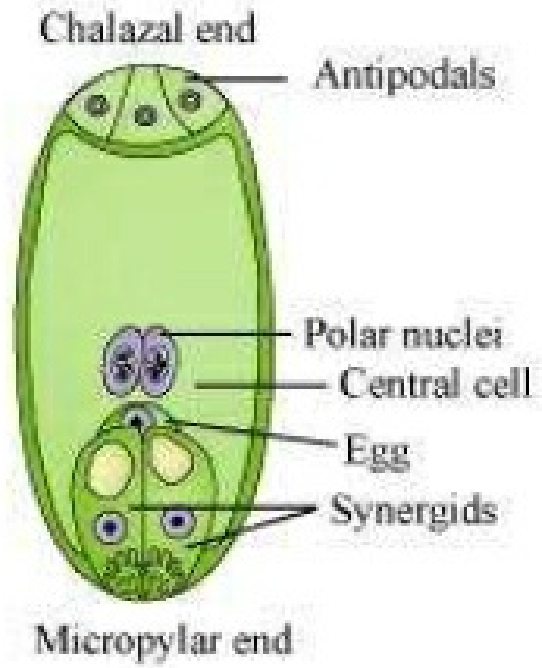
The various parts of an ovule are –
(1) Funiculus – It is a stalk-like structure which represents the point of attachment of the ovule to the placenta of the ovary.
(2) Hilum – It is the point where the body of the ovule is attached to the funiculus.
(3) Integuments –They are the outer layers surrounding 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.

5. What is meant by monosporic development of female gametophyte?
Ans. 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.

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

Ans.



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.

7. What are chasmogamous flowers? Can cross-pollination occur in cleistogamous flowers? Give reasons for your answer.

Ans. 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.

8. Mention two strategies evolved to prevent self-pollination in flowers.

Ans. 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.

9. What is self-incompatibility? Why does self-pollination not lead to seed formation in self-incompatible species?

Ans. 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.

10. What is bagging technique? How is it useful in a plant breeding programme?

Ans. Various artificial hybridization techniques 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.

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11. What is triple fusion? Where and how does it take place? Name the nuclei involved in triple fusion.

Ans. 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. 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.

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12. Why do you think the zygote is dormant for sometime in a fertilized ovule?

Ans. 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 theendosperm, further development of the embryo from the zygote starts.

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

Ans. (a)

SL	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)

SL	Coleoptile	Coleorrhiza
1.	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)

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

(d)

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

14. Why is apple called a false fruit? Which part(s) of the flower forms the fruit?

Ans. 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.

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

technique?

Ans. 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.

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16. If one can induce parthenocarpy through the application of growth substances, which fruits would you select to induce parthenocarpy and why?

Ans. 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.

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17. Explain the role of tapetum in the formation pollen-grain wall.

Ans. 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.

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18. What is apomixis and what is its importance?

Ans. 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

CBSE Class 12

Biology

Ch 03 – HUMAN REPRODUCTION

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 _____.

Ans. (a) Humans reproduce sexually. (asexually/**sexually**)

(b) Humans are viviparous. (oviparous/**viviparous**/ovoviviparous)

(c) Fertilization is internal in humans. (external/**internal**)

(d) Male and female gametes are haploid. (diploid/**haploid**)

(e) Zygote is diploid. (**diploid**/haploid)

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

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

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

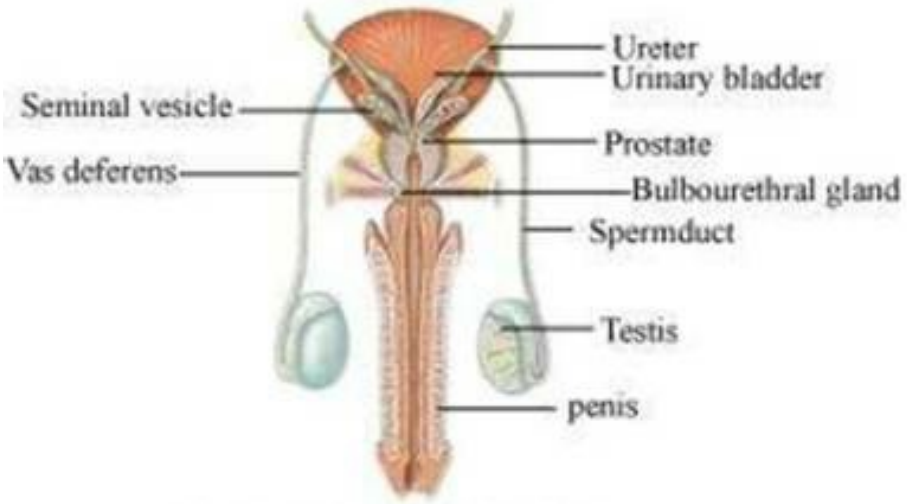
(i) Fertilization takes place in the fallopian tube.**(fallopian tube).**

(j) The zygote divides to form Blastocyst which is implanted in uterus.**(Blastocyst)**

(k) The structure which provides vascular connection between the fetus and uterusis called placenta.**(Placenta)**

2. Draw a labeled diagram of male reproductive system.

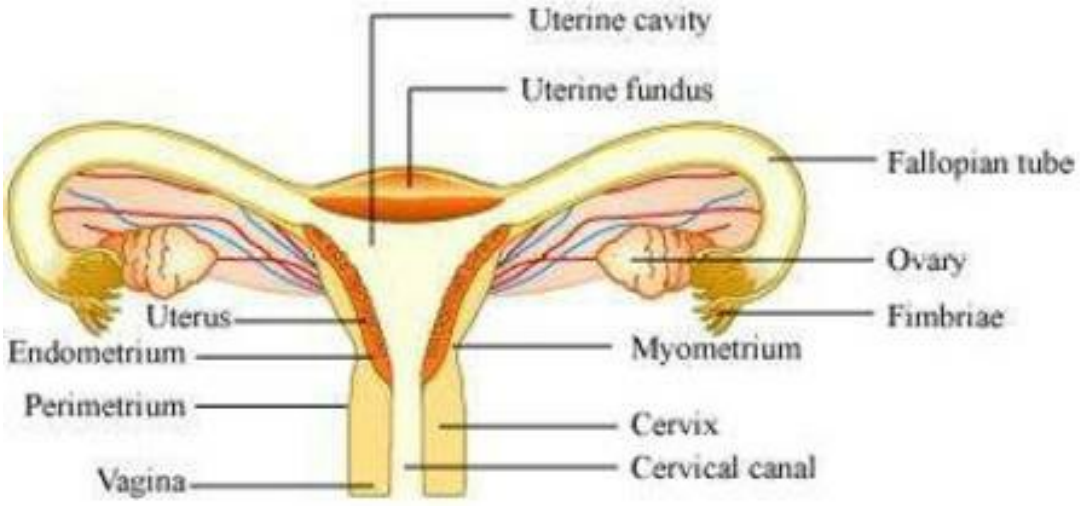
Ans.



The male reproductive system

3. Draw a labeled diagram of female reproductive system.

Ans.



The female reproductive system

4. Write two major functions each of testis and ovary.

Ans. Functions of the Testis:

(a) They produce male gametes called spermatozoa by the process of spermatogenesis.

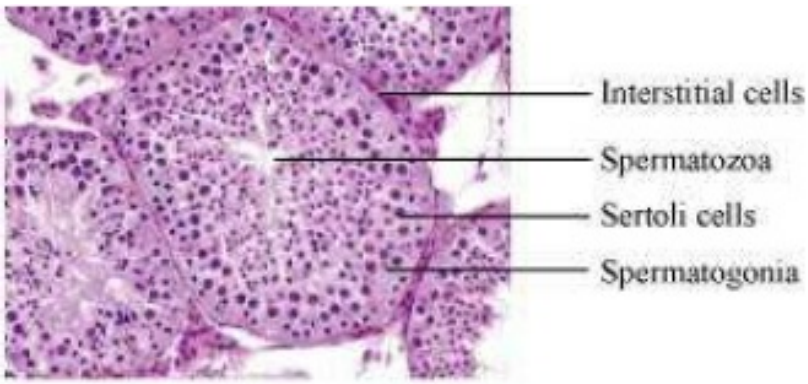
(b) The leydig cells of the seminiferous tubules secrete the male sex hormone called testosterone. Testosterone aids the development of secondary sex characteristics in males.

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.

5. Describe the structure of a seminiferous tubule.

Ans. 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.

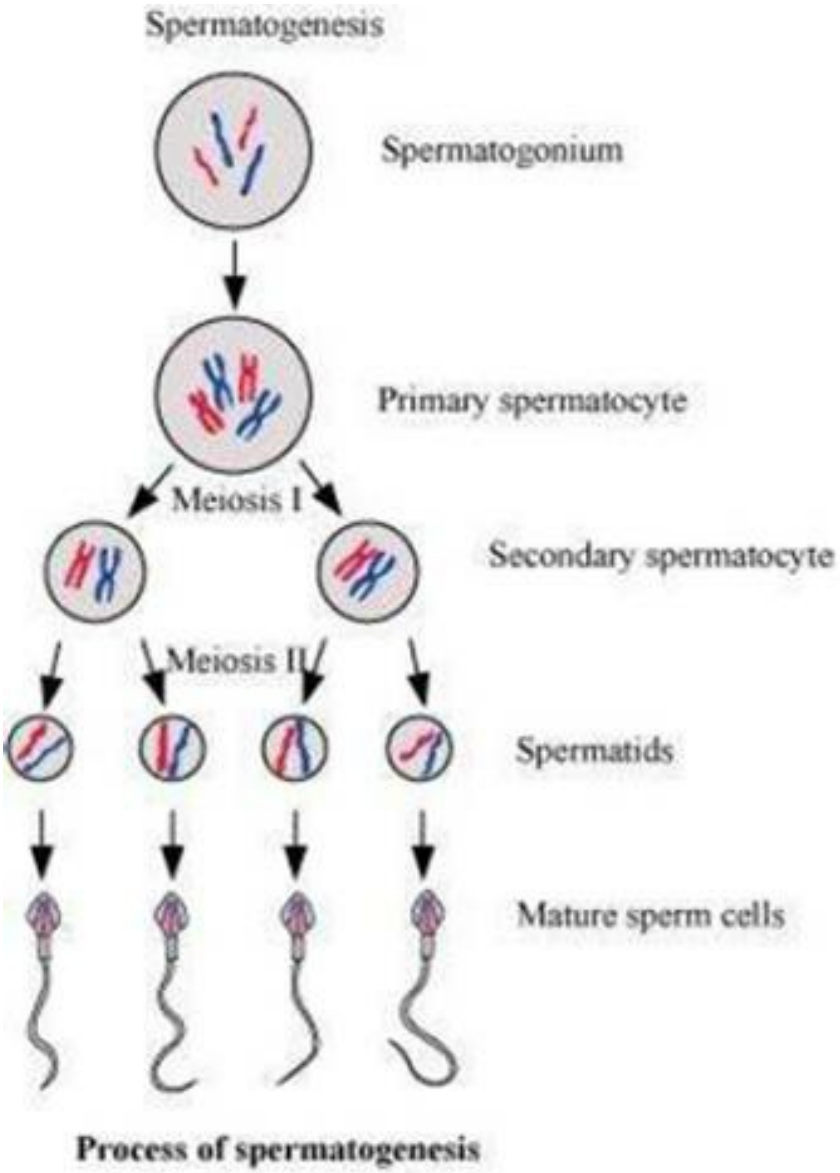


Transverse section of seminiferous tubules

6. What is spermatogenesis? Briefly describe the process of spermatogenesis.

Ans. 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

7. Name the hormones involved in regulation of spermatogenesis.

Ans. 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.

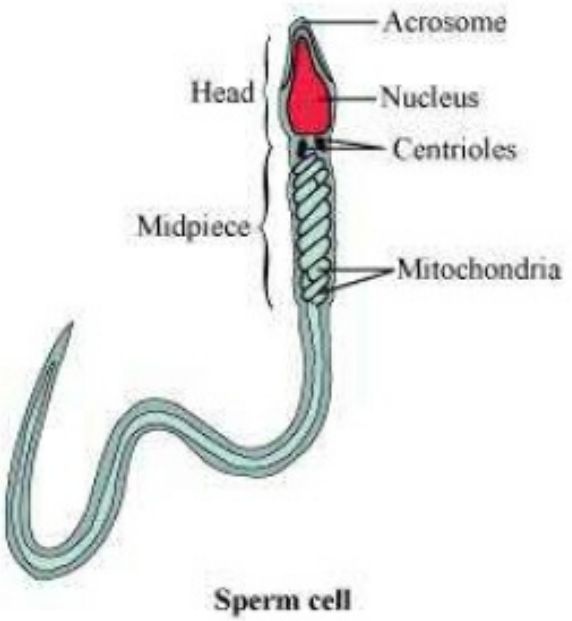
8. Define spermiogenesis and spermiation.

Ans. 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.

9. Draw a labeled diagram of sperm.

Ans.



Sperm cell

10. What are the major components of seminal plasma?

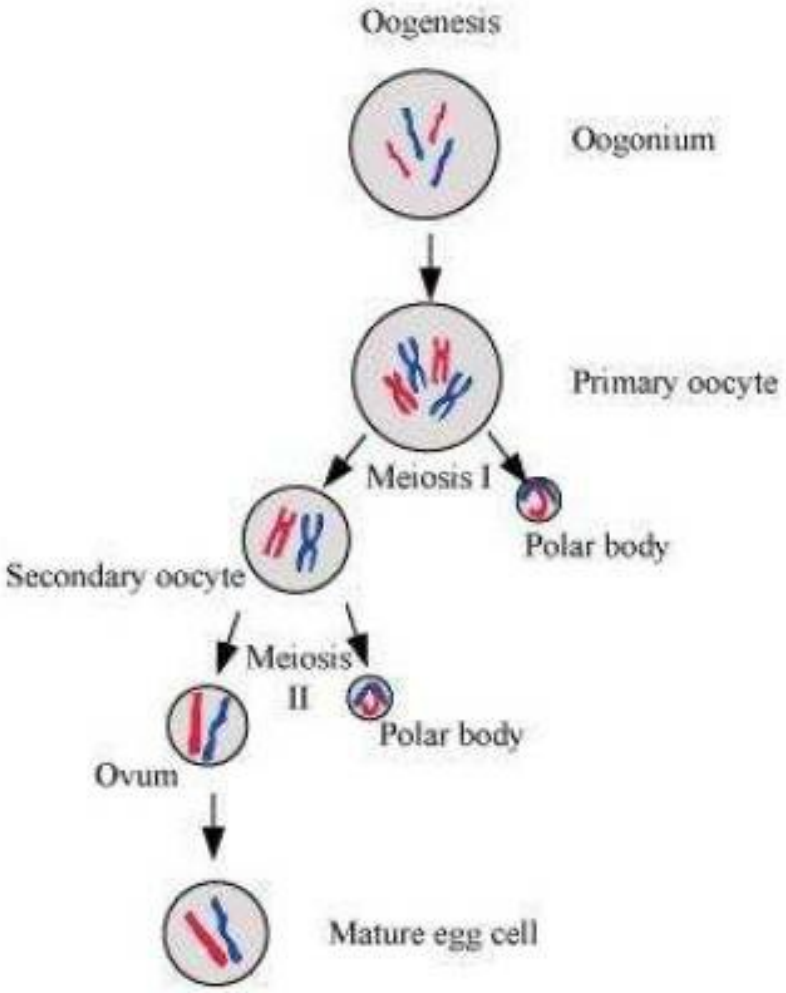
Ans. Semen is composed of sperms and seminal plasma. The major components of the seminal plasma in the male reproductive system are mucus, spermatozoa, and various secretions of accessory glands. The seminal plasma is rich in fructose, calcium, ascorbic acid, and certain enzymes. It provides nourishment and
protection to sperms.

11. What are the major functions of male accessory ducts and glands?

Ans. 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.

12. What is oogenesis? Give a brief account of oogenesis.

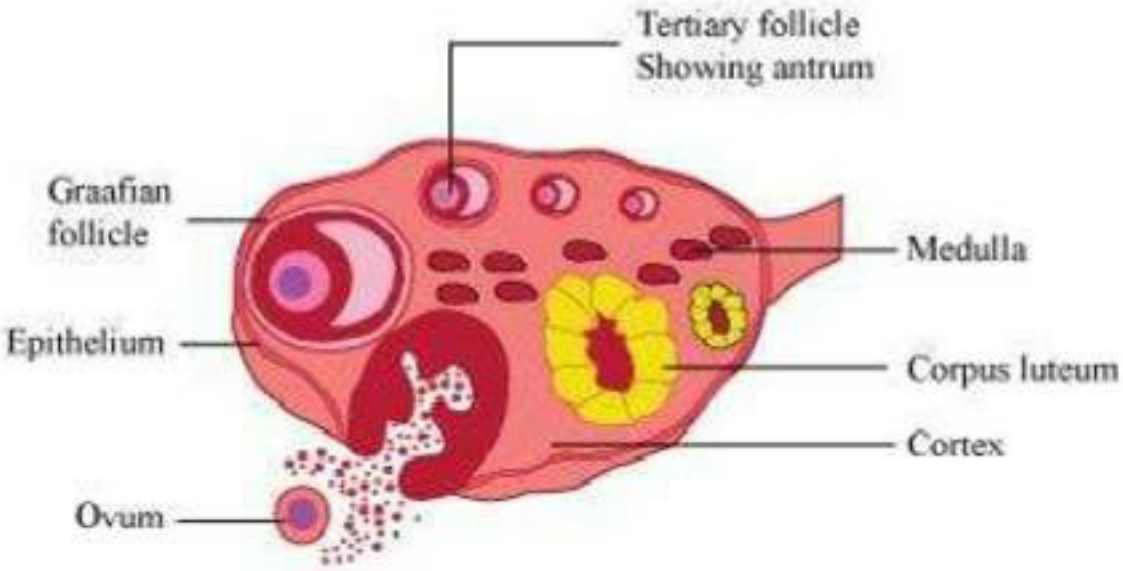
Ans. Oogenesis is the process of the formation of a mature ovum from the oogonia in females. It takes place in the ovaries. During oogenesis, a diploid oogonium or egg mother cell increases in size and gets transformed into a diploid primary oocyte. This diploid primary oocyte undergoes first meiotic 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

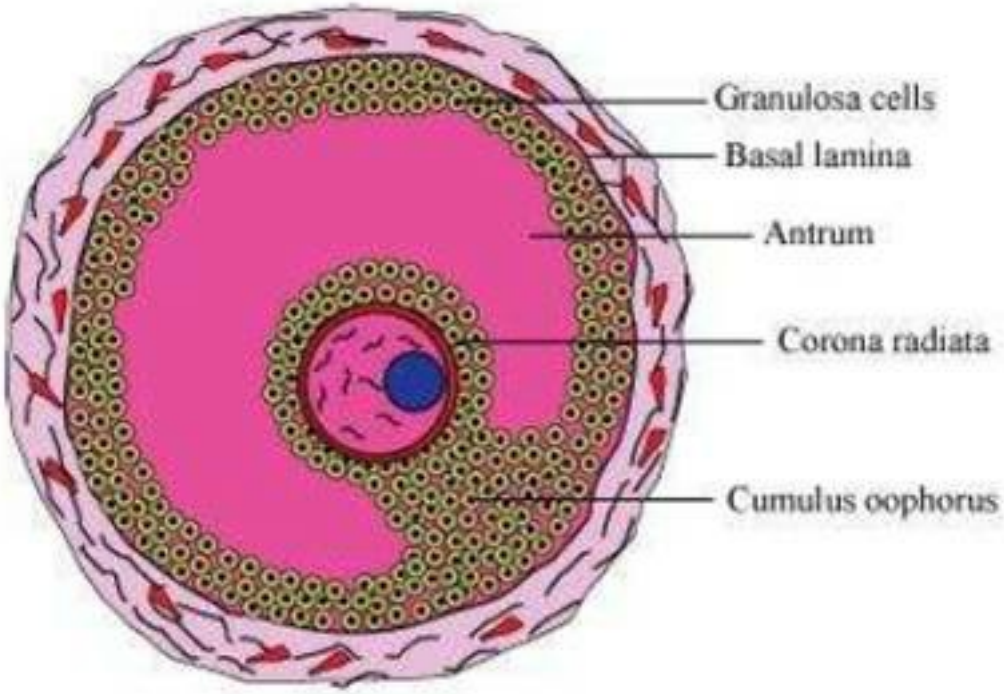
13. Draw a labeled diagram of a section through ovary.

Ans.



14. Draw a labeled diagram of a GraafianFollicle?

Ans.



Structure of the Graafian follicle

15. Name the functions of the following.

(a) Corpus luteum

(b) Endometrium

(c) Acrosome
(d) Sperm tail
(e) Fimbriae
Ans. (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.

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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)
Ans. (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)

17. What is menstrual cycle? Which hormones regulate menstrual cycle?
Ans. 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.

18. What is parturition? Which hormones are involved in induction of parturition?
Ans. 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.

19. In our society the women are often blamed for giving birth to daughters. Can you explain why this is not correct?

Ans. 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.

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?

Ans. An ovary releases an egg every month. When two babies are produced in after single gestation, 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.

21. How many eggs do you think were released by the ovary of a female dog which gave birth to 6 puppies?

Ans. 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.

CBSE Class 12

Biology

Ch 05 – Principles of Inheritance and Variation

1. Mention the advantages of selecting pea plant for experiment by Mendel.

Ans. Mendel selected 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 produceoffsprings 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.

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

Ans. (a) Dominance and Recessive

S.L.	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

S.L.	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

S.L.	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 ground seeds is a dihybrid cross.

