

CBSE
Class XII Biology (Theory)
Board Paper 2011 – Delhi (Set 3)

Time: 3 hrs

Total Marks: 70

General Instruction:

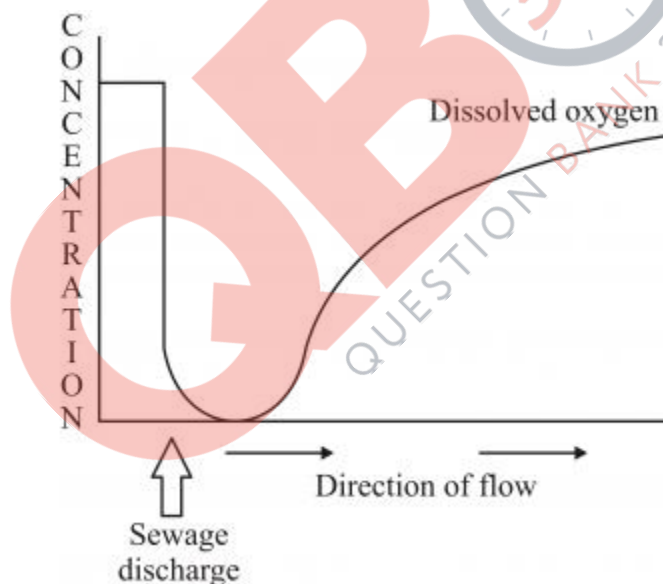
1. All questions are compulsory.
 2. This question paper consists of four Sections A, B C and D. Section A contains 8 questions of one mark each, Section B is of 10 questions of two marks each, Section C is of 9 questions of three marks each, and Section D is of 3 questions of five marks each.
 3. There is no overall choice. However an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks weight age. A student has to attempt only one of the alternatives in such questions.
 4. Wherever necessary, the diagrams drawn should be neat and properly labelled.
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SECTION A

1. Mention the role of the codons AUG and UGA during protein synthesis. [1]
2. Normally one embryo develops in one seed but when an orange seed is squeezed many embryos of different shapes and sizes are seen. Mention how it has happened. [1]
3. Why green plants are not found beyond a certain depth in the ocean? [1]
4. Write the scientific name of the microbe used for fermenting malted cereals and fruit juices. [1]
5. Name the type of cell division that takes place in the zygote of an organism exhibiting haplontic life cycle. [1]
6. How can bacterial DNA be released from the bacterial cell for biotechnology experiments? [1]
7. Name the event during cell division cycle that results in the gain or loss of chromosome. [1]
8. Write the importance of cryopreservation in conservation of biodiversity. [1]

SECTION B

9. State the dual role of deoxyribonucleoside triphosphates during DNA replication. [2]
10. Differentiate between albuminous and non-albuminous seeds, giving one example of each. [2]
11. Explain how a hereditary disease can be corrected. Give an example of first successful attempt made towards correction of such diseases. [2]
12. Justify with the help of an example where a deliberate attempt by humans has led to the extinction of a particular species. [2]
13. Explain the role of Ti plasmids in biotechnology. [2]
14. Study the graph given below. Explain how is oxygen concentration affected in the river when sewage is discharged into it. [2]



15. Name the two types of immune systems in a human body. Why are cell mediated and humoral immunities so called? [2]

OR

Write the scientific names of the causal organisms of elephantiasis and ringworm in humans. Mention the body parts affected by them.

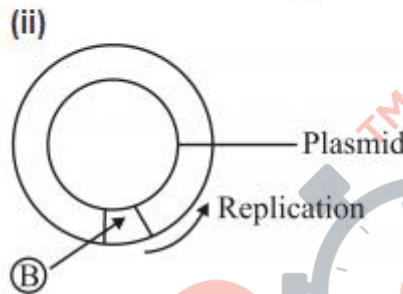
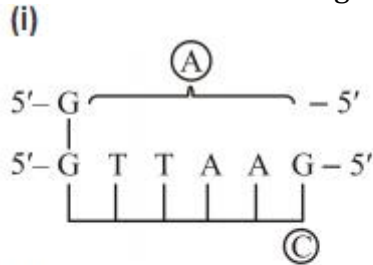
16. State the functions of primary and secondary lymphoid organs in humans. [2]
17. Why is CuT considered a good contraceptive device to space children? [2]
18. Explain the process of RNA interference. [2]

SECTION C

19.

(a) Identify (A) and (B) illustrations in the following:

[3]



(b) Write the term given to (A) and (C) and why?

(c) Expand PCR. Mention its importance in biotechnology.