3. A diploid organism is heterozygous for 4 loci, how many types of gametes can beproduced?

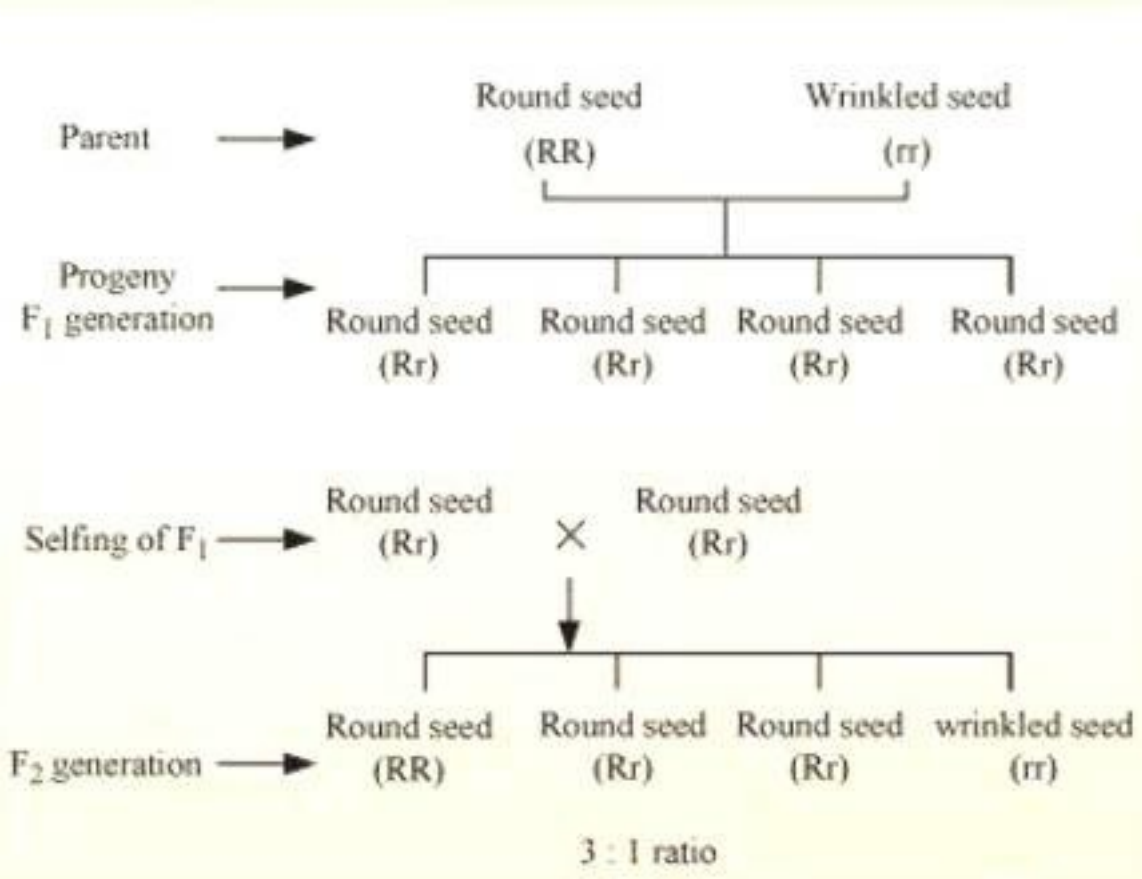
Ans. Locus is a fixed position on a chromosome, which is occupied by a single or more genes. Heterozygous organisms contain different alleles for an allelic pair. Hence, a diploid organism, which is heterozygous at four loci, will have four different contrasting characters at four different loci. For 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.

4. Explain the Law of Dominance using a monohybrid cross.

Ans. 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

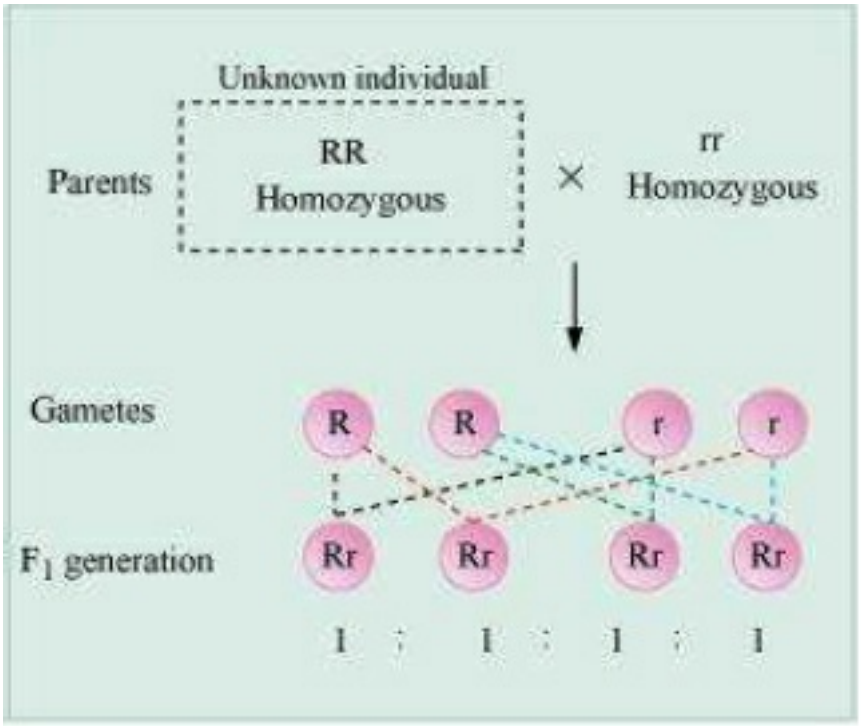
generation and reappears in the next generation.

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.

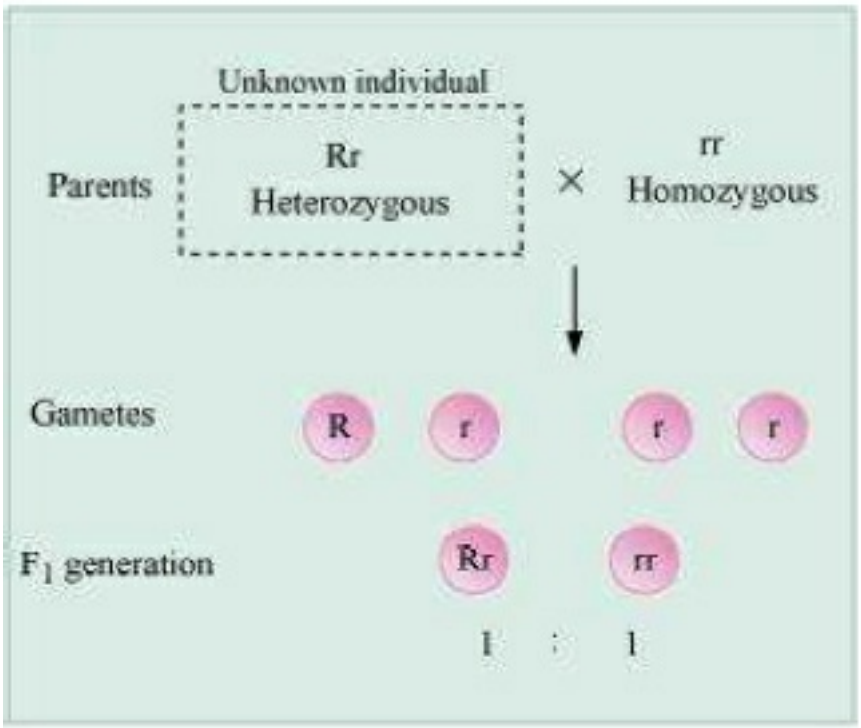


5. Define and design a test – cross?

Ans. 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

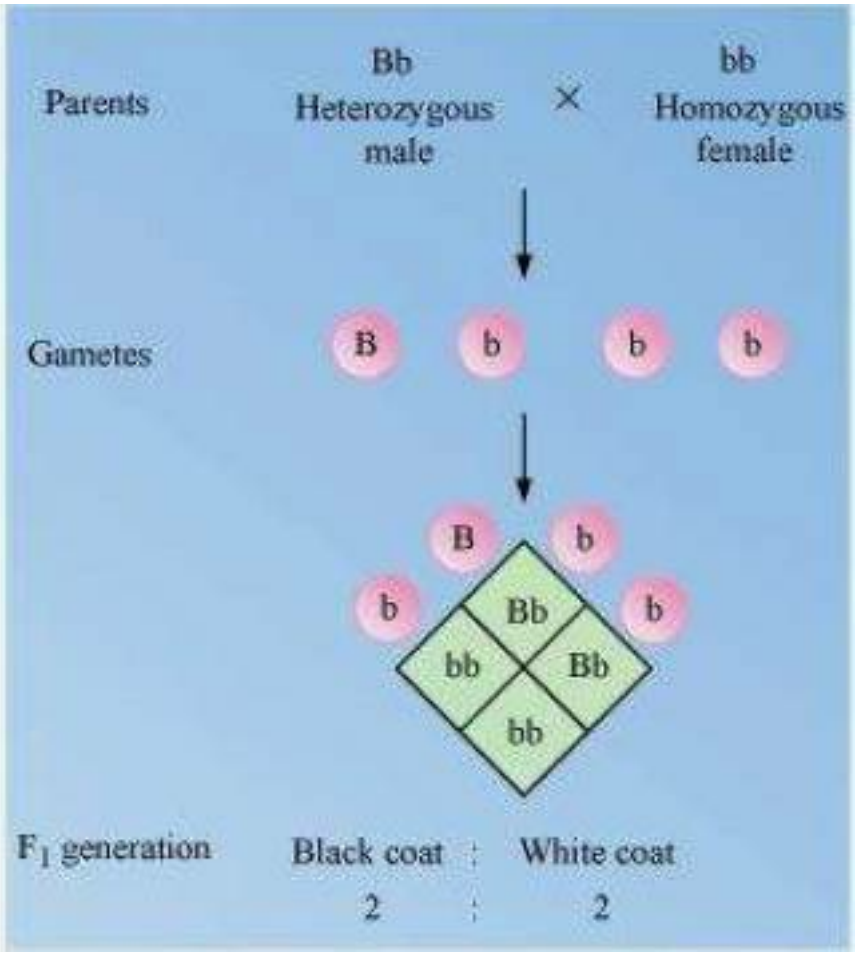


Cross between homozygous (unknown) individual and homozygous recessive individual

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.

Ans. 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.



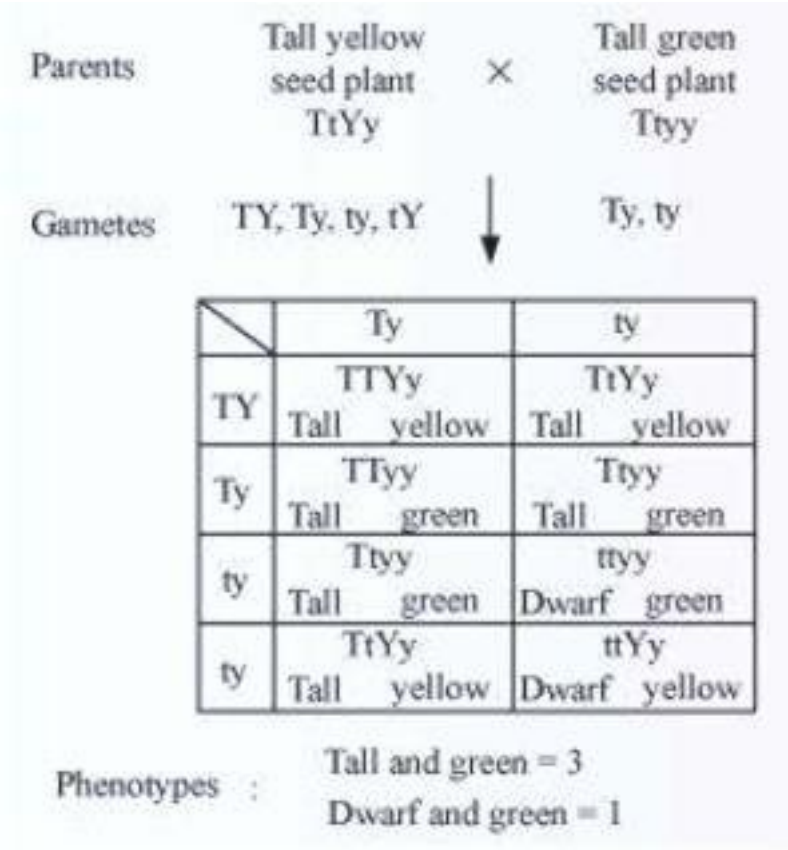
7. When a cross in made between tall plants with yellow seeds (TtYy) and tall plant withgreen seed (TtYy), what proportions of phenotype in the offspring could be expected to be

(a) Tall and green.
(b) Dwarf and green.

Ans. A cross between tall plant with yellow seeds and tall plant with green seeds will produce

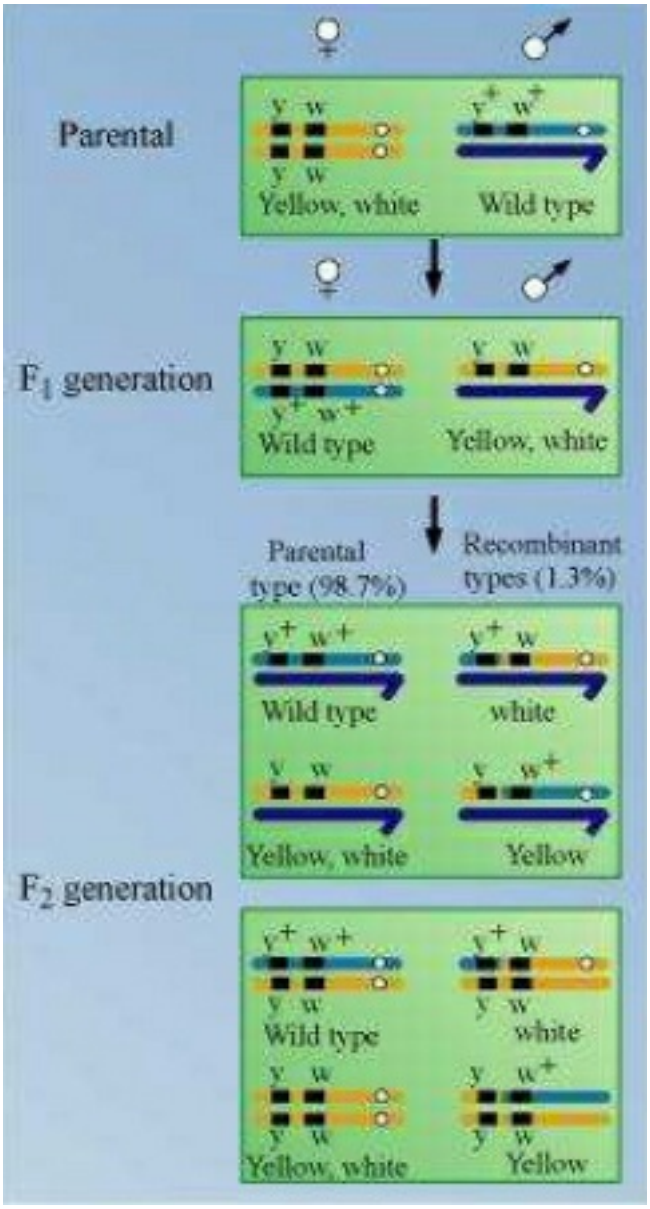
(a) three tall and green plants

(b) one dwarf and green plant



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?

Ans. 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 yellow bodied and white eyed genes are linked. Therefore, they are inherited together in progenies.



9. Briefly mention the contribution of T.H. Morgan in genetics.

Ans. 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.

10. What is pedigree analysis? Suggest how such an analysis, can be useful.

Ans. 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.

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11. How is sex determined in human beings?

Ans. 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.

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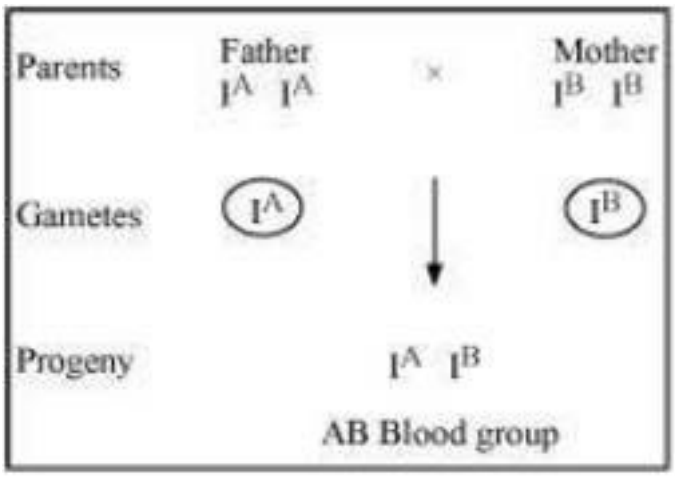
12. A child has blood group O. If the father has blood group A and mother blood group B, work out the genotypes of the parents and the possible genotypes of the other offsprings.

Ans. 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 (IAIB) and O blood group (ii).



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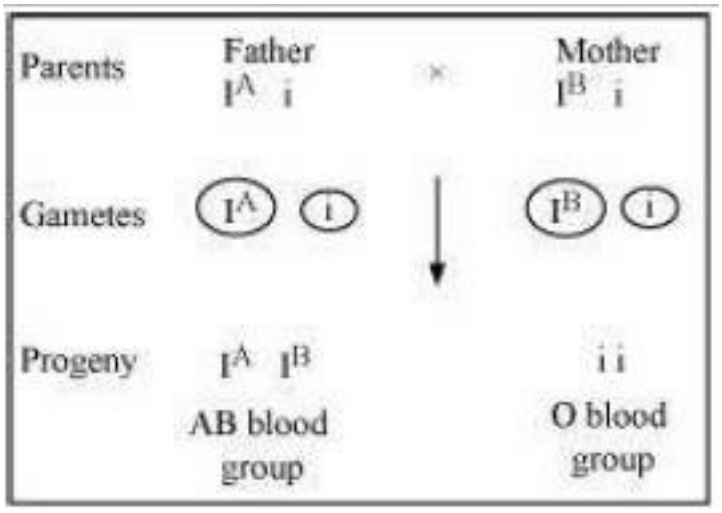
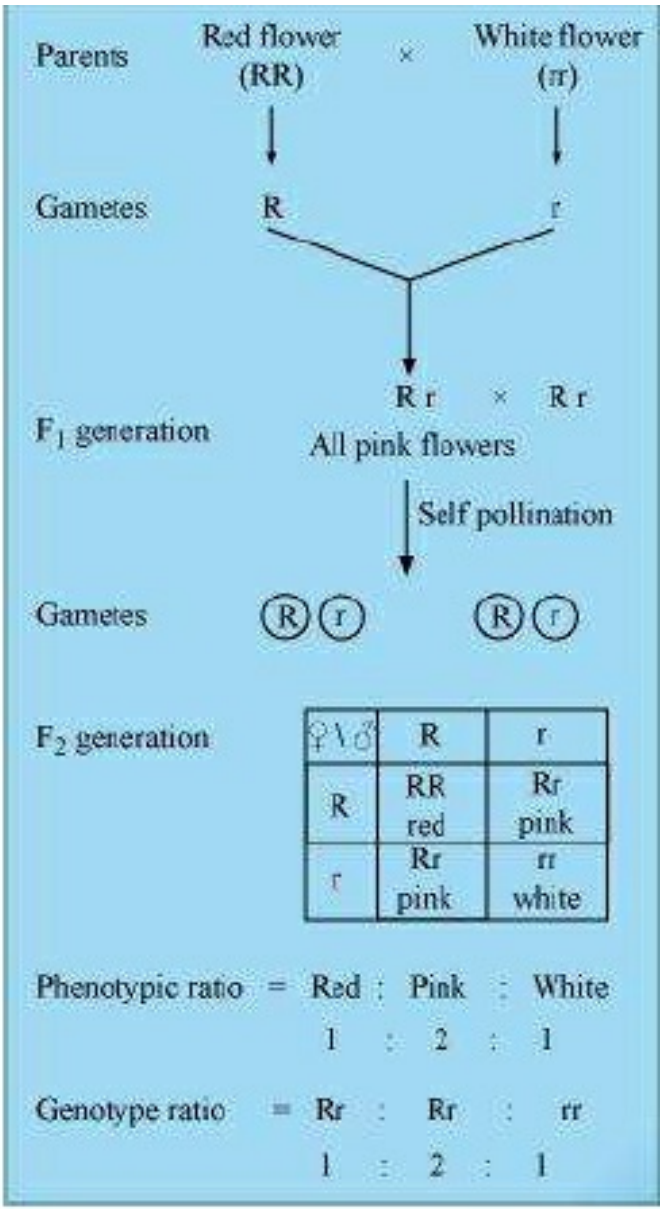


13. Explain the following terms with example
(a) Co-dominance
(b) Incomplete dominance

Ans. (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.

(b) 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.



14. What is point mutation? Give one example.

Ans. 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.

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15. Who had proposed the chromosomal theory of inheritance?

Ans. Sutton and Boveri proposed the chromosomal theory of inheritance in 1902. They linked the inheritance of traits to the chromosomes.

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16. Mention any two autosomal genetic disorders with their symptoms.

Ans. 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, HbSHbS, show the symptoms of this disease while the heterozygous individuals with genotype, HbAHbS, 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.

CBSE Class 12

Biology

Ch 06 – MOLECULAR BASIS OF INHERITANCE

1. Group the following as nitrogenous bases and nucleosides: Adenine, Cytidine, Thymine, Guanosine, Uracil and Cytosine.

Ans. Nitrogenous bases present in the list are adenine, thymine, uracil, and cytosine. Nucleosides present in the list are cytidine and guanosine.

2. If a double stranded DNA has 20 per cent of cytosine, calculate the per cent of adenine in the DNA.

Ans. 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%.

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

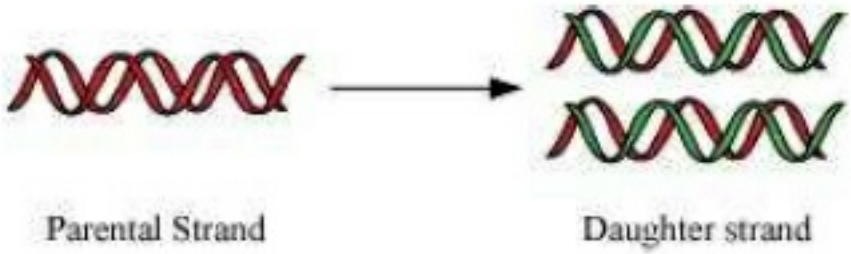
Ans. The DNA strands are complementary to each other with respect to base sequence. Hence, if the sequence of one strand of DNA is 5'- ATGCATGCATGCATGCATGCATGCATGC – 3' Then, the sequence of complementary strand in
3'- TACGTACGTACGTACGTACGTACGTACG – 5' direction will be Therefore, the sequence of nucleotides on DNA polypeptide in direction is 5'- GCATGCATGCATGCATGCATGCATGCAT–3'

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.

Ans. 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'

5. Which property of DNA double helix led Watson and Crick to hypothesise semi-conservative mode of DNA replication? Explain.
Ans. 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.

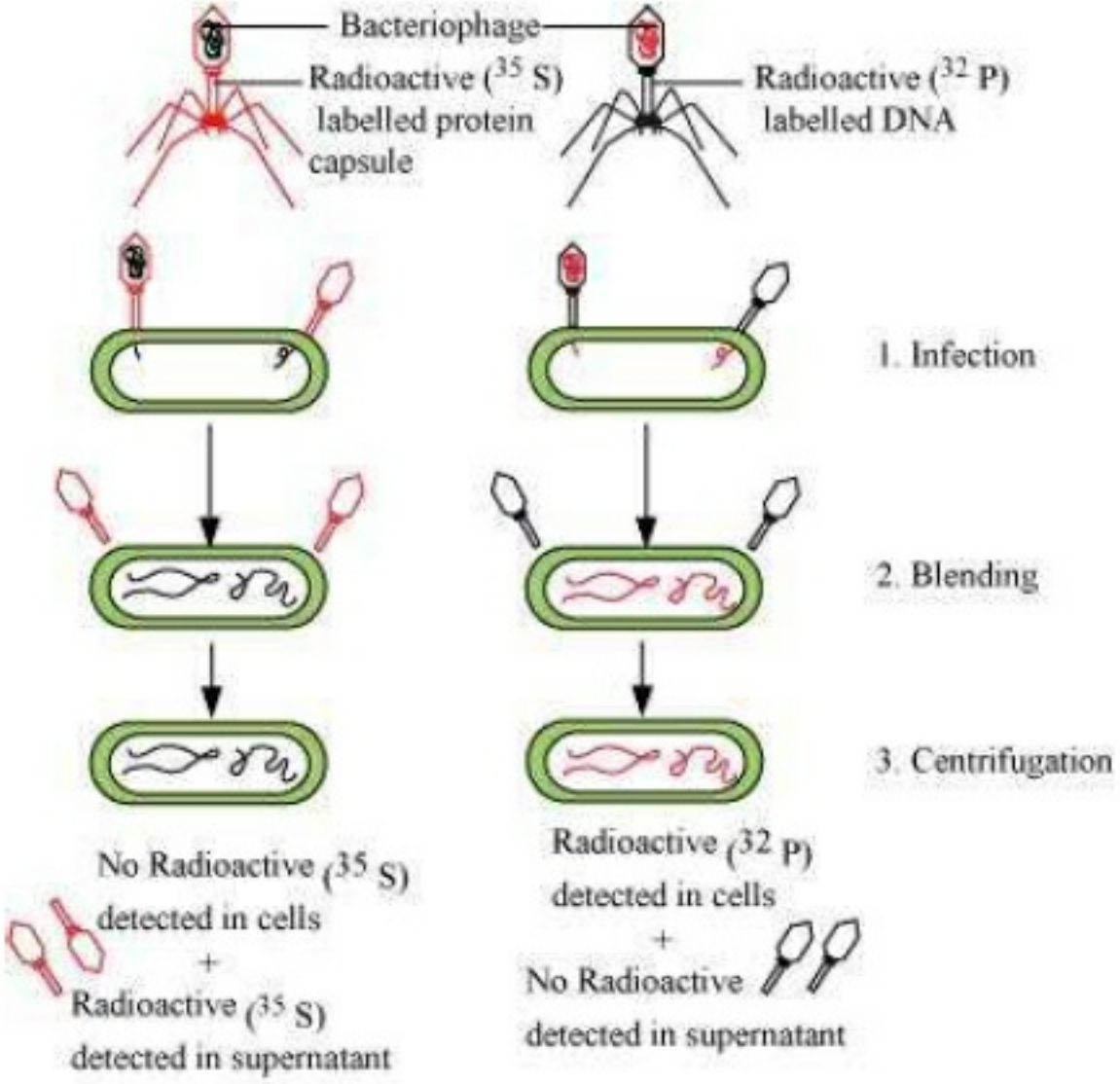


6. Depending upon the chemical nature of the template (DNA or RNA) and the nature of nucleic acids synthesised from it (DNA or RNA), list the types of nucleic acid polymerases.
Ans. There are two different types of nucleic acid polymerases.
(1) DNA-dependent DNA polymerases
(2) DNA-dependent RNA polymerases
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.

7. How did Hershey and Chase differentiate between DNA and protein in their

experiment while proving that DNA is the genetic material?

Ans. 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

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

Ans. (a)

Repetitive DNA	Satellite DNA
In some specific regions in a DNA sequence, a small stretch of DNA is repeated many times. This is called repetitive DNA. This DNA is separated from bulk genomic DNA as different peaks during density gradient centrifugation.	During density gradient centrifugation, the bulk DNA forms a major peak and the other small peaks are called satellite DNA. Depending on the base composition, length of segment and number of repetitive units, these may be micro-satellites and mini-satellites. These sequences do not code for any protein, but they form a large portion of the human genome.

(b)

mRNA	tRNA
It is formed by the DNA template in the nucleus and moves to the cytoplasm within two subunits of ribosomes. It forms about 5-10% of the total RNA in a cell. It carries codons which serve as a message tape to be decoded into a protein.	It is an adapter molecule which picks up activated amino acid from the cytoplasm and supplies it to m-RNA in a ribosome according to the message expressed in the form of a codon. It is soluble RNA and constitutes about 10-12% of the total RNA in the cell cytoplasm.

(c)

Template strand	Coding Strand
	This strand has polarity 5'-3' and the

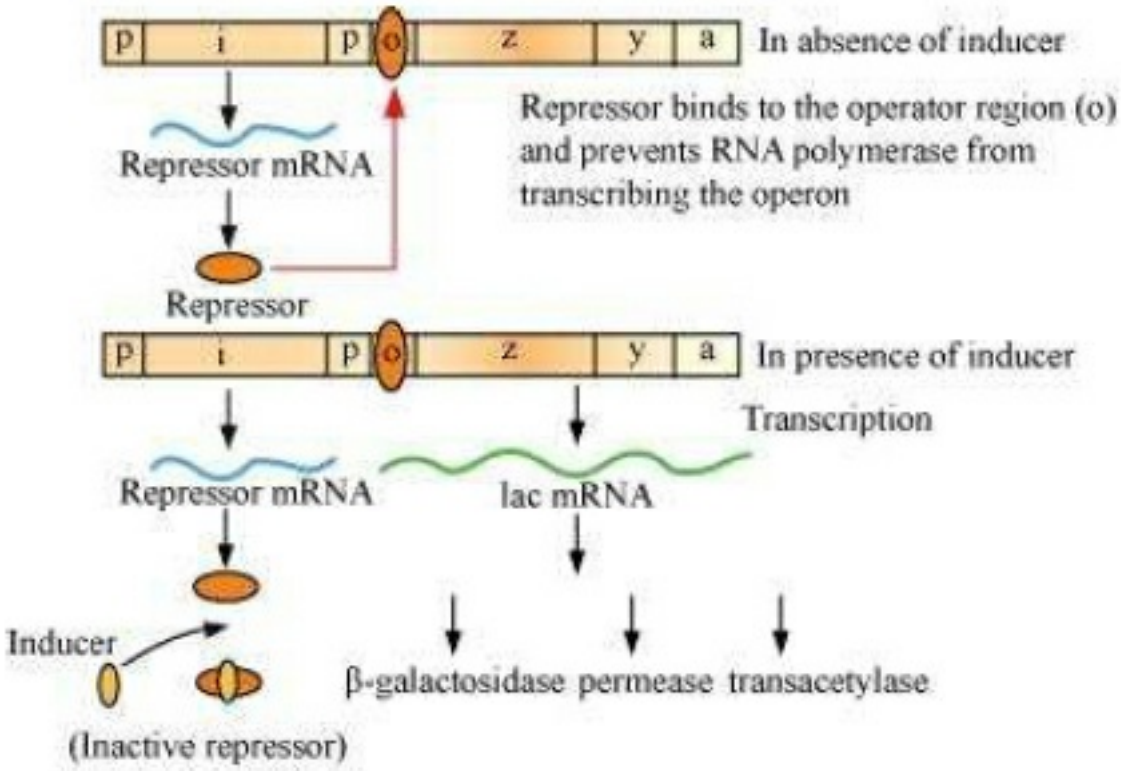
During the process of transcription, one of the strands which has polarity 3'-5' acts as a template strand.	sequence is the same as RNA except with thymine at the place of uracil. This strand which does not code for anything is referred to as the coding strand.

9. List two essential roles of ribosome during translation.

Ans. 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.

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?

Ans. 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.



11. Explain (in one or two lines) the function of the followings:
(a) Promoter
(b) tRNA
(c) Exons

Ans. (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.

12. Why is the Human Genome project called a mega project?

Ans. 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.

13. What is DNA fingerprinting? Mention its application.

Ans. 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.

14. Briefly describe the following:
(a) Transcription
(b) Polymorphism
(c) Translation
(d) Bioinformatics

Ans. (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.

(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.

(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.

CBSE Class 12

Biology

Ch 09 – STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

1. Explain in brief the role of animal husbandry in human welfare.

Ans. Animal husbandry deals with the scientific management of livestock. It includes various aspects such as feeding, breeding, and control diseases to raise the population of animal livestock.These animals are managed for the production of commercially important products such as milk, meat, wool, egg, honey, silk, etc. The increase in human population has increased the demand of these products. Hence, it is necessary to improve the management of livestock scientifically.

2. If your family owned a dairy farm, what measures would you undertake to improve the quality and quantity of milk production?

Ans. Dairy farm management deals with processes which aim at improving the quality and quantity of milk production. Milk production is primarily dependent on choosing improved cattle breeds, provision of proper feed for cattle, maintaining proper shelter facilities, and regular cleaning of cattle. Choosing improved cattle breeds is an important factor of cattle management. Hybrid cattle breeds are produced for improved productivity. Therefore, it is essential that hybrid cattle breeds should have a combination of various desirable genes such as high milk production and high resistance to diseases. Cattle should also be given healthy and nutritious food consisting of roughage, fibre concentrates, and high levels of proteins and other nutrients. Cattle's should be housed in proper cattle-houses and should be kept in well ventilated roofs to prevent them from harsh weather conditions such as heat,cold, and rain. Regular baths and proper brushing should be ensured to control diseases. Also, time-to-time check ups by a veterinary doctor for symptoms of various diseases should be undertaken.

3. What is meant by the term 'breed'? What are the objectives of animal breeding?

Ans. A breed is a special variety of animals within a species. It is similar in most characters

such as general appearance, size, configuration, and features with other members of the same species. Jersey and Brown Swiss are examples of foreign breeds of cattle.

Objectives of animal breeding:

(i) To increase the yield of animals.

(ii) To improve the desirable qualities of the animal produce.

(iii) To produce disease-resistant varieties of animals.

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4. Name the methods employed in animal breeding. According to you which one of the methods is best? Why?

Ans. Animal breeding is the method of mating closely related individuals. There are several methods employed in animals breeding, which can be classified into the following categories:

(A) Natural methods of breeding include inbreeding and out-breeding. Breeding between animals of the same breed is known as inbreeding, while breeding between animals of different breeds is known as out-breeding. Out- breeding of animals is of three types:

(a). Out-crossing: In this type of out-breeding, the mating of animals occurs within the same breed. Thus, they have no common ancestors up to the last 4-5 generations.

(b). Cross-breeding: In this type of out-breeding, the mating occurs between different breeds of the same species, thereby producing a hybrid.

(c). Interspecific hybridization: In this type of out-breeding, the mating occurs between different species.

(B) Artificial methods of breeding include modern techniques of breeding. It involves controlled breeding experiments, which are of two types:-

(a). Artificial insemination: It is a process of introducing the semen (collected from the male) into the oviduct or the uterus of the female body by the breeder. This method of breeding helps the breeder overcome certain problems faced in abnormal mating.

(b). Multiple ovulation embryo technology (MOET): It is a technique for cattle improvement in which super-ovulation is induced by a hormone injection. Then, fertilization is achieved by artificial insemination and early embryos are collected. Each of these embryos are then transplanted into the surrogate mother for further development of the embryo. The best method to carry out animal breeding is the artificial method of breeding, which includes artificial insemination and MOET technology. These technologies are scientific in nature.

They help overcome problems of normal
mating and have a high success rate of crossing between mature males and females. Also, it ensures the production of hybrids with the desired qualities. This method is highly economical as a small amount of semen from the male
can be used to inseminate several cattle.

5. What is apiculture? How is it important in our lives?

Ans. Apiculture is the practice of bee-keeping for the production of various products such as honey, bee's wax, etc. Honey is a highly nutritious food source and is used as an indigenous system of medicines. Other commercial products obtained from honey bees include bee's wax and bee pollen. Bee's wax is used for making cosmetics, polishes, and is even used inseveral medicinal preparations. Therefore, to meet the increasing demand of honey, people have started practicing bee-keeping on a large scale. It has become an income generating activity for farmers since it requires a low investment and is labour intensive.

6. Discuss the role of fishery in enhancement of food production.

Ans. Fishery is an industry which deals with catching, processing, and marketing of fishes and other aquatic animals that have a high economic value. Some commercially important aquatic animals are prawns crabs, oysters, lobsters, and octopus.

Fisheries play an important role in the Indian economy. This is because a large part of the Indian population is dependent on fishes as a source of food, which is both cheap and high in animal protein. A Fishery is an employment generating industry especially for people staying in the coastal areas.

7. Briefly describe various steps involved in plant breeding.

Ans. The various steps involved in plant breeding are asfollows:
(a). Collection of genetic variability: Genetic variability from various wild relatives of the cultivated species are collected to maintain the genetic diversity of a species. The entire collection of the diverse alleles of a gene ina crop is called the germplasm collection.
(b). Evaluation of germplasm and selection of parents: The germplasm collected is then

evaluated for the desirable genes. The selected plants with the desired genes are then used as parents in plant breeding experiments and are multiplied by the process of hybridization.
(c). Cross-hybridization between selected parents: The next step in plant breeding is to combine the desirable characters present in two different parents to produce hybrids. It is a tedious job as one has to ensure that thepollen grains collected from the male parent reach the stigma of the female parent.
(d). Selection of superior hybrids: The progenies of the hybrids having the desired characteristics are selected through scientific evaluation. The selected progenies are then self-pollinated for several generations to ensurehomozygosity.
(e). Testing, release, and commercialization of new cultivars: The selected progenies are evaluated for characters such as yield, resistance to diseases, performance, etc. by growing them in research fields for at least threegrowing seasons in different parts of the country. After thorough testing and evaluation, the selected varieties are given to the farmers for growing in fields for a large-scale production.

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8. Explain what is meant by biofortification.

Ans. Biofortification is a process of breeding crops with higher levels of vitamins, minerals, proteins, and fat content. This method is employed to improve public health. Breeding of crops with improved nutritional quality is undertaken to improve the content of proteins, oil, vitamins, minerals, and micro-nutrients in crops. It is also undertaken to upgrade the quality of oil and proteins. An example of this is a wheat variety known as Atlas 66, which has high protein content in comparison to the existing wheat. In addition, there are several other improved varieties of crop plants such as rice,carrots, spinach etc. which have more nutritious value and more nutrients than the existing varieties.

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9. Which part of the plant is best suited for making virus-free plants and why?

Ans. Apical and axillary meristems of plants is used for making virus-free plants. In a diseased plant, only this region is not infected by the virus as compared to the rest of the plant region. Hence, the scientists remove axillary and apical meristems of the diseased plant and grow it in vitro to obtain adisease-free and healthy plant. Virus-free plants of banana, sugarcane, and potato have been obtained usingthis method by scientists.

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10. What is the major advantage of producing plants by micropropagation?

Ans. Micropropagation is a method of producing new plants in a short duration using plant tissue culture. Some major advantages of micropropagation are as follows:
(a) Micropropagation helps in the propagation of a large number of plants in a short span of time.
(b) The plants produced are identical to the mother plant. (c) It leads to the production of healthier plantlets, which exhibit better disease-resisting powers.

11. Find out what the various components of the medium used for propagation of explants in vitro are?

Ans. The major components of medium used for propagation of explants in vitro are carbon sources such as sucrose, inorganic salts, vitamins, amino acids, water, agar-agar, and certain growth hormones such as auxins and gibberellins.

12. Name any five hybrid varieties of crop plants which have been developed in India.
Ans. The five hybrid varieties of crop plants which have been developed in India are:

Crop Varieties

	Crop	**Varieties**
1.	Wheat	Himgiri
2.	Rice	Jaya, Ratna
3.	Brassica	Pusa Swarnim
4	Cow pea	Pusa Komal
5.	Chilli	Pusa Sadabahar

CBSE Class 12

Biology

Ch 10 – MICROBES IN HUMAN WELFARE

1. Bacteria cannot be seen with the naked eyes, but these can be seen with the help of a microscope. If you have to carry a sample from your home to your biology laboratory to demonstrate the presence of microbes under a microscope, which sample would you carry and why?

Ans. Curd can be used as a sample for the study of microbes. Curd contains numerous lactic acid bacteria (LAB) or Lactobacillus. These bacteria produce acids that coagulate and digest milk proteins. A small drop of curd contains millions of bacteria, which can be easily observed under a microscope.

2. Give examples to prove that microbes release gases during metabolism.

Ans. The examples of bacteria that release gases during metabolism are:

(a) Bacteria and fungi carry out the process of fermentation and during this process, they release carbon dioxide.

(b) The dough used for making idli and dosa gives a puffed appearance. This is because of the action of bacteria which releases carbon dioxide. This CO_2 released from the dough gets trapped in the dough, thereby giving it a puffed appearance.

3. In which food would you find lactic acid bacteria? Mention some of their useful applications.

Ans. Lactic acid bacteria can be found in curd. It is this bacterium that promotes the formation of milk into curd. The bacterium multiplies and increases its number, which converts the milk into curd. They also increase the content of vitamin B_{12} in curd. Lactic acid bacteria are also found in our stomach where it keeps a check on the disease-causing micro-organisms.

4. Name some traditional Indian foods made of wheat, rice and Bengal gram (or their products) which involve use of microbes.

Ans. (a) Wheat Product: Bread, cake, etc.
(b) Rice: Product: Idli, dosa
(c) Bengal gram: Product: Dhokla, Khandvi

5. In which way have microbes played a major role in controlling diseases caused by harmful bacteria?

Ans. Several micro-organisms are used for preparing medicines. Antibiotics are medicines produced by certain micro-organisms to kill other disease-causing micro-organisms. These medicines are commonly obtained from bacteria and fungi. They either kill or stop the growth of disease-causing micro-organisms. *Streptomycin, tetracycline, and penicillin* are common antibiotics. *Penicillium notatum* produces chemical penicillin, which checks the growth of staphylococci bacteria in the body. Antibiotics are designed to destroy bacteria by weakening their cell walls.

6. Name any two species of fungus, which are used in the production of the antibiotics.

Ans. Antibiotics are medicines that are produced by certain micro-organisms to kill other disease-causing micro-organisms. These medicines are commonly obtained from bacteria and fungi. The species of fungus used in the production of antibiotics are:

Antibiotic	Fungus source
Penicillin	Penicillium notatum
Cephalosporin	Cephalosporium acremonium

7. What is sewage? In which way can sewage be harmful to us?

Ans. Sewage is the municipal waste matter that is carried away in sewers and drains. It includes both liquid and solid wastes, rich in organic matter and microbes. Many of these microbes are pathogenic and can cause several water- borne diseases. Sewage water is a

major cause of polluting drinking water.

8. What is the key difference between primary and secondary sewage treatment?

Ans. Primary treatment involves the removal of large-sized floating and suspended solids by physical methods, While secondary treatment involves decomposition of organic matter by microbial action which produces methane, hydrogen sulphide and carbon dioxide.

9. Do you think microbes can also be used as source of energy? If yes, how?

Ans. Yes, microbes can be used as a source of energy. Bacteria such as Methane bacterium is used for the generation of gobar gas or biogas. The generation of biogas is an anaerobic process in a biogas plant, which consists of a concrete tank (10–15 feet deep) with sufficient outlets and inlets. The dung is mixed with water to form the slurry and thrown into the tank. The digester of the tank is filled with numerous anaerobic methane-producing bacteria, which produce biogas from the slurry. Biogas can be removed through the pipe which is then usedas a source of energy, while the spent slurry is removed from the outlet and is used as a fertilizer.

10. Microbes can be used to decrease the use of chemical fertilisers and pesticides. Explain how this can be accomplished.