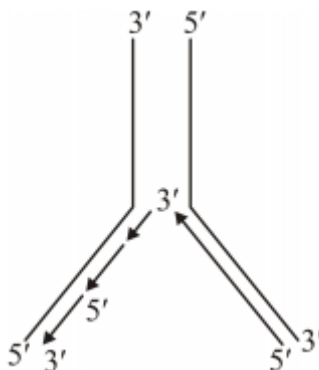
20. Name the type of interaction seen in each of the following examples:

[3]

- (i) *Ascaris* worms living in the intestine of human
- (ii) Wasp pollinating fig inflorescence
- (iii) Clown fish living among the tentacles of sea-anemone
- (iv) Mycorrhizae living on the roots of higher plants
- (v) Orchid growing on a branch of a mango tree
- (vi) Disappearance of smaller barnacles when *Balanus* dominated in the Coast of Scotland

21.

[3]



Why do you see two different types of replicating strands in the given DNA replication form? Explain. Name these strands.

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22. Draw a diagram of a male gametophyte of an angiosperm. Label any four parts. Why is sporopollenin considered the most resistant organic material? [3]
23. How are dominance, co-dominance and incomplete dominance patterns of inheritance different from each other? [3]
24. [3]
(a) Sickle celled anaemia in humans is a result of point mutation. Explain.
(b) Write the genotypes of both the parents who have produced a sickle celled anaemic offspring.
25. [3]
(a) Why do farmers prefer biofertilisers to chemical fertilizers these days? Explain.
(b) How do *Anabaena* and *Mycorrhiza* act as biofertilisers?
26. [3]
(a) Name the stage of *Plasmodium* that gains entry into the human body.
(b) Trace the stages of *Plasmodium* in the body of female *Anopheles* after its entry.
(c) Explain the cause of periodic recurrence of chill and high fever during malarial attack in humans.
- OR**
- Trace the events that occur in human body to cause immunodeficiency when HIV gains entry into the body.
27. What is inbreeding depression and how is it caused in organisms? Write any two advantages of inbreeding. [3]

SECTION D

28. [5]

- (a) Describe the stages of oogenesis in human females.
- (b) Draw a labelled diagram of human ovum released after ovulation.

OR

- (a) When and where does spermatogenesis occur in a human male?
- (b) Draw a diagram of a mature human male gamete. Label the following parts: acrosome, nucleus, middle piece and tail.
- (c) Mention the functions of acrosome and middle piece.

29. [5]

- (a) Explain primary productivity and the factors that influence it.
- (b) Describe how do oxygen and chemical composition of detritus control decomposition?

OR

- (a) What is El Nino effect? Explain how it accounts for biodiversity loss.
- (b) Explain any three measures that you as an individual would take, to reduce environmental pollution.

30. Explain the salient features of Hugo de Vries theory of mutation. How is Darwin's theory of natural selection different from it? Explain. [5]

OR

- (a) Name the primates that lived about 15 million years ago. List their characteristic features.
- (b)
 - (i) Where was the first man-like animal found?
 - (ii) Write the order in which Neanderthals, *Homo habilis* and *Homo erectus* appeared on earth. State the brain capacity of each one of them.
 - (iii) When did modern *Homo sapiens* appear on this planet?

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SOLUTION

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SECTION A

- 1. Ans.** AUG is the initiation codon which signals the start of translation, and UGA is the termination codon. When UGA comes into register with the A site, the protein-releasing factors modify the specificity of the peptidyl transferase so that the water molecule is added to the peptide instead of another amino acid, causing the dissociation of ribosomal subunits.
- 2. Ans.** Embryos are developed when the nucellar cells surrounding the embryo sac start dividing and protrude into the embryo sac. This condition of occurrence of more than one embryo in the seed is called polyembryony. Because orange is a citrus fruit, it shows the polyembryony stage, i.e. its seeds possess more than one embryo. Hence, when an orange seed is squeezed, many embryos of different shapes and sizes are seen.
- 3. Ans.** Plants are confined to the upper 200 metres strata of water because no light (and hence no photosynthesis) occurs beyond this depth.
- 4. Ans.** Brewer's yeast (*Saccharomyces cerevisiae*) is used for fermenting malted cereals and fruit juices.
- 5. Ans.** Meiosis occurs in the zygote of an organism exhibiting the haplontic life cycle to produce haploid individuals.
- 6. Ans.** DNA is enclosed within membranes, so it is released by breaking cells. DNA along with other macromolecules such as RNA, proteins, polysaccharides and lipids are released by treating bacterial, plant, fungal or animal cells with enzymes such as lysozyme (bacteria), cellulose (plants) and chitinase (fungi).
- 7. Ans.** Aneuploidy is a condition of having fewer or extra chromosomes than the normal genome number of the species. Loss of chromosomes is called hypoploidy and the addition of chromosomes is called heteroploidy.
- 8. Ans.** Cryopreservation is preservation at -196°C in liquid nitrogen. It is useful in sperms, eggs, cells and embryonic tissues of animals.