Ans. Microbes play an important role in organic farming, which is done without the use of chemical fertilizers and pesticides. Bio-fertilizers are living organisms which help increase the fertility of soil. It involves the selection of beneficial micro-organisms that help in improving plant growth through the supply of plant nutrients. Bio- fertilizers are introduced in seeds, roots, or soil to mobilize the availability of nutrients. Thus, they are extremely beneficial in enriching the soil with organic nutrients. Many species of bacteria and cyanobacteria have the ability to fix free atmospheric nitrogen. Rhizobium is a symbiotic bacteria found in the root nodules of leguminous plants. Azospirillium and Azotobocter are free living nitrogen-fixing bacteria, whereas Anabena, Nostoc and Oscillitoria are examples of nitrogen-fixing cyanobacteria. Bio-fertilizers are cost effective and eco-friendly.
Microbes can also act as bio-pesticides to control insect pests in plants. An example of bio-pesticides is Bacillus thuringiensis, which produces a toxin that kills the insect pests. Dried

bacterial spores are mixed in water and sprayed in agricultural fields. When larvae of insects feed on crops, these bacterial spores enter the gut of thelarvae and release toxins, thereby it. Similarly, Trichoderma are free living fungi. They live in the roots of higher plants and protect them from various pathogens. Baculoviruses is another bio-pesticide that is used as a biological control agent against insects and other arthropods.

11. Three water samples namely river water, untreated sewage water and secondary effluent discharged from a sewage treatment plant were subjected to BOD test. The samples were labelled A, B and C; but the laboratory attendant did not note which was which. The BOD values of the three samples A, B and C were recorded as 20mg/L, 8mg/L and 400mg/L, respectively. Which sample of the water is most polluted? Can you assign the correct label to each assuming the river water is relatively clean?

Ans. The BOD values of the three samples A, Band C were recorded as 20 mg/L, 8 mg/L and 400 mg/L.
Greater the BOD of waste water more is its polluting potential. So, sample C is more polluting as compared to sample A.
Hence, sample A is the secondary effluent, sample B is river water and sample C is untreated sewage water.

12. Find out the name of the microbes from which cyclosporin A (an immuno-suppressive drug) and statins (blood cholesterol-lowering agents) are obtained.

Ans. (a) Cyclosporin A is produced by the fungus*Trichoderma polysporum*.

(b) Statins are produced by the yeast *Monascus purpureus* which acts as a blood cholesterol-lowering agent.

13. Find out the role of microbes in the following and discuss it with your teacher.
(a) Single cell protein (SCP)
(b) Soil

Ans. (a) Single cell protein (SCP)
A single cell protein is a protein obtained from certain microbes, which forms an alternate

source of proteins in animal feeds. The microbes involved in the preparation of single cell proteins are algae, yeast, or bacteria. These microbes are grown on an industrial scale to obtain the desired protein. For example, *Spirulina* can be grown on waste materials obtained from molasses, sewage, and animal manures. It serves as a rich supplement of dietary nutrients such as proteins, carbohydrate, fats, minerals, and vitamins. Similarly, micro-organisms such as Methylophilus and methylotrophus have a large rate of biomass production. Their growth can produce a large amount of proteins.

(b) Soil Microbes play an important role in maintaining soil fertility. They help in theformation of nutrient-rich humus by the process of decomposition. Many species of bacteria and cyanobacteria have the ability to fix atmospheric nitrogen into usable form. Rhizobium is a symbiotic bacteria found in the root nodules of leguminous plants. Azospirillium and Azotobocter are free living nitrogen-fixing bacteria, whereas Anabena, Nostoc, and Oscillitoria are examples of nitrogen-fixing cyanobacteria.

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14. Arrange the following in the decreasing order (most important first) of their importance, for the welfare of human society. Give reasons for your answer. Biogas, Citric acid, Penicillin and Curd

Ans. The order of arrangement of products according to their decreasing importance is:
Penicillin - Biogas – Citric acid – Curd
Penicillin is the most important product for the welfare of human society. It is an antibiotic, which is used for controlling various bacterial diseases. The second most important product is biogas. It is an eco-friendly source of energy. The next important product is citric acid, which is used as a food preservative. The least important product is curd, a food item obtained by the action of lactobacillus bacteria on milk Hence, the products in the decreasing order of their importance are as follows:
Penicillin - Biogas – Citric acid – Curd

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15. How do biofertilisers enrich the fertility of the soil?

Ans. Bio-fertilizers are living organisms which help in increasing the fertility of soil. It involves the selection of beneficial micro-organisms that help in improving plant growth through the supply of plant nutrients. These are introduced to seeds, roots,or soil to mobilize

the availability of nutrients by their biological activity. Thus, they are extremely beneficial in enriching the soil with organic nutrients. Many species of bacteria and cyanobacteria have the ability to fix free atmospheric nitrogen. Rhizobium is a symbiotic bacteria found in the root nodules of leguminous plants. Azospirillium and Azotobocter are free living nitrogen-fixing bacteria, whereasAnabena, Nostoc, and Oscillitoria are examples of nitrogen-fixing cyanobacteria. Bio- fertilizers are cost effective and eco-friendly.

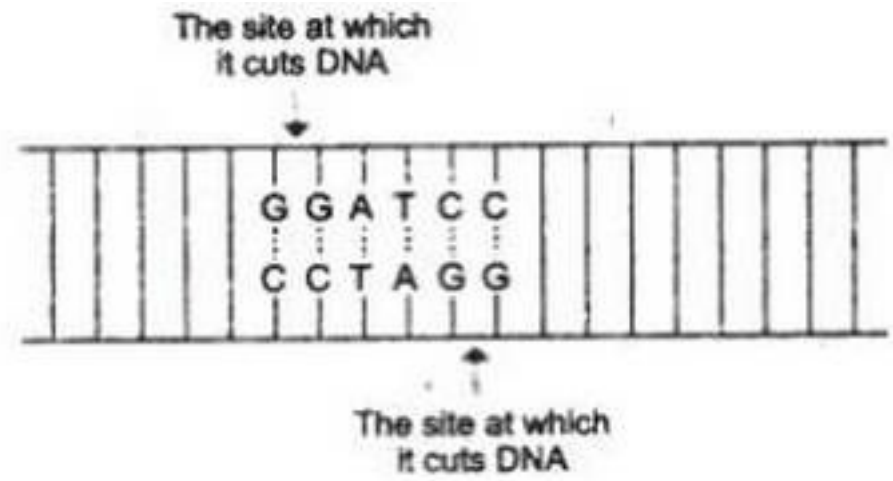
16. Can you list 10 recombinant proteins which are used in medical practice? Find out where they are used as therapeutics (use the internet).

Ans.

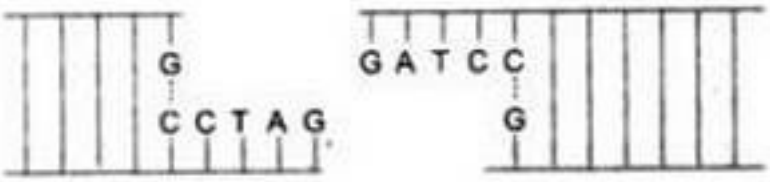
	Recombinant protein	Therapeutic use
1.	Insulin	Treatment for type I diabetes mellitus
2.	Interferon-α	Used for chronic hepatitis C
3.	Interferon -β	Used for herpes and viral enteritis
4.	Coagulation factor VII	Treatment of haemophilia A
5.	Coagulation factor IX	Treatment of haemophilia B
6.	DNAase I	Treatment of cystic fibrosis
7.	Anti-thrombin III	Prevention of blood clot
8.	Interferon B.	For treatment of multiple sclerosis
9.	Human recombinant growth hormone	For promoting growth in an individual
10.	Tissue plasminogen activator	Treatment of acute myocardial infection

17. Make a chart (with diagrammatic representation) showing a restriction enzyme, the substrate DNA on which it acts, the site at which it cuts DNA and the products it produces.

Ans. The substrate DNA on which a restriction enzyme acts:



The products it produces:



18. From what you have learnt, can you tell whether enzymes are bigger or DNA is bigger in molecular size? How did you know?

Ans. The molecular size of DNA molecules is more than that of enzymes. It is because an enzyme (protein) is synthesised from a segment of DNA called the gene.

CBSE Class 12

Biology

Ch 11 – Biotechnology : Principles and Processes

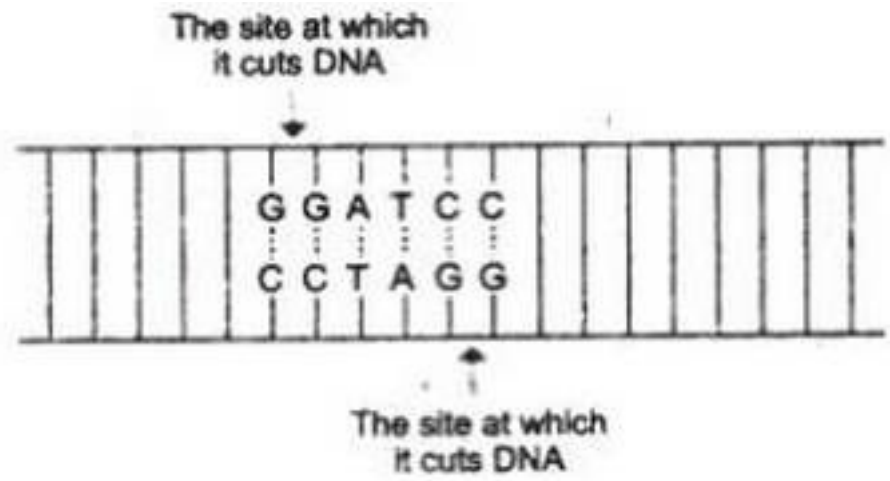
1. Can you list 10 recombinant proteins which are used in medical practice? Find out where they are used as therapeutics (use the internet).

Ans.

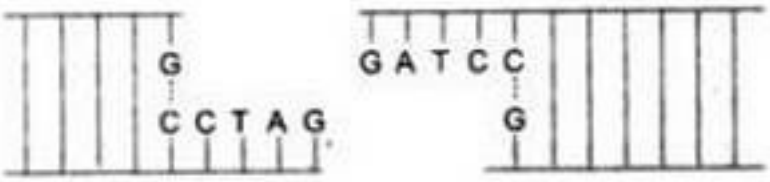
Recombinant Proteins	Therapeutic uses
(a) Insulin	Used for diabetes mellitus
(b) OKT-3	Therapeutic antibody, used for reversal of transplantation rejection
(c) DNase	Treatment of cystic fibrosis
(d) Reo Pro	Prevention of blood clots
(e) Blood clotting factor VIII	Treatment of haemophilia A
(f) Blood clotting factor IX	Treatment of haemophilia B
(g) Tissue plasminogen activator	For acute myocardial infarction
(h) Interferon alpha (INF alpha)	Used for hepatitis C
(i) Interferon beta (INF beta)	Used for multiple sclerosis
(j) Interferon gamma (INF gamma)	Used for granulomatous disease

2. Make a chart (with diagrammatic representation) showing a restriction enzyme, the substrate DNA on which it acts, the site at which it cuts DNA and the products it produces.

Ans. The substrate DNA on which a restriction enzyme acts:



The products it produces:



3. From what you have learnt, can you tell whether enzymes are bigger or DNA is bigger in molecular size? How did you know?

Ans. The molecular size of DNA molecules is more than that of enzymes. It is because an enzyme (protein) is synthesised from a segment of DNA called the gene.

4. What would be the molar concentration of human DNA in a human cell? Consult your teacher.

Ans. The average molecular weight of a nucleotide in human DNA is 130.86. The molecular weight of human DNA will therefore be 6 x 10^9 nucleotides (based on the human genome project) x 130.86 = 784.56 x 109 gm/mol. The molar concentration of DNA can be calculated accordingly.

5. Do eukaryotic cells have restriction endonucleases? Justify you answer.

Ans. No. Eukaryotic cells do not have restriction endonucleases. All the restriction endonucleases have been isolated from the various strains of bacteria and they are also named according to the genus and species of prokaryotes. The first letter of the enzyme comes from the genus and the second two letters come from the species of the prokaryotic

cell from which they have been isolated.

6. Besides better aeration and mixing properties, what other advantages do stirred tank bioreactors have over shake flasks?

Ans. Shake flasks are used for growing microbes and mixing the desired materials on a small scale in the laboratory. However, the large-scale production of a desired biotechnological product requires large stirred tank bioreactors.

Besides better aeration and mixing properties, bioreactors have the following advantages:

i.It has an oxygen delivery system.

ii.It has a foam control, temperature and pH control system.

iii.Small volumes of culture can be withdrawn periodically.

7. Collect 5 examples of palindromic DNA sequences by consulting your teacher. Better try to create a palindromic sequence by following base-pair rules.

Ans. Some palindromic DNA sequences and the restriction enzymes which act on them are

(i) 5'-AGCT-3'AluI (*Arthrobacter luteus*)

3'-TCGA-5'

(ii) 5'-GAATTC-3'EcoRI (*Escherichia coli*)

3'-CTTAAG-5'

(iii) 5'-AAGCTT-3'HindIII (*Haemophilus influenzae*)

3'-TTCGAA-5'

(iv) 5'-GTCGAC-3'SalI (*Streptomyces albus*)

3'-CAGCTG-5'

(v) 5'-CTGCAG-3'PstI (*Providencia stuartii*)

3'-GACGTC-5'

8. Can you recall meiosis and indicate at what stage a recombinant DNA is made?

Ans. A recombinant DNA is made in the pachytene stage of prophase I by crossing over during meiosis cell division.

9. Can you think and answer how a reporter enzyme can be used to monitor transformation of host cells by foreign DNA in addition to a selectable marker?

Ans. Reporter enzyme can differentiate recombinants from non-recombinants on the basis of their ability to produce a specific colour in the presence of a chromogenic substrate. DNA is inserted within the coding sequence of the enzyme β-galactosidase. This results into inactivation of the enzyme which is referred to as insertional inactivation.

The presence of a chromogenic substrate gives blue-coloured colonies if the plasmid in the bacteria does not have an insert. The presence of the insert results in insertional inactivation of β-galactosidase and the colonies do not produce any colour. These are identified as recombinant colonies.

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10. Describe briefly the following:
(a) Origin of replication
(b) Bioreactors
(c) Downstream processing

Ans. (a) Origin of replication (ori): This is a sequence from where replication starts and any piece of DNA when linked to this sequence can be made to replicate within the host cells. This sequence is also responsible for controlling the copy number of the linked DNA. So, if one wants to recover many copies of the target DNA it should be cloned in a vector whose origin supports a high copy number.

(b) Bioreactors: Bioreactors are vessels in which raw materials are biologically converted into specific products, individual enzymes etc. using microbial plant, animal or human cells. A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions (temperature, pH, substrate, salts, vitamins, oxygen). The most commonly used bioreactors are of stirring type. A biogas plant is a good example of a bioreactor.

(c) Downstream processing: After completion of the biosynthetic stage, the product is subjected through a series of processes before it is ready for marketing as a finished product. The processes include separation and purification, which are collectively referred to as downstream processing. The product has to be formulated with suitable preservatives. Such formulation has to undergo thorough clinical trials as in the case of drugs. Strict quality control testing for each product is also required. Downstream processing and quality control testing vary from product to product.

11. Explain briefly

(a) PCR

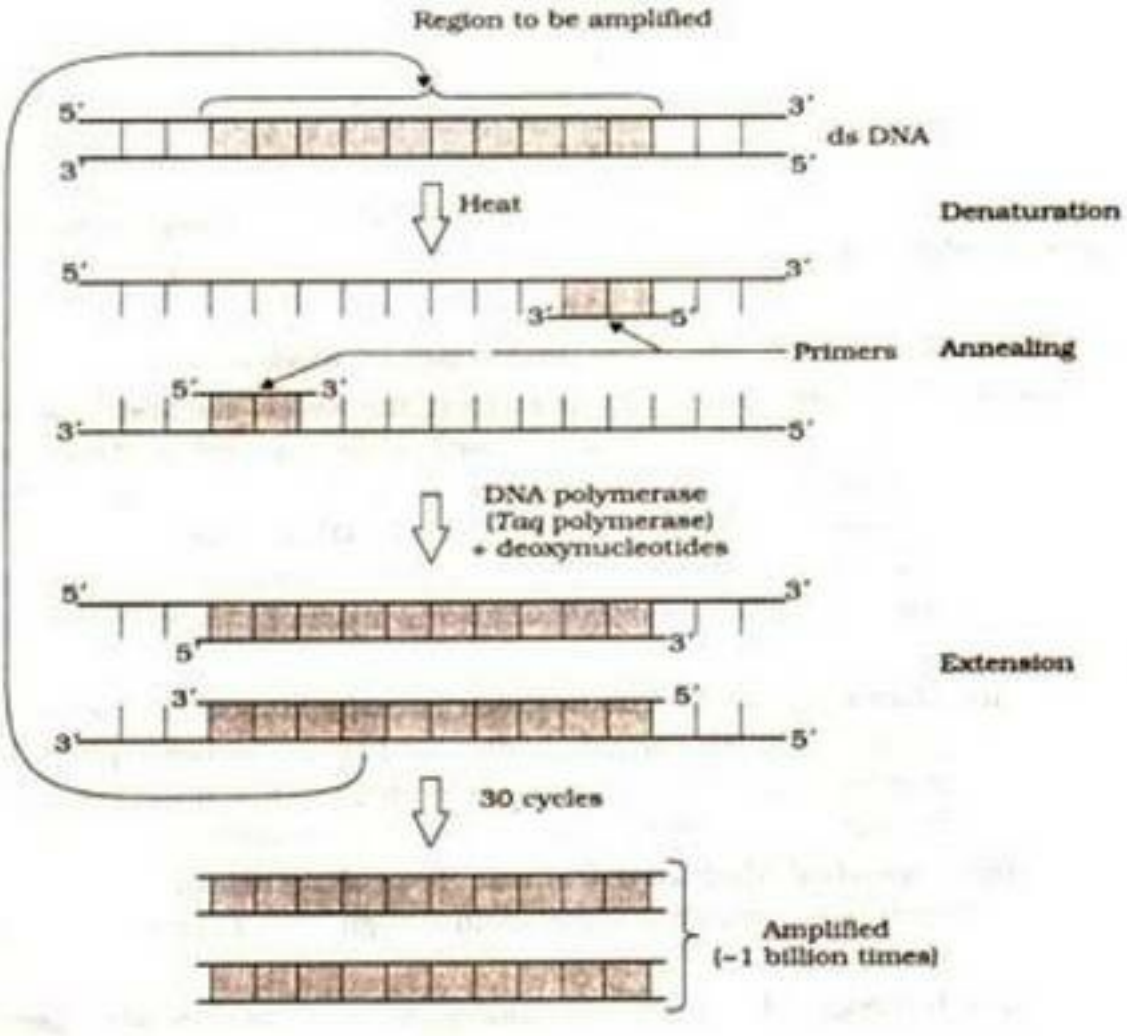
(b) Restriction enzymes and DNA

(c) Chitinase

Ans. (a) process of polymerase chanin reaction (PCR).:enaturation: Double-stranded DNA is converted to single-stranded DNA, often achieved by heating or alkaline conditions. This is called 'melting' of DNA.

ii.Annealing: The two sets of primers undergo the biochemical process of annealing at an optimum temperature of 40-65?C.

iii.Extension: The enzyme DNA polymerase extends the primers using the nucleotides provided in the reaction and the genomic DNA as the template.



If the process of replication of DNA is repeated many times, the segment of DNA can be

amplified to approximately a billion times. Such repeated amplification is achieved by the use of a thermostable DNA polymerase and the amplified fragment if desired can be used to ligate with a vector for further cloning.

(b) Restriction enzymes and DNA: Restriction enzymes are synthesised by microbes as a defence mechanism and are specifically endonucleases which cleave the double-stranded DNA with the desired genes. This activity occurs at a limited number of sites depending on the number of recognition sequences in DNA. Lysing enzymes, synthesising enzymes (DNA polymerase and reverse transcriptase) and ligases are also tools of genetic engineering.

(c) Chitinase: During the isolation of DNA in the processes of recombinant DNA technology, the fungal cell is heated with an enzyme called chitinase. The chitinase enzyme dissolves the chitin membrane to open the cell for release of DNA along with other macromolecules such as RNA, proteins, polysaccharides and lipids.

12. Discuss with your teacher and find out how to distinguish between

(a) Plasmid DNA and Chromosomal DNA

(b) RNA and DNA

(c) Exonuclease and Endonuclease

Ans. (a)

Plasmid DNA	Chromosomal DNA
Plasmid DNA is the naked double-stranded DNA which forms a circle with no free ends. It is associated with few proteins but contains RNA polymerase enzyme. They are smaller than the host chromosomes and can be easily separated.	Chromosomal DNA is a double-stranded linear DNA molecule associated with large proteins. This DNA exists in relaxed and supercoiled forms and provides a template for replication and transcription. It has free ends represented as 3'-5'.

(b)

DNA	RNA
i.It is mainly confined to the nucleus. A	

small quantity occurs in mitochondria and chloroplasts. ii.Its quantity is constant in each cell of a species. iii.It contains deoxyribose sugar. iv.Its pyrimidines are adenine and thymine. v.The amount of adenine is equal to the amount of thymine. Also, the amount of cytosine is equal to the amount of guanine. vi.It can replicate itself.	i.It mainly occurs in the cytoplasm. A small quantity is found in the nucleus. ii.Its quantity varies in different cells. iii.It contains ribose sugar. iv.Its pyrimidines are adenine and uracil. v.Adenine and uracil are not necessarily in equal amounts, nor are cytosine and guanine necessarily in equal amounts. vi.It cannot replicate itself. It is formed by DNA. Some RNA viruses (paramyxo virus) can produce RNA from an RNA template.

(c) Exonucleases are nucleases which cut off the nucleotides from the 5' or 3' ends of a DNA molecule, whereas endonucleases are nucleases which cleave the DNA duplex at any point except at the ends.

CBSE Class 12 Biology
Ch 13 – Organisms and Populations

1. How is diapause different from hibernation?

Ans. Diapause is a stage of suspended development to cope with unfavourable conditions. Many species of Zooplankton and insects exhibit diapause to tide over adverse climatic conditions during their development. On the other hands Hibernation or winter sleep is a resting stage where in animals escape winters (cold) by hiding themselves in their shelters. They escape the winter season by entering a state of inactivity by slowing their metabolism. The phenomenon of hibernation is exhibited by bats, squirrels, and other rodents.

2. If a marine fish is placed in a fresh water aquarium, will the fish be able to survive? Why or why not?

Ans. If a marine fish is placed in a fresh water aquarium, then its chances of survival will diminish. This is because their bodies are adapted to high salt concentrations of the marine environment. In fresh water conditions, they are unable to regulate the water entering their body (through osmosis). Water enters their body due to the hypotonic environment outside. This results in the swelling up of the body, eventually leading to the death of the marine fish.

3. Most living organisms cannot survive at temperature above 45°C°. How are some microbes able to live in habitats with temperatures exceeding 100°C?

Ans. Archaebacteria (Thermophiles) are ancient forms of bacteria found in hot water springs and deep sea hydrothermal vents. They are able to survive in high temperatures because their bodies have adapted to such environmental conditions. These organisms contain specialized thermo-resistant enzymes, which carry out metabolic functions that do not get destroyed at such high temperatures unlike othe enzymes.

4. List the attributes that populations but not individuals possess.

Ans. The main attributes of a population residing in a given area are:-

a. Birth rate (Natality): It is the ratio of live births in an area to the population of an area. It is expressed as the number of individuals added to the population with respect to the

members of the population.

b. Death rate (Mortality): It is the ratio of deaths in an area to the population of an area. It is expressed as the loss of individuals with respect to the members of the population.
c. Sex ratio: It is the number of males or females per thousand individuals.
d. Age Distribution: It is the percentage of individuals of different ages in a given population. At any given time, the population is composed of individuals that are present in various age groups. The age distribution pattern is commonly represented through age pyramids.
e. Population density: It is defined as the number of individuals of a population present per unit area at a given time.

5. If a population growing exponentially double in size in 3 years, what is the intrinsic rate of increase (r) of the population?

Ans. A population grows exponentially if sufficient amounts of food resources are available to the individual. Its exponential growth can be calculated by the following integral form of the exponential growth equation:

Nt = No ert

Where,

Nt= Population density after time t

NO= Population density at time zero

r = Intrinsic rate of natural increase

e = Base of natural logarithms (2.71828)

From the above equation, we can calculate the intrinsic rate of increase (r) of a population.

Now, as per the question,

Present population density = x

Then, Population density after two years = 2x

t = 3 years

Substituting these values in the formula, we get:

⇒ 2x = x e3r

⇒ 2 = e3r

Applying log on both sides:

⇒ log 2 = 3r log e

$$\frac{\log 2}{3 \log e} = r$$

$$\frac{\log 2}{3\times 0.434} = r$$
$$\frac{0.301}{3\times 0.434} = r$$
$$\frac{0.301}{1.302} = r$$
$$0.2311 = r$$

Hence, the intrinsic rate of increase for the above illustrated population is 0.2311.

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6. Name important defence mechanisms in plants against herbivory.

Ans. Several plants have evolved various mechanisms both morphological and chemical to protect themselves against herbivory.

1. **Morphological defence mechanisms:**
   a. Cactus leaves (Opuntia) are modified into sharp spines (thorns) to deter herbivores from feeding on them.
   b. Sharp thorns along with leaves are present in Acacia to deter herbivores.
   c. In some plants, the margins of their leaves are spiny or have sharp edges that prevent herbivores from feeding on them.
2. **Chemical defence mechanisms:**
   a. All parts of Calotropis weeds contain toxic cardiac glycosides, which can prove to be fatal if ingested by herbivores.
   b. Chemical substances such as nicotine, caffeine, quinine, and opium are produced in plants as a part of self-defense.

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7. An orchid plant is growing on the branch of mango tree. How do you describe this interaction between the orchid and the mango tree?

Ans. An orchid growing on the branch of a mango tree is an epiphyte. Epiphytes are plants growing on other plants which however, do not derive nutrition from them. Therefore, the relationship between a mango tree and an orchid is an example of commensalisms, where one species gets benefited while the other remains unaffected. In the above interaction, the orchid is benefited as it gets support while the mango tree remains unaffected.

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8. What is the ecological principle behind the biological control method of managing with pest insects?

Ans. The basis of various biological control methods is on the concept of predation.

Predation is a biological interaction between the predator and the prey, whereby the predator feeds on the prey. Hence, the predators regulate the population of preys in a habitat, thereby helping in the management of pest insects.

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9. Distinguish between the following:
(a) Hibernation and Aestivation
(b) Ectotherms and Endotherms
Ans.

a. Hibernation is the stage of dormancy in winter, while aestivation is the stage of dormancy in summer. Many animals use this technique to tide over unfavourable environmental conditions.
b. Ectotherms are cold-blooded animals with body temperature change with the environmental temperature, while endotherms are warm-blooded animals which can regulate their body temperature by physiological means and maintain more or less constant internal temperature.

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10. Write a short note on
(a) Adaptations of desert plants and animals
(b) Adaptations of plants to water scarcity
(c) Behavioural adaptations in animals
(d) Importance of light to plants
(e) Effect of temperature or water scarcity and the adaptations of animals.
Ans.

a. **Adaptations of desert plants and animals**
    i. **Adaptations of desert plants:** Plants have an extensive root system to tap underground water. They bear thick cuticles and sunken stomata on the surface of their leaves to reduce transpiration. In Opuntia, the leaves are entirely modified into spines and photosynthesis is carried out by green stems. Desert plants have special pathways to synthesize food, called CAM (C4 pathway). It enables the stomata to remain closed during the day to reduce the loss of water through transpiration.
    ii. **Adaptations of desert animals:** Animals found in deserts such as desert kangaroo rats, lizards, snakes, etc. are well adapted to their habitat. The kangaroo rat found in

the deserts of Arizona never drinks water in its life. It has the ability to concentrate its urine to conserve water. Desert lizards and snakes bask in the sun during early morning and burrow themselves in thesand during afternoons to escape the heat of the day. These adaptations occur in desert animals to prevent the loss of water.

b. **Adaptations of plants to water scarcity**
Plants found in deserts are well adapted to cope with water scarcity and scorching heat of the desert. Plants have an extensive root system to tap underground water. They bear thick cuticles and sunken stomata on the surface of their leaves to reduce transpiration. In Opuntia, the leaves are modified into spines and the process of photosynthesis iscarried out by green stems. Desert plants have special pathways to synthesize food, called CAM (C4 pathway). It enables their stomata to remain closed during the day to reduce water loss by transpiration.

c. **Behavioural adaptations in animals**
Certain organisms are affected by temperature variations. These organisms undergo adaptations such as hibernation, aestivation, migration, etc. to escape environmental stress to suit their natural habitat. These adaptations in the behaviour of an organism are called behavioural adaptations. For example, ectothermal animals and certain endotherms exhibit behavioral adaptations. Ectotherms are cold blooded animals such as fish, amphibians, reptiles, etc. Their temperature varies with their surroundings. For example, the desert lizard basks in the sun during early hours when the temperature is quite low. However, as the temperature begins to rise, the lizard burrows itself inside the sand to escape the scorching sun. Similar burrowing strategies are exhibited by otherdesert animals. Certain endotherms (warm-blooded animals) such as birds and mammals escape cold and hot weather conditions by hibernating during winters and aestivating during summers. They hide themselves in shelters such as caves, burrows, etc. to protect against temperature variations.

d. **Importance of light to plants**
Sunlight acts as the ultimate source of energy for plants. Plants are autotrophic organisms, which need light for carrying out the process of photosynthesis. Light also plays an important role in generating photoperiodic responses occurring in plants. Plants respond to changes in intensity of light during various seasons to meet their photoperiodic requirements for flowering. Light also plays an important role in aquatic habitats for vertical distribution of plants in the sea.

e. **Effects of temperature or water scarcity and the adaptations of animals**
Temperature is the most important ecological factor. Average temperature on the Earth varies from one place to another. These variations in temperature affect the distribution of animals on the Earth. Animals that can tolerate a wide range of temperature are called eurythermals. Those which can tolerate a narrow range of temperature are called stenothermal animals. Animals also undergo adaptations to suit their natural habitats. animals found in Polar regions have thick layers of fat below their skin and thick coats of fur to prevent the loss of heat. Some organisms exhibit various behavioural changes to suit their natural habitat. These adaptations present in the behaviour of an organism to escape environmental stresses are called behavioural adaptations. For example, desert lizards are ectotherms. This means that they do not have a temperature regulatory mechanism to escape temperature variations. These lizards bask in the sun during early hours when the temperature is quite low. As the temperature begins to increase, the lizard burrows itself inside the sand to escape the scorching sun. Similar burrowing strategy is seen in other desert animals.
Water scarcity is another factor that forces animals to undergo certain adaptations to suit their natural habitat. Animals found in deserts such as desert kangaroo rats, lizards, snakes, etc. are well adapted to stay in their habitat. The kangaroo rat found in the deserts of Arizona never drinks water in its life. It has the ability to concentrate its urine to conserve water. Desert lizards and snakes bask in the sun during early morning and burrow in the sand as the temperature rises to escape the heat of the day. Such adaptations can be seen to prevent the loss of water.

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11. List the various abiotic environmental factors.

Ans. A non-living conditional factor or thing of the environment that influences the survival and reproduction functions of organism is called an abiotic factor. Abiotic factors can determine which species of organisms will survive in a given environment. Some important factors are discussed below:

Temperature: It is the most ecologically significant environmental factor. It varies seasonally on land and decreases progressively from the equator towards the poles and from plains to the mountain tops. It ranges from sub-zero levels in polar areas and high altitudes to >50°C in tropical deserts in summer.

There are also certain unique habitats such as thermal springs, deep sea hydrothermal vents

where the average temperature exceeds 100°C.
Physiological functions as well as - geographical distribution of plants and animals are governed by the temperature conditions and their thermal tolerance.
Organisms which can tolerate and thrive in a wide range of temperatures are called eurythermal, e.g. most mammals and birds while organisms which can tolerate a narrow range of temperatures are called stenothermal, e.g. polar bear, amphibians.
Water: It is the second most important factor influencing life of organisms. Life on earth is known to have originated in water and cannot sustain without it. The productivity and distribution of plants is dependent on availability of water.
For aquatic organisms, pH, chemical composition and temperature of water is important. They are also affected by the salinity of water, which is less than 5 parts per thousand in inland waters, 30-35 parts per thousand in sea and 100 parts per thousand in some hypersaline lagoons.
Organisms which can tolerate a wide range of salinity are called euryhaline while organisms which can tolerate a narrow range of salinity are called stenohaline. Many freshwater animals cannot live for long in sea water because of osmotic problems arising due to high salinity and vice-versa.
Light: The significance of light lies in the fact that all autotrophs depend upon light as a source of energy for preparing their food by photosynthesis and release oxygen during the process. Therefore, it is an important factor for life to exist on earth. Small herbs and shrubs growing in forests are adapted to photosynthesise under very low light intensities, because they are overshadowed by the tall, canopied trees. Most plants depend on sunlight to meet their photoperiodic requirement for flowering also.
Many animals depend upon diurnal and seasonal variations in light intensity as cues for timing their foraging, reproductive and migratory activities. The availability of light on land is closely linked with that of temperature as the sun is the source for both. However, in deep oceans (> 500m), the environment is perpetually dark.
The spectral' quality of solar radiation is also important for life. The UV component of light is harmful for many organisms. Different components of the visible spectrum are available for marine plants living at different depths of the ocean. This is why different types of algae, i.e. green, brown and red algae occur at different depths in sea in the upper, middle and deep layers of water respectively.
Soil: The nature and properties of soil in different places vary significantly. It is dependent

mainly on the following factors:

a. Climate
b. Weathering process
c. Whether soil is transported or sedimentary
d. Soil development process

Water holding capacity and percolation of the soil is determined by its various characteristics, such as soil composition, grain size and aggregation.
These characteristics of soil along with its pH, mineral composition, topography, etc., determine the type of plants that can grow in a particular habitat and the type of animals that can feed on them. In aquatic environment also, the bottom sediments and its characteristics determine the type of benthic animals that can live there.

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12. Give an example for:
(a) An endothermic animal
(b) An ectothermic animal
(c) An organism of benthic zone
Ans.

a. Endothermic animal: Birds such as crows, sparrows, pigeons, cranes, etc. and mammals such as bears, cows, rats, rabbits, etc. are endothermic animals.
b. Ectothermic animal: Fishes such as sharks, amphibians such as frogs, and reptiles such as tortoise, snakes, and lizards are ectothermic animals.
c. Organism of benthic zone: Decomposing bacteria is an example of an organism found in the benthic zone of a water body.

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13. Define population and community.
Ans. Population: A population can be defined as a group of individuals of the same species residing in a particular geographical area at a particular time and functioning as a unit. For example, all human beings living at a particular place at a particular time constitute the population of humans.
Community: A community is defined as a group of individuals of different species, living within a certain geographical area. Such individuals can be similar or dissimilar, but cannot

reproduce with the members of other species.

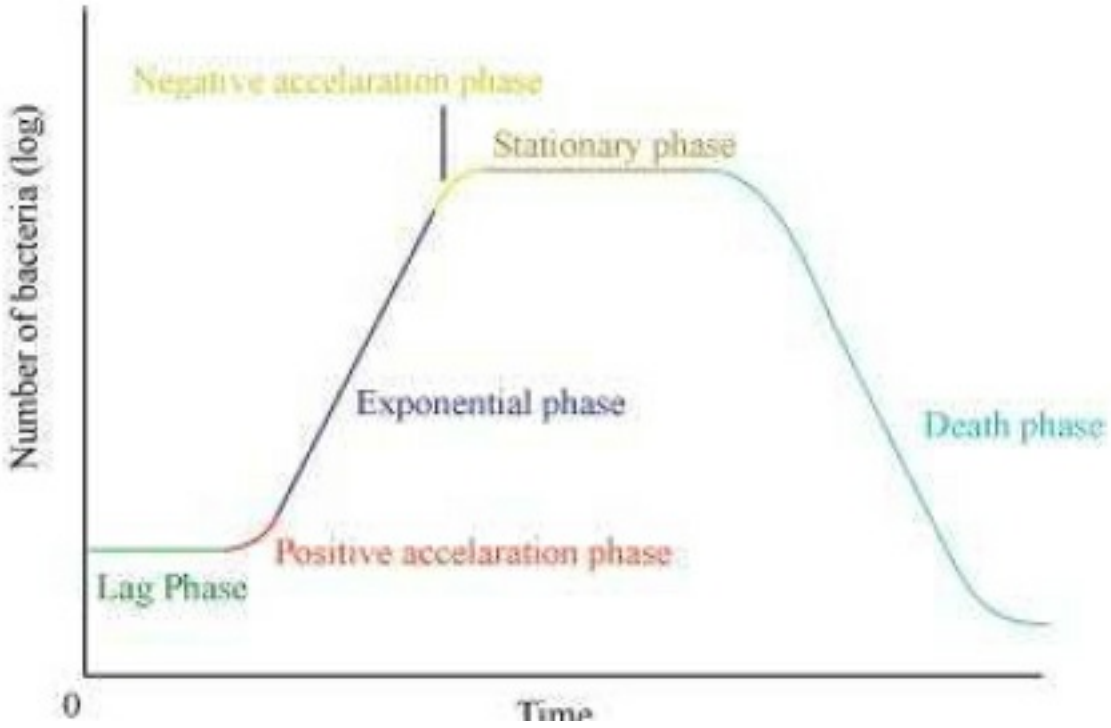
14. Define the following terms and give one example for each:
(a) Commensalism
(b) Parasitism
(c) Camouflage
(d) Mutualism
(e) Interspecific competition
Ans.

a. **Commensalism:** Commensalism is an interaction between two species in which one species gets benefited while the other remains unaffected. An orchid growing on the branches of a mango tree and barnacles attached to the body of whales are examples of commensalisms.
b. **Parasitism:** It is an interaction between two species in which one species (usually smaller) gets positively affected, while the other species (usually larger) is negatively affected. An example of this is liver fluke. Liver fluke is a parasite that lives inside the liver of the host body and derives nutrition from it. Hence, the parasite is benefited as it derives nutrition from the host, while the host is negatively affected as the parasitereduces the host fitness, making its body weak.
c. **Camouflage:** It is a strategy adapted by prey species to escape their predators. Organisms are cryptically coloured so that they can easily mingle in their surroundings and escape their predators. Many species of frogs and insects camouflage in their surroundings and escape their predators.
d. **Mutualism:** It is an interaction between two species in which both species involved are benefited. For example, lichens show a mutual symbiotic relationship between fungi and blue green algae, where both are equally benefited from each other.
e. **Interspecific competition:** It is an interaction between individuals of different species where both species get negatively affected. For example, the competition between flamingoes and resident fishes in South American lakes for common food resources i.e., zooplankton.

15. With the help of suitable diagram describe the logistic population growth curve.

Ans. The logistic population growth curve is commonly observed in yeast cells that are grown under laboratory conditions. It includes five phases: the lag phase, positive acceleration phase, exponential phase, negative acceleration phase, and stationary phase.

a. Lag phase: Initially, the population of the yeast cell is very small. This is because of the limited resource present in the habitat.
b. Positive acceleration phase: During this phase, the yeast cell adapts to the new environment and starts increasing its population. However, at the beginning of this phase, the growth of the cell is very limited.
c. Exponential phase: During this phase, the population of the yeast cell increases suddenly due to rapid growth. The population grows exponentially due to the availability of sufficient food resources, constant environment, and the absence of any interspecific competition. As a result, the curve rises steeply upwards.
d. Negative acceleration phase: During this phase, the environmental resistance increases and the growth rate of the population decreases. This occurs due to an increased competition among the yeast cells for food and shelter.
e. Stationary phase: During this phase, the population becomes stable. The number of cells produced in a population equals the number of cells that die. Also, the population of the species is said to have reached nature's carrying-capacity in its habitat.



A Verhulst–pearl logistic curve is also known as an S-shaped growth curve.

16. Select the statement which explains best parasitism.

(a) One organism is benefited.

(b) Both the organisms are benefited.

(c) One organism is benefited, other is not affected.

(d) One organism is benefited, other is affected.

Ans. (d) One organism is benefited, other is affected.

Parasitism is an interaction between two species in which one species (parasite) derives benefit while the other species (host) is harmed.

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17. List any three important characteristics of a population and explain

Ans. Three important characteristics of a population are:

a. Birth rate (Natality): It is the ratio of live births in an area to the population of an area. It is expressed as the number of individuals added to the population with respect to the members of the population.
b. Death rate (Mortality): It is the ratio of deaths in an area to the population of an area. It is expressed as the loss of individuals with respect to the members of the population.
c. Age Distribution: It is the percentage of individuals of different ages in a given population. At any given time, a population is composed of individuals that are present in various age groups. The age distribution pattern is commonly represented through age pyramids.

CBSE Class 12

Biology

Ch 14 – ECOSYSTEM

1. Fill in the blanks.

(a) Plants are called as_____ because they fix carbon dioxide.

(b) In an ecosystem dominated by trees, the pyramid (of numbers) is _____ type.

(c) In aquatic ecosystems, the limiting factor for the productivity is _____.

(d) Common detritivores in our ecosystem are_____.

(e) The major reservoir of carbon on earth is_____.

Ans. (a) Producers

(b) Upright

(c) Availability of sunlight

(d) Bacteria, fungi and earthworm

(e) Oceans

2. Which one of the following has the largest population in a food chain?

(a) Producers

(b) Primary consumers

(c) Secondary consumers

(d) Decomposers

Ans. (d) Decomposers

Decomposers include micro-organisms such as bacteria and fungi. They form the largest population in a food chain and obtain nutrients by breaking down the remains of dead plants and animals.

3. The second trophic level in a lake is-

(a) Phytoplankton

(b) Zooplankton

(c) Benthos
(d) Fishes

Ans. (b) Zooplankton
Zooplankton are primary consumers in aquatic food chains that feed upon phytoplankton. Therefore, they are present at the second trophic level in a lake.

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4. Secondary producers are
(a) Herbivores
(b) Producers
(c) Carnivores
(d) None of the above

Ans. (d) None of the above
Plants are the only producers. Thus, they are called primary producers. There are no other producers in a food chain.

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5. What is the percentage of photosynthetically active radiation (PAR), in the incident solar radiation.
(a) 100%
(b) 50 %
(c) 1-5%
(d) 2-10%

Ans. (b) 50%
Out of total incident solar radiation, about fifty percent of it forms photosynthetically active radiation or PAR.

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6. Distinguish between
(a) Grazing food chain and detritus food chain
(b) Production and decomposition
(c) Upright and inverted pyramid
(d) Food chain and Food web
(e) Litter and detritus

(f) Primary and secondary productivity

Ans. (a) Grazing food chain and detritus food chain

Grazing Food Chain	Detritus Food Chain
i. Energy for the food chain comes from the Sun.	i. Energy comes from detritus (organic matter).
ii. First trophic level organisms are producers.	ii. First trophic level organisms are detritivores and decomposers.

(b) Production and decomposition

Production	Decomposition
i. It refers to the process of synthesis of organic compounds from inorganic substances utilising sunlight.	i. It is the phenomenon of degradation of waste biomass.
ii. Example: Plants perform the function of production of food.	ii. Example: Bacteria and fungi decompose dead organic matter.

(c) Upright pyramid and inverted pyramid

Upright Pyramid	Inverted Pyramid
When the number of producers or their biomass is maximum in an ecosystem and it decreases progressively at each trophic level in a food chain, an upright pyramid is formed.	When the number of individuals or their biomass at the producer level is minimum and it increases progressively at each trophic level in a food chain, an inverted pyramid is formed.

(d) Food chain and food web

Food Chain	Food Web
i. A food chain is a single pathway where energy is transferred from producers to successive orders of consumers.	i. A food web is a network of various food chains which are interconnected with each other like an interlocking pattern.
ii. All food chains start with green plants which are the original source of all food.	ii. It has many linkages and intercrosses among producers and consumers.

(e) Litter and detritus

Litter	Detritus
The dead remains of plants (leaves, flowers etc.) and animals and animal excreta which falls on the surface of the Earth in terrestrial ecosystems is called litter.	The dead remains of plants and animals constitute detritus. It is differentiated into litter fall (above ground detritus) and below ground detritus.

(f) Primary and secondary productivity

Primary Productivity	Secondary Productivity
i. It is the rate at which organic matter is built up by producers.	i. It is the rate of synthesis of organic matter by consumers.
ii. It is due to photosynthesis.	ii. It is due to herbivory and predation.

7. Describe the components of an ecosystem.

Ans. An ecosystem is defined as an interacting unit that includes both the biological community as well as the non-living components of an area.
The two components of an ecosystem are:

(a) Biotic component: It is the living component of an ecosystem that includes biotic factors such as producers, consumers, decomposers, etc. Producers include plants and algae. They contain chlorophyll pigment, which helps them carry out the process of photosynthesis in the presence of light.Consumers or heterotrophs are organisms that are directly (primary consumers) or indirectly (secondary and tertiary consumers) dependent on producers for their food. Decomposers include micro-organisms such as bacteria and fungi. They form the largest population in a food chain and obtain nutrients by breaking down the remains of dead plants and animals.

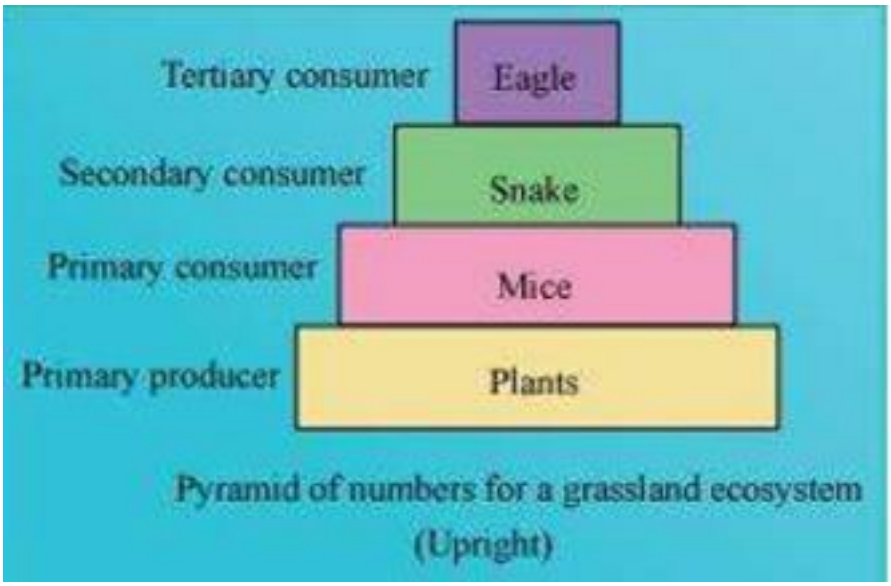
(b) Abiotic component: They are the non-living component of an ecosystem such as light, temperature, water, soil, air, inorganic nutrients, etc.

8. Define ecological pyramids and describe with examples, pyramids of number and biomass.

Ans. An ecological pyramid is a graphical representation of various ecological parameters such as the number of individuals present at each trophic level, the amount of energy, or the biomass present at each trophic level. Ecological pyramids represent producers at the base, while the apex represents the top level consumers present in the ecosystem. There are three types of pyramids:

(a) Pyramid of numbers
(b) Pyramid of energy
(c) Pyramid of biomass

Pyramid of numbers: It is a graphical representation of the number of individuals present at each trophic level in a food chain of an ecosystem. The pyramid of numbers can be upright or inverted depending on the number of producers. For example, in a grassland ecosystem, the pyramid of numbers is upright. In this type of a food chain, the number of producers (plants) is followed by the number of herbivores (mice), which in turn is followed by the number of secondary consumers (snakes) and tertiary carnivores (eagles). Hence, the number of individuals at the producer level will be the maximum, while the number of individuals present at top carnivores will be least.

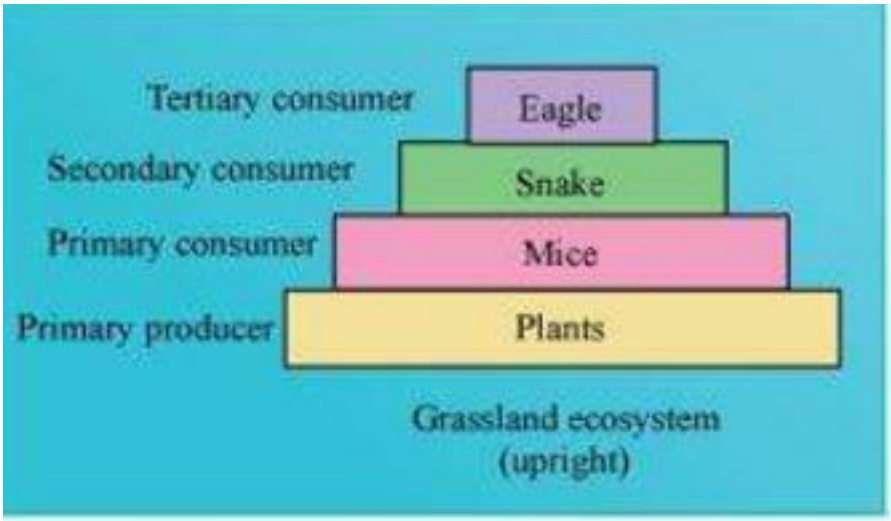


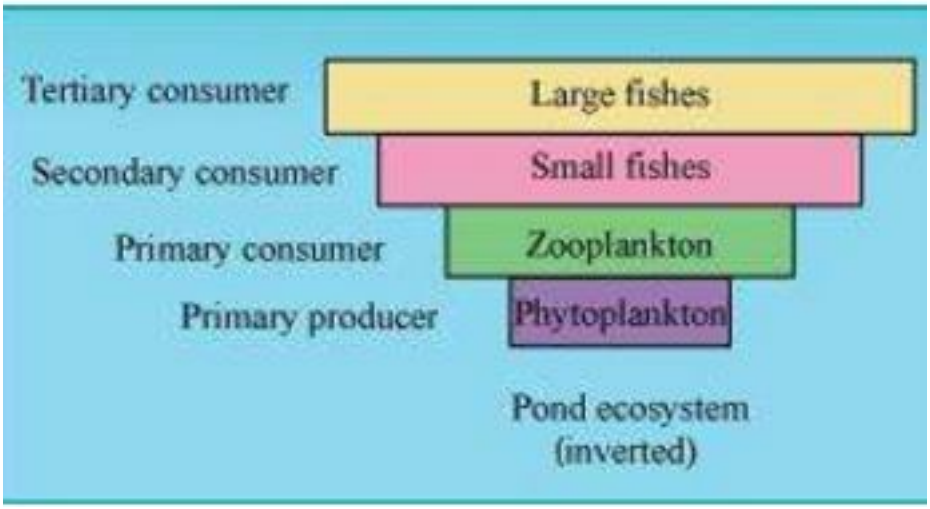
On the other hand, in a parasitic food chain, the pyramid of numbers is inverted. In this type of a food chain, a single tree (producer) provides food to several fruit eating birds, which in turn support several insect species.

Pyramid of biomass

A pyramid of biomass: It is a graphical representation of the total amount of living matter

present at each trophic level of an ecosystem. It can be upright or inverted. It is upright in grasslands and forest ecosystems as the amount of biomass present at the producer level is higher than at the top carnivore level. The pyramid of biomass is inverted in a pond ecosystem as the biomass of fishes far exceeds the biomass of zooplankton (upon which they feed).





9. What is primary productivity? Give brief description of factors that affect primary productivity.

Ans. It is defined as the amount of organic matter or biomass produced by producers per unit area over a period of time. Primary productivity of an ecosystem depends on the variety of environmental factors such as light, temperature, water, precipitation, etc. It also depends on the availability of nutrients and the availability of plants to carry out photosynthesis.

10. Define decomposition and describe the processes and products of decomposition.

Ans. Decomposition is the process that involves the breakdown of complex organic matter or biomass from the body of dead plants and animals with the help of decomposers into inorganic raw materials such as carbon dioxide, water, and other nutrients.

The various processes involved in decomposition are as follows:

(1) Fragmentation: It is the first step in the process of decomposition. It involves the breakdown of detritus into smaller pieces by the action of detritivores such as earthworms.

(2) Leaching: It is a process where the water soluble nutrients go down into the soil layers and get locked as unavailable salts.

(3) Catabolism: It is a process in which bacteria and fungi degrade detritus through various enzymes into smaller pieces.

(4) Humification: The next step is humification which leads to the formation of a dark-coloured colloidal substance called humus, which acts as reservoir of nutrients for plants.

(5) Mineralization: The humus is further degraded by the action of microbes, which finally leads to the release of inorganic nutrients into the soil. This process of releasing inorganic nutrients from the humus is known as mineralization. Decomposition produces a dark coloured, nutrient-rich substance called humus. Humus finally degrades and releases inorganic raw materials such as CO2, water, and other nutrient in the soil.

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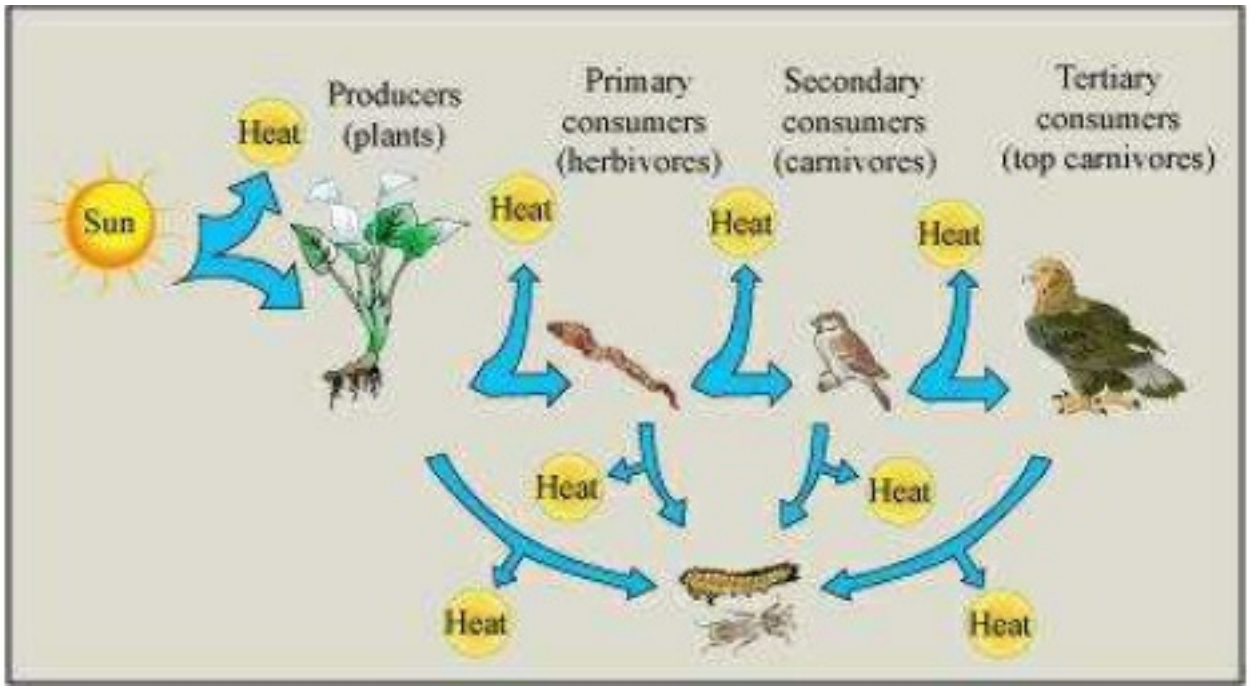
11. Give an account of energy flow in an ecosystem.

Ans. Energy enters an ecosystem from the Sun. Solar radiations help plants in carrying out the process of photosynthesis. Also, they help maintain the Earth's temperature for the survival of living organisms. Some solar radiations are reflected by the Earth's surface. Only 2-10 percent of solar energy is captured by green plants (producers) during photosynthesis to be converted into food. The rate at which the biomass is produced by plants during photosynthesis is termed as 'gross primary productivity'. When these green plants are consumed by herbivores, only 10% of the stored energy from producers is transferred to herbivores. The remaining 90 % of this energy is used by plants for various processes such as

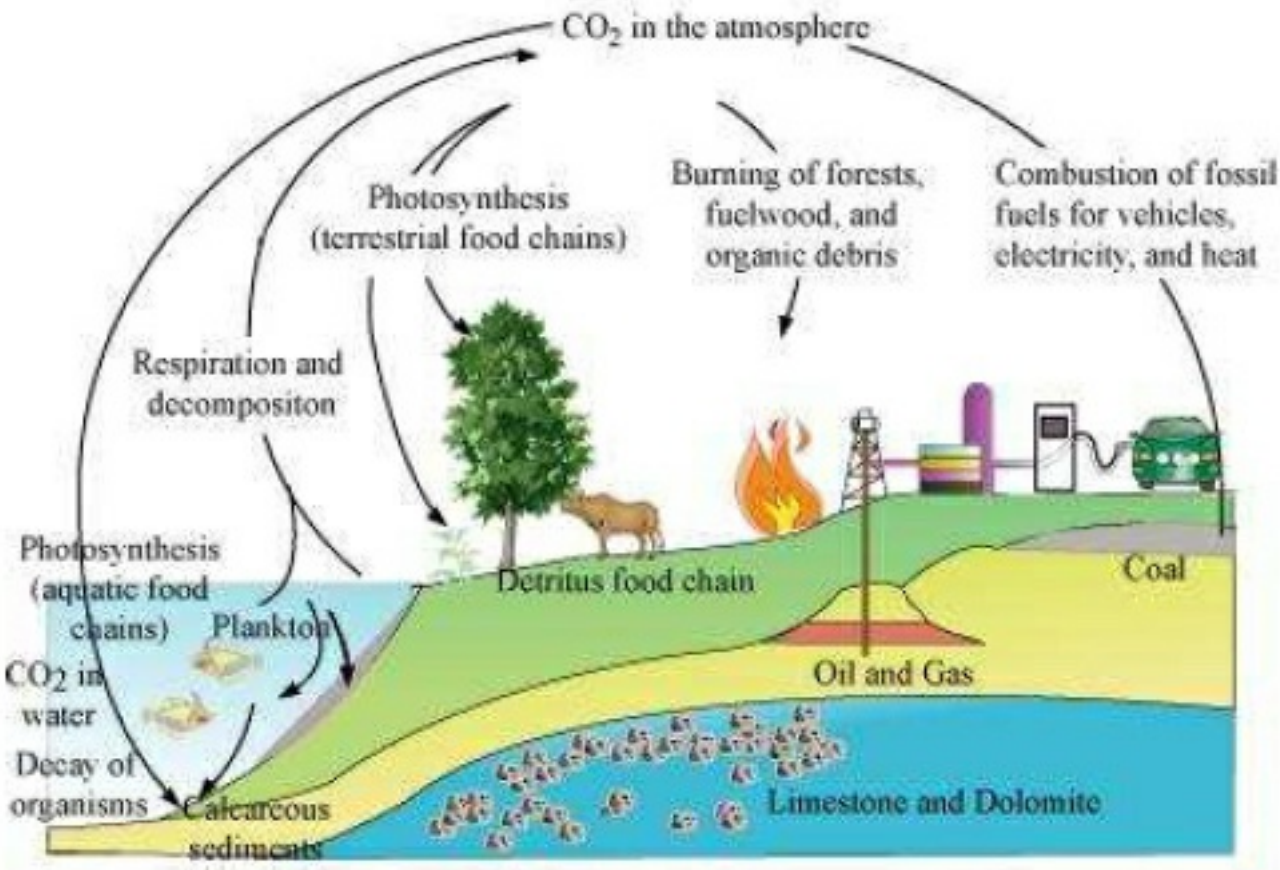
respiration, growth, and reproduction. Similarly, only 10% of the energy of herbivores is ransferred to carnivores. This is known as ten percent law of energy flow.



12. Write important features of a sedimentary cycle in an ecosystem.

Ans. Sedimentary cycles have their reservoirs in the Earth's crust or rocks. Nutrient elements are found in the sediments of the Earth. Elements such as sulphur, phosphorus, potassium, and calcium have sedimentary cycles.
Sedimentary cycles are very slow. They take a long time to complete their circulation and are considered as less perfect cycles. This is because during recycling, nutrient elements may get locked in the reservoir pool, thereby taking a very long time to come out and continue circulation. Thus, it usually goes out of circulation for a long time.

13. Outline salient features of carbon cycling in an ecosystem
Ans.



The carbon cycle is an important gaseous cycle which has its reservoir pool in the atmosphere. All living organisms contain carbon as a major body constituent. Carbon is a fundamental element found in all living forms. All biomolecules such as carbohydrates, lipids, and proteins required for life processes are made of carbon. Carbon is incorporated into living forms through a fundamental process called ‘photosynthesis’. Photosynthesis uses sunlight and atmospheric carbon dioxide to produce a carbon compound called ‘glucose’. This glucose molecule is utilized by other living organisms. Thus, atmospheric carbon is incorporated in living forms. Now, it is necessary to recycle this absorbed carbon dioxide back into the atmosphere to complete the cycle. There are various processes by which carbon is recycled back into the atmosphere in the form of carbon dioxide gas. The process of respiration breaks down glucose molecules to produce carbon dioxide gas. The process of decomposition also releases carbon dioxide from dead bodies of plants and animals into the atmosphere. Combustion of fuels, industrialization, deforestation, volcanic eruptions, and forest fires act as other major sources of carbon dioxide.

CBSE Class 12

Biology

Ch 15 – Biodiversity and Conservation

1. Name the three important components of biodiversity.

Ans. Three important components of biodiversity are:

(a) Genetic diversity

(b) Species diversity

(c) Ecosystem diversity

2. How do ecologists estimate the total number of species present in the world?

Ans. The diversity of living organisms present on the Earth is very vast. According to an estimate by researchers, it is about seven millions. The total number of species present in the world is calculated by ecologists by statistical comparison between a species richness of a well studied group of insects of temperate and tropical regions. Then, these ratios are extrapolated with other groups of plants and animals to calculate the total species richness present on the Earth.

3. Give three hypotheses for explaining why tropics show greatest levels of species richness.

Ans. There are three different hypotheses proposed by scientists for explaining species richness in the tropics.

(1) Tropical latitudes receive more solar energy than temperate regions, which leads to high productivity and high species diversity.

(2) Tropical regions have less seasonal variations and have a more or less constant environment. This promotes the niche specialization and thus, high species richness.

(3) Temperate regions were subjected to glaciations during the ice age, while tropical regions remained undisturbed which led to an increase in the species diversity in this region.

4. What is the significance of the slope of regression in a species – area relationship?

Ans. The slope of regression (z) has a great significance in order to find a species-area relationship. It has been found that in smaller areas (where the species-area relationship is

analyzed), the value of slopes of regression is similar regardless of the taxonomic group or the region. However, when a similar analysis is done in larger areas, then the slope of regression is much steeper.

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5. What are the major causes of species losses in a geographical region?
Ans. The following are the major causes for the loss of biodiversity around the world.
(i) Habitat loss and fragmentation: Habitats of various organisms are altered or destroyed by uncontrolled and unsustainable human activities such as deforestation, slash and burn agriculture, mining, and urbanization. This results in the breaking up of the habitat into small pieces, which effects the movement of migratory animals and also, decreases the genetic exchange between populations leading to a declination of species.
(ii) Over-exploitation: Due to over-hunting and over-exploitation of various plants and animals by humans, many species have become endangered or extinct (such as the tiger and the passenger pigeon).
(iii) Alien species Invasions: Accidental or intentional introduction of non-native species into a habitat has also led to the declination or extinction of indigenous species. For example, the Nile perch introduced in Lake Victoria in Kenya led to the extinction of more than two hundred species of native fish in the lake.
(iv) Co–extinction: In a native habitat, one species is connected to the other in an intricate network. The extinction of one species causes the extinction of other species, which is associated with it in an obligatory way. For example, the extinction of the host will cause the extinction of its parasites.

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6. How is biodiversity important for ecosystem functioning?
Ans. An ecosystem with high species diversity is much more stable than an ecosystem with low species diversity. Also, high biodiversity makes the ecosystem more stable in productivity and more resistant towards disturbances such as alien species invasions and floods.
If an ecosystem is rich in biodiversity, then the ecological balance would not get affected. Various trophic levels are connected through food chains. If any one organism or all organisms of any one trophic level is illed, then it will disrupt the entire food chain. For example, in a food chain, if all plants are killed, then all deer's will die due to the lack of food. If all deer's are dead, soon the tigers will also die. Therefore, it can be concluded that if an

ecosystem is rich in species, then there will be other food alternatives at each trophic level which would not allow any organism to die due to the absence of their food resource. Hence, biodiversity plays an important role in maintaining the health and ecological balance of an ecosystem.

7. What are sacred groves? What is their role in conservation?

Ans. Sacred groves are tracts of forest which are regenerated around places of worship. Sacred groves are found in Rajasthan, Western Ghats of Karnataka,and Maharashtra, Meghalaya, and Madhya Pradesh. Sacred groves help in the protection of many rare, threatened, and endemic species of plants and animals found in an area. The process of deforestation is strictly prohibited in this region by tribals. Hence, the sacred grove biodiversity is a rich area.

8. Among the ecosystem services are control of floods and soil erosion. How is this achieved by the biotic components of the ecosystem?

Ans. The biotic components of an ecosystem include the living organisms such as plants and animals. Plants play a very important role in controlling floods and soil erosion. The roots of plants hold the soil particles together, thereby preventing the top layer of the soil to get eroded by wind or running water. The roots also make the soil porous, thereby allowing ground water infiltration and preventing floods. Hence, plants are able to prevent soil erosion and natural calamities such as floods and droughts. They also increase the fertility of soil and biodiversity.

9. What measures, as an individual, you would take to reduce environmental pollution?

Ans. The following initiatives can be taken to prevent environmental pollution:

Measure for preventing air pollution:

(i) Planting more trees

(ii) Use of clean and renewable energy sources such as CNG and bio-fuels

(iii) Reducing the use of fossil fuels

(iv) Use of catalytic converters in automobiles

Measures for preventing water pollution:-

(i) Optimizing the use of water

(ii) Using kitchen waste water in gardening and other household purposes

Measures for controlling Noise pollution:-

(i) Avoid burning crackers on Diwali

(i) Plantation of more trees

Measures for decreasing solid waste generation:-

(i) Segregation of waste

(ii) Recycling and reuse of plastic and paper

(iii) Composting of biodegradable kitchen waste

(iv) Reducing the use of plastics

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10. Can you think of a situation where we deliberately want to make a species extinct? How would you justify it?

Ans. Yes, there are various kinds of parasites and disease-causing microbes that we deliberately want to eradicate from the Earth. Since these micro-organisms are harmful to human beings, scientists are working hard to fight against them. Scientists have been able to eliminate smallpox virus from the world through the use of vaccinations. This shows that humans deliberately want to make these species extinct. Several other eradication programmes such as polio and Hepatitis B vaccinations are aimed to eliminate these disease-causing microbes.

CBSE Class 12

Biology

Ch 16 – ENVIRONMENTAL ISSUES

1. What are the various constituents of domestic sewage? Discuss the effects of sewage discharge on a river?

Ans. Domestic sewage are the waste originating from the kitchen, toilet, laundry, and other sources. They contain impurities such as suspended solid (sand, salt, clay), colloidal materials (faecal matters, bacteria, plastic and cloth fiber), dissolved materials (nitrate, phosphate, calcium, sodium, ammonia), and disease-causing microbes.

When organic wastes from the sewage enter the water bodies, they serve as a food source for micro- organisms such as algae and bacteria. As a result, the population of these micro-organisms in the water body increases. Here, they utilize most of the dissolved oxygen for their metabolism. This results in an increase in the levels of BOD in river water and results in the death of aquatic organisms. Also, the nutrients in the water lead to the growth of planktonic algal, causing algal bloom. This causes deterioration of water quality and fish mortality.

2. List all the wastes that you generate, at home, school or during your Trips to other places, could you very easily reduce? Which would be Difficult or rather impossible to reduce?

Ans. Wastes generated at home include plastic bags, paper napkin, toiletries, kitchen wastes (such as peelings of vegetables and fruits, tea leaves), domestic sewage, glass, etc.

Wastes generated at school include waste paper, plastics, vegetable and fruit peels, food wrappings, sewage etc.

Wastes generated at trips or picnics include plastic, paper, vegetable and fruit peels, disposable cups, plates, spoons etc.

Yes, wastes can be easily reduced by the judicious use of the above materials. Wastage of paper can be minimized by writing on both sides of the paper and by using recycled paper.

Plastic and glass waste can also be reduced by recycling and re-using. Also,substituting plastics bags with biodegradable jute bags can reduce wastes generated at home, school, or during trips. Domestic sewage can be reduced by optimizing the use of water while bathing, cooking, and other household activities.
Non- biodegradable wastes such as plastic, metal, broken glass, etc are difficult to decompose because micro-organisms do not have the ability to decompose them.

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3. Discuss the causes and effects of global warming. What measures need to be taken to control global warming?
Ans. Global warming is defined as an increase in the average temperature of the Earth's surface due to green house effect.

Causes of global warming: Global warming occurs as a result of the increased concentration of greenhouse gases in the atmosphere. Greenhouse gases include carbon dioxide, methane, and water vapour. These gases trap solar radiation released back by the Earth.Global warming is a result of industrialization, burning of fossil fuels, and deforestation.

Effects of global warming: Global warming is defined as an increase in the average temperature of the Earth's surface. It has been observed that in the past three decades, the average temperature of the Earth has increased by 0.6ºC. As a result, the natural water cycle has been disturbed resulting in changes in the pattern of rainfall. It also changes the amount of rain water. Also, it results in the melting of Polar ice caps and mountain glaciers, which has caused a rise in the sea level, leading to the inundation of coastal regions.

Control measures for preventing global warming:
(i) Reducing the use of fossil fuels
(ii) Use of bio-fuels
(iii) Improving energy efficiency
(iv) Use of renewable source of energy such as CNG etc.
(v) Reforestation.
(vii) Recycling of materials

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4. Match the items given in column A and B:

Column A	Column B
(a) Catalytic converter	(i) Particulate Matter
(b) Electrostatic precipitator	(ii) Carbon monoxide and nitrogen oxides
(c) Earmuffs	(iii) High noise level
(d) Landfills	(iv) Solid wastes

Ans. (a) - (ii)

(b) - (i)

(c) - (iii)

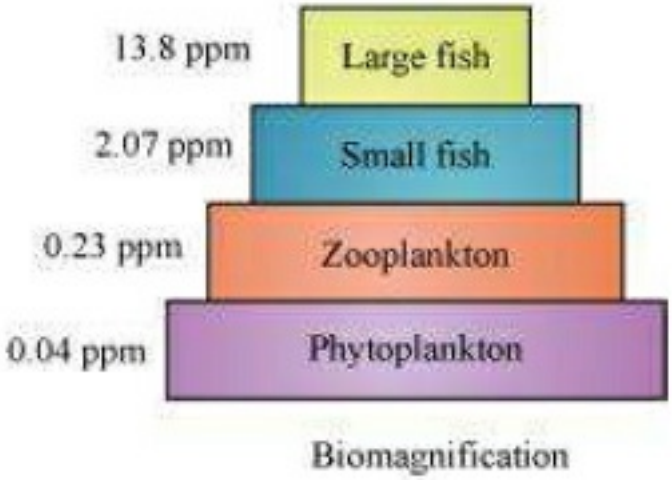
(d) - (iv)

5. Write critical notes on the following:
(a) Eutrophication
(b) Biological magnification
(c) Groundwater depletion and ways for its replenishment

Ans. (a) Eutrophication:- It is the natural ageing process of a lake caused due to nutrient enrichment. It is brought down by the runoff of nutrients such as animal wastes, fertilizers, and sewage from land which leads to an increased fertility of the lake. As a result, it causes a tremendous increase in the primary productivity of the ecosystem. This leads to an increased growth of algae, resulting into algal blooms. Later, the decomposition of these algae depletes the supply of oxygen, leading to the death of other aquatic animal life.

(b) Biological magnification: – The increase in concentration of harmful non-biodegradable subsntances into higher tropic level is called biological magnification. DDT used to protect the crops reach the soil and are absorbed by plants with water and minerals from the soil. Due to rain, these chemicals can also enter water sources and into the body of aquatic plants and animals. As a result, chemicals enter the food chain. Since these chemicals cannot be decomposed, they keep on accumulating at each trophic level. The maximum concentration is accumulated at the top carnivore's level. The producers (phytoplankton) were found to have 0.04 ppm concentration of DDT. Since many types of phytoplankton were eaten by zooplankton (consumers), the concentration of DDT in the bodies of zooplankton was found

to be 0.23 ppm. Small fish that feed on zooplankton accumulate more DDT in their body. Thus, large fish (top carnivore) that feed on several small fish have the highest concentration of DDT.



(c) Ground water depletion and ways for its replenishment: – The level of ground water has decreased in the recent years. The source of water supply is rapidly diminishing each year because of an increase in the population and water pollution. To meet the demand of water, water is withdrawn from water bodies such as ponds, rivers etc. As a result, the source of ground water is depleting. This is because the amount of groundwater being drawn for human use is more than the amount replaced by rainfall. Lack of vegetation cover also results in very small amounts of water seeping through the ground. An increase in water pollution is another factor that has reduced the availability of ground water.

Measures for replenishing ground water:-
(i) Preventing over-exploitation of ground water
(ii) Optimizing water use and reducing water demand
(iii) Rain water harvesting
(iv) Preventing deforestation and plantation of more trees

6. Why ozone hole forms over Antarctica? How will enhanced ultraviolet Radiations affect us?

Ans. The ozone hole is more prominent over the region of Antarctica. It is formed due to an increased concentration of chlorine in the atmosphere. Chlorine is mainly released from chlorofluorocarbons (CFC's) widely used as refrigerants. The CFC's release chlorine atoms by

the action of UV rays on them. The release of Chlorine atoms causes the conversion of ozone into molecular oxygen. One atom of chlorine can destroy around 10,000 molecules of ozone and causes ozone depletion.

The formation of the ozone hole will result in an increased concentration of UV – B radiation on the Earth's surface. UV –B damages DNA and activates the process of skin ageing. It also causes skin darkening and skin cancer. High levels of UV –B cause corneal cataract in human beings.

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7. Discuss the role of women and communities in protection and conservation of forests.

Ans. Women and communities have played a major role in environmental conservation movements.

The Bishnoi community in Rajasthan strictly believes in the concept of living peacefully with nature. In 1731, the king of Jodhpur ordered his ministers to arrange wood for the construction of his new palace. For this purpose, the minister and the workers went to bishnoi village. There, a Bishnoi woman called Amrita Devi along with her daughter and hundreds of other Bishnois showed the courage to step forward and stop them from cutting trees. They embraced the trees and lost their lives at the hands of soldiers of the king. This resistance by the people of the village forced the king to give up the idea of cutting trees.

The Chipko movement was started in 1974 in the Garhwal region of the Himalayas. In this movement, the women from the village stopped the contractors from cutting forest trees by embracing them.

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8. What measures, as an individual, you would take to reduce environmental pollution?

Ans. The following initiatives can be taken to prevent environmental pollution:
Measures for preventing Air pollution:
(i) Planting more trees
(ii) Use of clean and renewable energy sources such as CNG and bio-fuels
(iii) Reducing the use of fossil fuels
(iv) Use of catalytic converters in automobiles

Measures for preventing water pollution:-
(i) Optimizing the use of water
(ii) Using kitchen waste water in gardening and other household purposes Measures for controlling Noise pollution:-
(i) Avoid burning crackers on Diwali
(i) Plantation of more trees

Measures for decreasing solid waste generation:-
(i) Segregation of waste
(ii) Recycling and reuse of plastic and paper
(iii) Composting of biodegradable kitchen waste
(iv) Reducing the use of plastics

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9. Discuss briefly the following:
(a) Radioactive wastes
(b) Defunct ships and e-wastes
(c) Municipal solid wastes

Ans. (a) Radioactive wastes: – Radioactive wastes are generated during the process of generating nuclear energy from radioactive materials. Nuclear waste is rich in radioactive materials that generate large quantities of ionizing radiation such as gamma rays. These rays cause mutation in organisms, which often results in skin cancer. At high dosage, these rays can be lethal. Safe disposal of radioactive wastes is a big challenge. It is recommended that nuclear wastes should be stored after pre-treatment in suitable shielded containers, which should then be buried in rocks.

(b) Defunct ships and e-wastes: – Defunct ships are dead ships that are no longer in use. Such ships are broken down for scrap metal in countries such as India and Pakistan. These ships are a source of various toxicants such as asbestos, lead, mercury etc. Thus, they contribute to solid wastes that are hazardous to health. E-wastes or electronic wastes generally include electronic goods such as computers etc. Such wastes are rich in metals such as copper, iron, silicon, gold etc. These metals are highly toxic and pose serious health hazards. People of developing countries are involved in the recycling process of these metals and therefore, get exposed to toxic substances present in these wastes.

(c) Municipal solid wastes: – Municipal solid wastes are generated from schools, offices, homes, and stores. It is generally rich in glass, metal, paper waste, food, rubber, leather, and textiles. The open dumps of municipal wastes serve as a breeding ground for flies, mosquitoes, and other disease-causing microbes. Hence, it is necessary to dispose municipal solid waste properly to prevent the spreading of diseases. Sanitary landfills and incineration are the methods for the safe disposal of solid wastes.

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10. What initiatives were taken for reducing vehicular air pollution in Delhi? Has air quality improved in Delhi?

Ans. Delhi has been categorized as the fourth most polluted city of the world in a list of 41 cities. Burning of fossil fuels has added to the pollution of air in Delhi. Various steps have been taken to improve the quality of air in Delhi.

(a) Introduction of CNG (Compressed Natural Gas):By the order of the supreme court of India, CNG-powered vehicles were introduced at the end of year 2006 to reduce the levels of pollution in Delhi. CNG is a clean fuel that produces very little unburnt particles.
(b) Phasing out of old vehicles
(c) Use of unleaded petrol
(d) Use of low-sulphur petrol and diesel
(e) Use of catalytic converters
(f) Application of stringent pollution-level norms for vehicles
(g) Implementation of Bharat stage I, which is equivalent to euro II norms in vehicles of major Indian cities.
The introduction of CNG-powered vehicles has improved Delhi's air quality, which has lead to a substantial fall in the level of CO_2 and SO_2. However, the problem of suspended particulate matter (SPM) and respiratory suspended particulate matter (RSPM) still persists.

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11. Discuss briefly the following:
(a) Greenhouse gases
(b) Catalytic converter
(c) Ultraviolet B

Ans. (a) Greenhouse gases: – The green house effect refers to an overall increase in the

average temperature of the Earth due to the presence of greenhouse gases. Greenhouse gases mainly consist of carbon dioxide, methane, and water vapour. When solar radiation reach the Earth, some of these radiation are absorbed. These absorbed radiation are released back into the atmosphere. These radiation are trapped by the greenhouse gases present in the atmosphere.. This helps in keeping our planet warm and thus, helps in human survival. However, an increase in the amount of greenhouse gases can lead to an excessive increase in the Earth's temperature, thereby causing global warming.

(b) Catalytic converter: – Catalytic converters are devices fitted in automobiles to reduce vehicular pollution. These devices contain expensive metals such as platinum, palladium, and rhodium that act as catalysts. As the vehicular discharge passes through the catalytic converter, the unburnt hydrocarbons present in it get converted into carbon dioxide and water. Carbon monoxide and nitric oxide released by catalytic converters are converted into carbon dioxide and nitrogen gas (respectively).

(c) Ultraviolet-B: – Ultraviolet-B is an electromagnetic radiation which has a shorter wavelength than visible light. It is a harmful radiation that comes from sunlight and penetrates through the ozone hole onto the Earth's surface. It induces many health hazards in humans. UV –B damages DNA and activates the process of skin ageing. It also causes skin darkening and skin cancer. High levels of UV –B cause corneal cataract in human beings.

CBSE Class 12
Biology
Ch 04 – REPRODUCTIVE HEALTH

1. What do you think is the significance of reproductive health in a society?

Ans. 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.

2. Suggest the aspects of reproductive health which need to be given special attention in the present scenario.

Ans. 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

3. Is sex education necessary in schools? Why?

Ans. 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.

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.

Ans. 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

5. What are the suggested reasons for population explosion?

Ans. 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.

6. Is the use of contraceptives justified? Give reasons.

Ans. Yes, 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.

7. Removal of gonads cannot be considered as a contraceptive option. Why?

Ans. 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.

8. Amniocentesis for sex determination is banned in our country. Is this ban necessary? Comment.

Ans. 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.

9. Suggest some methods to assist infertile couples to have children.

Ans. 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.

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10. What are the measures one has to take to prevent from contracting STDs?

Ans. 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.

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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)

Ans. (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**

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.

Ans. (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.

CBSE Class 12

Biology

Ch 07 – EVOLUTION

1. Explain antibiotic resistance observed in bacteria in light of Darwinian selection theory.

Ans. Darwinian selection theory states that individuals with favourable variations are better adapted than individuals with less favourable variation. It means that nature selects the individuals with useful variation as these individuals are better evolved to survive in the existing environment. An example of such selection is antibiotic resistance in bacteria. When bacterial population was grown on an agar plate containing antibiotic penicillin, the colonies that were sensitive to penicillin died, whereas one or few bacterial colonies that were resistant to penicillin survived. This is because these bacteria had undergone chance mutation, which resulted in the evolution of a gene that made them resistant to penicillin drug. Hence, the resistant bacteria multiplied quickly as compared to non- resistant (sensitive) bacteria, thereby increasing their number. Hence, the advantage of an individual over other helps in the struggle for existence.

2. Find out from newspapers and popular science articles any new fossil discoveries orcontroversies about evolution.

Ans. Fossils of dinosaurs have revealed the evolution of reptiles in Jurassic period. As a result of this, evolution of other animals such as birds and mammals has also been discovered. However, two unusual fossils recently unearthed in China have ignited a controversy over the evolution of birds.Confuciusornis is one such genus of primitive birds that were crow sized and lived during the Creataceous period in China.

3. Attempt giving a clear definition of the term species

Ans. Species can be defined as a group of organisms, which have the capability to interbreed in order to produce fertile offspring.

4. Try to trace the various components of human evolution (hint: brain size and function,skeletal structure, dietary preference, etc.)

Ans. The various components of human evolution are as follows.
(i) Brain capacity
(ii) Posture
(iii.) Food / dietary preference and other important features
i. About 15 million years ago, primates called *Dryopithecus* and *Ramapithecus*e existed. They were hairy and walked like gorillas and chimpanzees.*Ramapithecus*was more man-like, while *Dryopithecus*was more ape-like. So, these were the forerunners of hominids.
ii. Progress was made further when a skull was discovered about 5 million years ago. It had a brain size of about 500 cm3within the range of an ape's brain, but its jaw and teeth were human like. It was probably not taller than 4 feet but walked upright. It was named as *Australopithecus africanus* and lived in the East Africa grasslands. Evidence showed that this species hunted with stone weapons but essentially ate fruits.
iii. From *Australopithecus* evolved *Homo habilis* who was characterised by having a larger brain than *Australopithecus*(650-800 cc), used tools and were bipedal. They probably did not eat meat.
iv. *Homo erectus* appeared about 1.5 million years ago. Their brain capacity increased to about 800-1,200 cc, and they migrated to Asia and Europe. Fossils of 'Java man' and 'Peking man' belong to *Homo erectus*. They probably ate meat.
v. *Homo erectus*was later replaced by *Homo sapiens*. There were several sub-species of *H. sapiens*, a widespread one of which was *H. sapiens neanderthalis*, a large brained game hunter. They have a brain size of 1,400 cc and lived in the Near East and Central Asia between 100,000 and 40,000 years ago. They used hides to protect their body and buried their dead ones.
vi. The oldest remains of *H. sapiens sapiens* appeared about 35,000 years ago, probably having evolved from Neanderthal man. They were as large brained (1,500 cc) as they were today and existed as hunter gatherers in co-operative bands. They were stout, short and used hides for clothing. They built huts and buried their dead ones.
vii. Prehistoric cave art developed about 1,800 years ago. Agriculture came about 10,000 years ago and human settlements started.

5. Find out through internet and popular science articles whether animals other than manhave self-consciousness.

Ans. There are many animals other than humans, which have self consciousness. An

example of an animal being self conscious is dolphins. They are highly intelligent. They have a sense of self and they also recognize others among themselves and others. They communicate with each other by whistles, tail-slapping, and other body movements. Not only dolphins, there are certain other animals such as crow, parrot, chimpanzee, gorilla, orangutan, etc., which exhibit self-consciousness.

6. List 10 modern-day animals and using the internet resources link it to a corresponding ancient fossil. Name both.

Ans. The modern day animals and their ancient fossils are listed in the following table.

Modern Day	**Ancient Fossil**
Modern horse (*Equus*)	*Eohippus* (=*Hydracotherium*) - Dawn horse - The first fossil found in the evolution of horse.
Camel (*Camelus*)	*Protylopus*- The first ancestor of modern camel.
Modern Elephant (*Elephas*)	*Moeritherium*- The ancestor of modern elephant.
Man (*Homo sapiens*)	*Ramapithecus*- The oldest of man's ancestors.
Vertebrates	*Seymouria*- The missing link between amphibians and reptiles.
Reptiles	*Cyanognathus*- The missing link between reptiles and mammals.
Birds	*Archaeopteryx*- The missing link between reptiles and birds.
Mammals	*Cyanognathus*- The missing link between reptiles and mammals.
Apes and mammals	*Dryopithecus*- The common ancestor of apes and mammals.
Frogs, toads and	Some stem amphibians called Labyrinthodontia (e.g.*Eryops*) gave rise to

salamanders	modern amphibians such as frogs, toads and salamanders.

7. Practise drawing various animals and plants.

Ans. Ask your teachers and parents to suggest the names of plants and animals and practice drawing them. You can also take help from your book to find the names of plants and animals.

8. Describe one example of adaptive radiation.

Ans. Adaptive radiation is an evolutionary process that produces new species from a single, rapidly diversifying lineage. This process occurs due to natural selection. An example of adaptive radiation is Darwin finches, found in Galapagos Island. A large variety of finches is present in Galapagos Island that arose from a single species, which reached this land accidentally. As a result, many new species have evolved, diverged, and adapted to occupy new habitats. These finches have developed different eating habits and different types of beaks to suit their feeding habits. The insectivorous, blood sucking, and other species of finches with varied dietary habits have evolved from a single seed eating finch ancestor.

9. Can we call human evolution as adaptive radiation?

Ans. No, human evolution cannot be called adaptive radiation. This is because adaptive radiation is an evolutionary process that produces new species from a single, rapidly diversifying lineage, which is not the case with human evolution. Human evolution is a gradual process that took place slowly in time. It represents an example of anagenesis.

10. Using various resources such as your school library or the internet and discussions with your teacher, trace the evolutionary stages of any one animal say horse.

Ans. The evolution of horse started with Eohippus during Eocene period. It involved the following evolutionary stages.

(i) Gradual increase in body size

(ii) Elongation of head and neck region

(iii) Increase in the length of limbs and feet

(iv) Gradual reduction of lateral digits

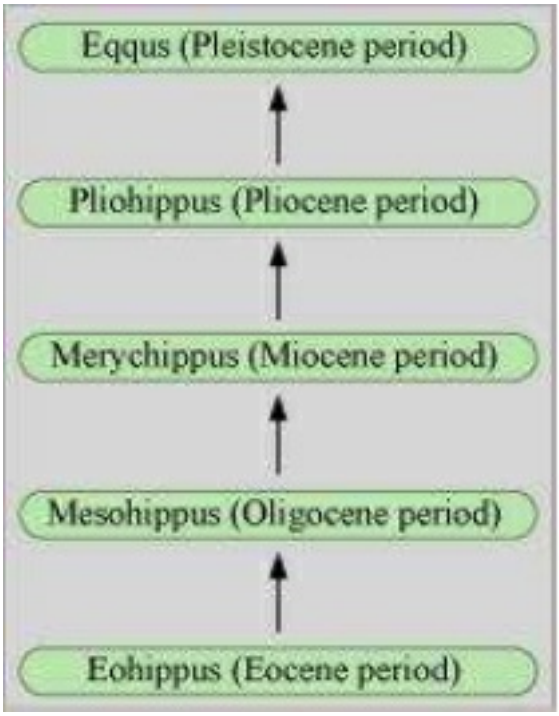
(v) Enlargement of third functional toe

(vi) Strengthening of the back

(vii) Development of brain and sensory organs

(viii) Increase in the complexity of teeth for feeding on grass

The evolution of horse is represented as



(i) Eohippus : It had a short head and neck. It had four functional toes and a splint of 1 and 5 on each hind limb and a splint of 1 and 3 in each forelimb. The molars were short crowned that were adapted for grinding the plant diet.

(ii) Mesohippus : It was slightly taller than Eohippus. It had three toes in each foot.

(iii) Merychippus : It had the size of approximately 100 cm. Although it still had three toes in each foot, but it could run on one toe. The side toe did not touch the ground. The molars were adapted for chewing the grass.

(iv) Pliohippus : It resembled the modern horse and was around 108 cm tall. It had a single functional toe with splint of 2nd and 4th in each limb.

(v) Equus : Pliohippus gave rise to Equus or the modern horse with one toe in each foot. They have incisors for cutting grass and molars for grinding food.

CBSE Class 12
Biology
Chapter 08 – Human Health and Disease

1. What are the various public health measures, which you would suggest as safeguard against infectious diseases?

Ans. Public health measures are preventive measures which are taken to check the spread of various infectious diseases. These measures should be taken to reduce the contact with infectious agents.
Some of these methods are:
(1) Maintenance of personal and public hygiene:It is one of the most important methods of preventing infectious diseases. This measure includes maintaining a clean body, consumption of healthy and nutritious food, drinking clean water, etc.
(2) Isolation: To prevent the spread of air-borne diseases such as pneumonia, chicken pox, tuberculosis, etc., it is essential to keep the infected person in isolation to reduce the chances of spreading these diseases.
(3) Vaccination: Vaccination is the protection of the body from communicable diseases by administering some agent that mimics the microbe inside the body. It helps in providing passive immunizationto the body. Several vaccines are available against many diseases such as tetanus, polio, measles, mumps, etc.
(4) Vector Eradication: Various diseases such as malaria, filariasis, dengue, and chikungunya spread through vectors. Thus, these diseases can be prevented by providing a clean environment and by preventing the breeding of mosquitoes. This can be achieved by not allowing water to stagnate around residential areas. Also, measures like regular cleaning of coolers, use of mosquito nets and insecticides such as malathion in drains, ponds, etc. can be undertaken to ensure a healthy environment. Introducing fish such as Gambusia in ponds also controls the breeding of mosquito larvae in stagnant water.

2. In which way has the study of biology helped us to control infectious diseases?

Ans. Various advancements that have occurred in the field of biology have helped us gain a better understanding to fight against various infectious diseases. Biology has helped us study

the life cycle of various parasites, pathogens, and vectors along with the modes of transmission of various diseases and the measures for controlling them. Vaccination programmes against several infectious diseases such as small pox, chicken pox, tuberculosis, etc. have helped eradicate these diseases. Biotechnology has helped in the preparation of newer and safer drugs and vaccines. Antibiotics have also played an important role in treating infectious diseases.

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3. How does the transmission of each of the following diseases take place?
(a) Amoebiasis
(b) Malaria
(c) Ascariasis
(d) Pneumonia

Ans. (a) Amoebiasis: By ingesting quadrinucleated cysts of *Entamoeba histolytica* with food and water. The cysts are carried from the faeces of the patient to food and water.
(b) Malaria: *Plasmodium* (malarial parasite) is transmitted from the patient to a healthy person when bitten by a female Anopheles mosquito.
(c) Ascariasis: The disease is transmitted by ingesting contaminated food and water with embryonated eggs of Ascaris.
(d) Pneumonia: It is a bacterial disease which is transmitted by the sputum and droplets released during coughing of the patient.

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4. What measure would you take to prevent water-borne diseases?

Ans. Water-borne diseases such as cholera, typhoid, hepatitis B, etc. spread by drinking contaminated water. These water-borne diseases can be prevented by ensuring proper disposal of sewage, excreta, periodic cleaning. Also, measures such as disinfecting community water reservoirs, boiling drinking water, etc. should be observed.

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5. Discuss with your teacher what does 'a suitable gene' means, in the context of DNA vaccines.

Ans. A 'suitable gene' refers to a specific DNA segment which can be injected into the cells of the host body to produce specific proteins. This protein kills the specific disease- causing

organism in the host body and provides immunity.

6. Name the primary and secondary lymphoid organs.

Ans. (a) Primary lymphoid organs include the bone marrow and the thymus.
(b) Secondary lymphoid organs are the spleen, lymph nodes, tonsils, Peyer's patches of small intestine, and appendix.

7. The following are some well-known abbreviations, which have been used in this chapter. Expand each one to its full form:
(a) MALT
(b) CMI
(c) AIDS
(d) NACO
(e) HIV

Ans. (a) MALT- Mucosa-Associated Lymphoid Tissue
(b) CMI- Cell-Mediated Immunity
(c) AIDS- Acquired Immuno Deficiency Syndrome
(d) NACO- National AIDS Control Organization
(e) HIV- Human Immuno Deficiency virus

8. Differentiate the following and give examples of each:
(a) Innate and acquired immunity
(b) Active and passive immunity

Ans. (a) Innate and acquired immunity

Innate Immunity	Acquired Immunity
i. It is non-specific in nature.	i. It is specific in nature.
ii. It is present from birth.	ii. It is acquired in response to a specific pathogen.
iii. It involves different types of	

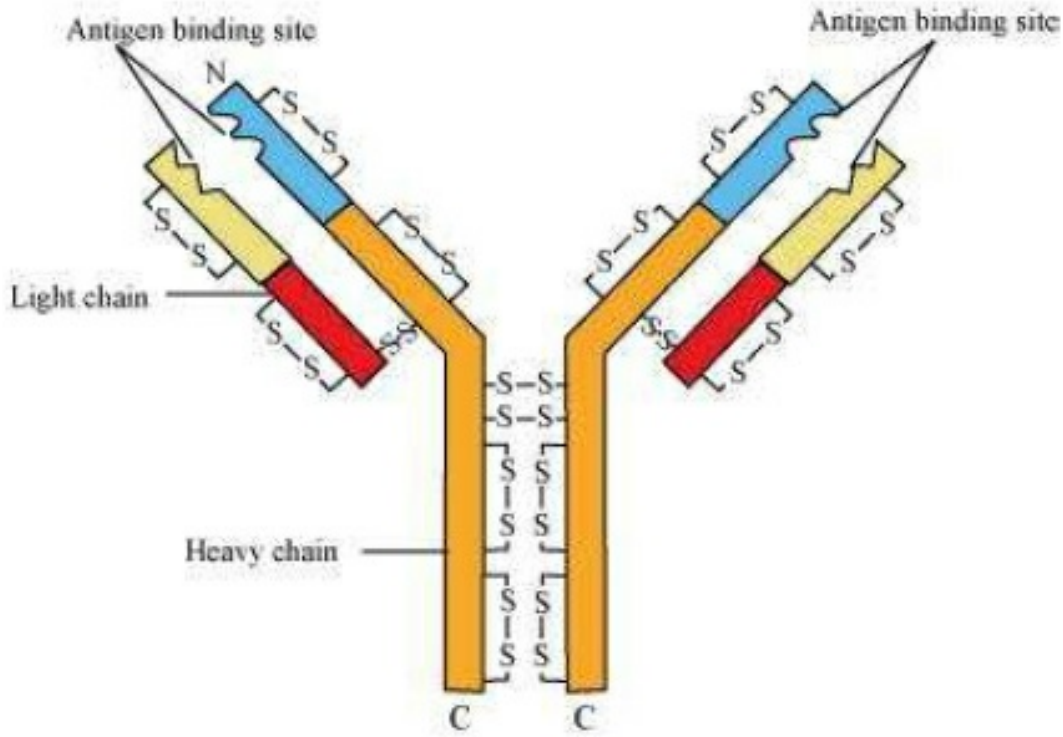
barriers.	iii. It involves memory of antibody.
iv. Example: Skin acts like a barrier.	iv. Example: Antibody response after vaccination.

(b)

Active Immunity	**Passive Immunity**
i. The body produces antigen in response to pathogens in active immunity.	i. Antigen is injected in the body to initiate immunity.
ii. It is slow in action.	ii. It is fast in action.
iii. Example:Antibody response after vaccination.	iii. Example: Yellow liquid in mother's milk (colostrum) is full of antibodies.

9. Draw a well-labelled diagram of an antibody molecule.

Ans.



Structure of an antibody molecule

10. What are the various routes by which transmission of human immunodeficiency virus takes place?

Ans. AIDS (Acquired Immuno Deficiency Syndrome) is caused by the Human immunodeficiency virus HIV).
It has the following modes of transmission:
(a) Unprotected sexual contact with an infected person.
(b) Transfusion of blood from a healthy to an infected person.
(c) Sharing infected needles and syringes.
(d) From an infected mother to a child through the placenta.

11. What is the mechanism by which the AIDS virus causes deficiency of immune system of the infected person?

Ans. AIDS (Acquired Immuno Deficiency Syndrome) is caused by the human immunodeficiency virus (HIV) via sexual or blood-blood contact. After entering the human body, the HIV virus attacks and enters the macrophages. Inside the macrophages, the RNA of the virus replicates with the help of enzyme reverse transcriptase and gives rise to viral DNA. Then, this viral DNA incorporates into the host DNA and directs the synthesis of virus particles. At the same time, HIV enters helper T- lymphocytes. It replicates and produces viral progeny there. These newly formed progeny viruses get released into the blood, attacking other healthy helper T- lymphocytes in the body. As a result, the number of T-lymphocytes in the body of an infected person decreases progressively, thereby decreasing the immunity of a person.

12. How is a cancerous cell different from a normal cell?

Ans. Differences between cancer cells and normal cells:

Cancer cells	Normal cells
i. Divide in an uncontrolled manner.	i. Divide in a regulated manner.
ii. Do not show contact inhibition.	ii. Show contact inhibition.
iii. Do not remain confined in the area of formation.	iii. Remain confined.

iv. Do not undergo differentiation.	iv. Undergo differentiation.

13. Explain what is meant by metastasis.

Ans. The property of metastasis is exhibited by malignant tumors. It is the pathological process of spreading cancerous cells to the different parts of the body. These cells divide uncontrollably, forming a mass of cells called tumor. From the tumor, some cells get sloughed off and enter into the blood stream. From the blood stream, these cells reach distant parts of the body and therefore, initiate the formation of new tumors by dividing actively.

14. List the harmful effects caused by alcohol/drug abuse.

Ans. Alcohol and drugs have several adverse effects on the individual, his family, and the society.

A. Effects of alcohol:

Effects on the individual: Alcohol has an adverse effect on the body of an individual. When an individual consumes excess alcohol, it causes damage to the liver and the nervous system. As a result, other symptoms such as depression, fatigue, aggression, loss of weight and appetite may also be observed in the individual. Sometimes, extreme levels of alcohol consumption may also lead to heart failure, resulting coma and death. Also, it is advisable for pregnant women to avoid alcohol as it may inhibit normal growth of the baby.

Effects on the family:

Consumption of excess alcohol by any family member can have devastating effects on the family. It leads to several domestic problems such as quarrels, frustrations, insecurity, etc.

Effects on the society:

(a) Rash behavior

(b) Malicious mischief and violence

(c) Deteriorating social network

(d) Loss of interest in social and other activities

B Effects of drugs: An individual who is addicted to drugs creates problems not only for himself but also for his family.

Effects on the individual:

Drugs have an adverse effect on the central nervous system of an individual. This leads to

the malfunctioning of several other organs of the body such as the kidney, liver, etc. The spread of HIV is most common in these individuals as they share common needles while injecting drugs in their body. Drugs have long-term side effects on both males and females. These side effects include increased aggressiveness, mood swings, and depression Effects on the family and society: A person addicted to drugs creates problems for his family and society. A person dependant on drugs becomes frustrated, irritated, and anti-social.

15. Do you think that friends can influence one to take alcohol/drugs? If yes, how may one protect himself/herself from such an influence?

Ans. Yes, friends can influence one to take drugs and alcohol. A person can take the following steps for protecting himself/herself against drug abuse:
(a) Increase your will power to stay away from alcohol and drugs. One should not experiment with alcohol for curiosity and fun.
(b) Avoid the company of friends who take drugs.
(c) Seek help from parents and peers.
(d) Take proper knowledge and counseling about drug abuse. Devote your energy in other extra-curricular activities.
(e) Seek immediate professional and medical help from psychologists and psychiatrists if symptoms of depression and frustration become apparent.

16. Why is that once a person starts taking alcohol or drugs, it is difficult to get rid of this habit? Discuss it with your teacher.

Ans. Drug and alcohol consumption has an inherent addictive nature associated with euphoria and a temporary feeling of well-being. Repeated intake of drugs increases the tolerance level of the body's receptors, leading to more consumption of drugs.

17. In your view what motivates youngsters to take to alcohol or drugs and how can this be avoided?

Ans. Many factors are responsible for motivating youngsters towards alcohol or drugs. Curiosity, need for adventure and excitement, experimentation are the initial causes of motivation. Some youngsters start consuming drugs and alcohol in order to overcome

negative emotions (such as stress, pressure, depression, frustration) and to excel in various fields. Several mediums like television, internet, newspaper, movies etc. are also responsible for promoting the idea of alcohol to the younger generation. Amongst these factors, reasons such as unstable and unsupportive family structures and peer pressure can also lead an individual to be dependant ondrugs and alcohol. Preventive measures against addiction of alcohol and drugs:

(a) Parents should motivate and try to increase the will power of their child.

(b) Parents should educate their children about the ill-effects of alcohol. They should provide them with proper knowledge and counselling regarding the consequences of addiction to alcohol.

(c) It is the responsibility of the parent to discourage a child from experimenting with alcohol. Youngsters should be kept away from the company of friends who consume drugs.

(d) Children should be encouraged to devote their energy in other extra- curricular and recreational activities.

(e) Proper professional and medical help should be provided to a child if sudden symptoms of depression and frustration are observed.

CBSE Class 12

Biology

Ch 12 – Biotechnology and Its Applications

1. Crystals of Bt toxin produced by some bacteria do not kill the bacteria themselves because

(a) Bacteria are resistant to the toxin.

(b) Toxin is immature.

(c) Toxin is inactive.

(d) Bacteria enclose toxin in a special sac.

Ans. (c) Toxin is inactive. In bacteria, the toxin is present in an inactive form called prototoxin. This gets converted into the active form when it enters the salivary gland of insects having alkaline medium.

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2. What are transgenic bacteria? Illustrate using any one example.

Ans. Transgenic bacteria are bacteria in which a foreign gene is introduced into its genome. For example, two DNA sequences coding for A and B chains of human insulin introduced into the plasmid of *E. coli* start producing insulin chains.

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3. Compare and contrast the advantages and disadvantages of production of genetically modified crops.

Ans. Advantages of GM crops:

(i) Genetic modification has made crops more tolerant to abiotic stresses (cold, drought, heat, salt).

(ii) Viral resistance can be introduced.

(iii) Over ripening losses can be reduced. Example: Flavr Savr tomato

(iv) Enhanced nutritional value of food. Example: Golden Rice

(v) Reduced reliance on chemical pesticides.

Disadvantages of GM crops:

(i) Transgenes in crop plants can endanger native species. Example: The gene for Bt toxin expressed in pollen may end natural pollinators such as honey bees.

(ii) Weeds also become resistant.

(iii) Products of transgenes may be allergic or toxic.

(iv) They cause damage to the natural environment.

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4. What are Cry proteins? Name an organism which produces it. How has man exploited this protein to his benefit?

Ans. Cry proteins are toxic proteins (insecticidal proteins) secreted by *Bacillus thuringiensis* in crystal form during a particular phase of their growth. The toxin is coded by a gene called *cry*.

The genes encoding cry proteins called Bt toxin genes were isolated from *B. thuringiensis* and incorporated into several crop plants such as Bt cotton, Bt corn etc. to provide resistance against insect pests.

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5. What is gene therapy? Illustrate using the example of adenosine deaminase (ADA) deficiency.

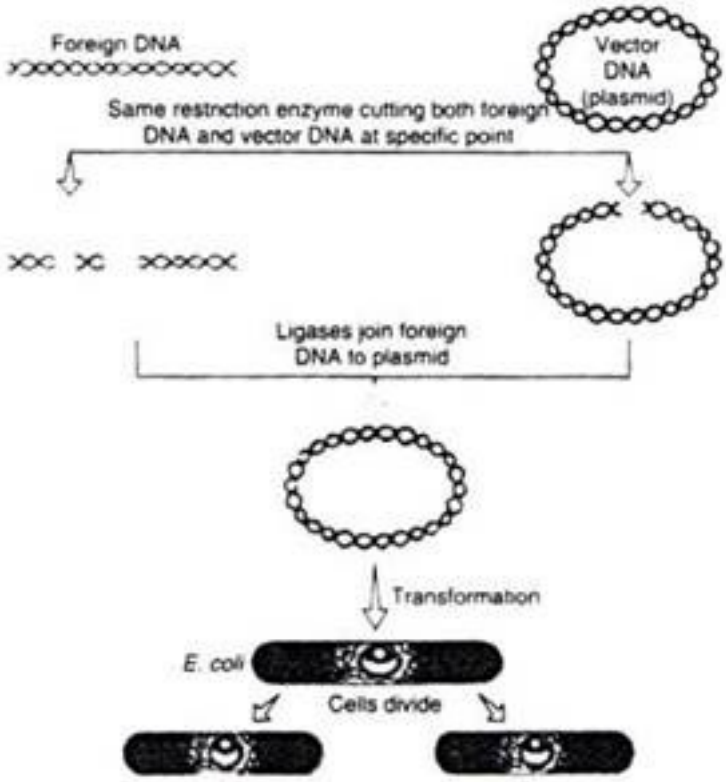
Ans. It is a collection of methods which allows correction of a gene defect that has been diagnosed in a child or embryo. In gene therapy, normal genes are inserted into a person's cells or tissues to treat a hereditary defect. Gene therapy is being tried for sickle cell anaemia and severe combined immunodeficiency (SCID).

In some children, ADA deficiency can be cured by bone marrow transplantation. In others, it can be treated by enzyme replacement therapy, in which functional ADA is given to the patient by injection. However, both of these approaches are not completely curative.

In gene therapy, lymphocytes from the blood of the patient are grown in culture outside the body. A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient. Because these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes. However, if the gene isolated from marrow cells producing ADA is introduced into cells at early embryonic stages, the disease could be cured permanently.

6. Diagrammatically represent the experimental steps in cloning and expressing a human gene (say the gene for growth hormone) into a bacterium like *E. coli*?

Ans.



7. Can you suggest a method to remove oil (hydrocarbon) from seeds based on your understanding of rDNA technology and chemistry of oil?

Ans. Oil is a lipid synthesised by the condensation of one molecule of glycerol with three molecules of fatty acids. Thus, the oil from the seeds can be removed by preventing the synthesis of either glycerol or the enzyme lipase which catalyses the synthesis of oil. It can be achieved by knocking out the genes coding for the enzyme lipase or the enzyme required for

the synthesis of glycerol.

8. Find out from the internet what is golden rice.

Ans. Golden rice is a variety of rice produced through genetic engineering to biosynthesize beta-carotene, a precursor of vitamin A, in the edible parts of rice. It is intended to produce a fortified food to be grown and consumed in areas with a shortage of dietary vitamin A.

9. Does our blood have proteases and nucleases?

Ans. No. Human blood does not have the enzymes nucleases and proteases. In human beings, blood serum contains different types of protease inhibitors, which protect the blood proteins from being broken down by the action of proteases. The enzyme nuclease catalyses the hydrolysis of nucleic acids which are absent in blood.

10. Consult the internet and find out how to make an orally active protein pharmaceutical. What is the major problem to be encountered?

Ans. For making any oral drug or nutritional supplement, the action of digestive enzymes has to be taken into account. Most of the antibiotics and vitamin supplements are made in capsule form to prevent the action of HCl in the stomach. For protein preparation, the major source is groundnut shells. The protein extracted from the source is predigested so as to make it absorbable by the digestive system.