SECTION B

9. Ans. Deoxyribonucleoside triphosphate acts as a substrate, and it provides energy for the polymerisation reaction as its two terminal phosphates are high-energy phosphates.

10. Ans.

| Albuminous seeds | Non-albuminous seeds |
|--|--|
| (i) The seeds in which the cotyledons are thin and membranous and the food is stored in the endosperm are called endospermic or albuminous seeds. (ii) Examples: Wheat, maize | (i) The seeds which are without endosperms are called non-endospermic or non-albuminous seeds. (ii) Examples: Pea, gram |

11. Ans. A hereditary disease can be corrected by gene therapy. Treatment of a genetic disorder by manipulating genes is called gene therapy. The first clinical gene therapy was given in 1990 to a 4-year-old girl with adenosine deaminase (ADA) deficiency.

Gene therapy of ADA deficiency:

- (i) The patient lacks functional T-lymphocytes and therefore fails to fight the infecting pathogens.
- (ii) Lymphocytes are extracted from the patient's bone marrow and a normal functional copy of genes coding for ADA is introduced into these lymphocytes with the help of a retrovirus.
- (iii) The cells so treated are introduced into the patient's bone marrow.
- (iv) The lymphocytes produced by these cells contain functional ADA gene and reactivate the victim's immune system for life.

12. Ans. When the Nile Perch, a large predator fish, was introduced in Lake Victoria, it started feeding on the native cichlid fish. As a result, the cichlid fish became extinct and the Nile Perch, not finding any food, died too.

13. Ans. The Ti plasmid (tumour-inducing plasmid) of *Agrobacterium tumefaciens* has been modified to be used as a cloning vector. The Ti plasmid integrates as a segment of its DNA, TDNA, into the chromosomal DNA of its host plant cells which causes tumour. As gene transfer occurs without any human effort, the bacterium is known as the 'natural genetic engineer' of plants. Ti plasmids are used as vectors to transfer

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the foreign gene of interest into the target plant cells so these are used in genetic transformation in plants.

14. Ans. Discharge of domestic sewage into rivers results in the rise of BOD because decomposer organisms consume a large amount of oxygen to decompose organic matter. When the amount of organic matter reduces, the amount of dissolved oxygen again increases.

15. Ans. The two types of immune systems in the human body are

(a) Humoral or antibody-mediated immune system: This immune system operates by the production of humoral antibodies, so it is named humoral or antibody-mediated immune system. The humoral antibodies in blood and lymph react with specific foreign substances (antigens) and promote their destruction.

(b) Cell-mediated immune system: This immune system operates by the production of lymphocytes and macrophages. Hence, it is called cell-mediated. The T-lymphocytes attack the pathogenic microorganisms which have entered the host's body or grafts such as a transplanted kidney. It also protects the body from its own cells which have become cancerous.

OR

Elephantiasis is caused by the filarial worm *Wuchereria bancrofti* and *Wuchereria malayi*. It usually affects the lymphatic vessels of the lower limbs and genital organs.

Ringworm is caused by the fungi *Microsporum*, *Trichophyton* and *Epidermophyton*. It affects the skin, nails and scalp.

16. Ans. Primary lymphoid organs are those organs where T lymphocytes and B lymphocytes mature and acquire their antigen-specific receptors. They include bone marrow and thymus.

Secondary lymphoid organs are spleen, tonsils, Peyer's patch of the small intestine and appendix. The lymphocytes interact with the antigen and proliferate to form a clone.

17. Ans. CuT increases the phagocytosis of sperms in the uterus and copper ions released decrease sperm motility and prevent fertilisation. So, it is considered a good contraceptive device to space children.

18. Ans. RNA interference (RNAi) is a system within living cells which helps control the activity of specific genes and is used as a method of cellular defence against parasites. This method involves silencing of a specific mRNA. The introduction of DNA produces both sense and antisense RNA in the host cells. These two RNAs, being complementary to each other, form double-stranded RNA which binds to and prevents the translation of mRNA.

SECTION C

19. Ans.

- (i) A – AATTC (Recognition site of the restriction endonuclease); B – Ori (Origin of replication).
- (ii) A and C depict a palindromic nucleotide sequence. It is the sequence of base pairs which read the same when the orientation of reading is the same.
- (iii) PCR stands for polymerase chain reaction.
Importance of PCR in biotechnology:
 - a. It is used to detect HIV in suspected AIDS patients.
 - b. It is used to detect gene mutations in persons suspected with cancer.

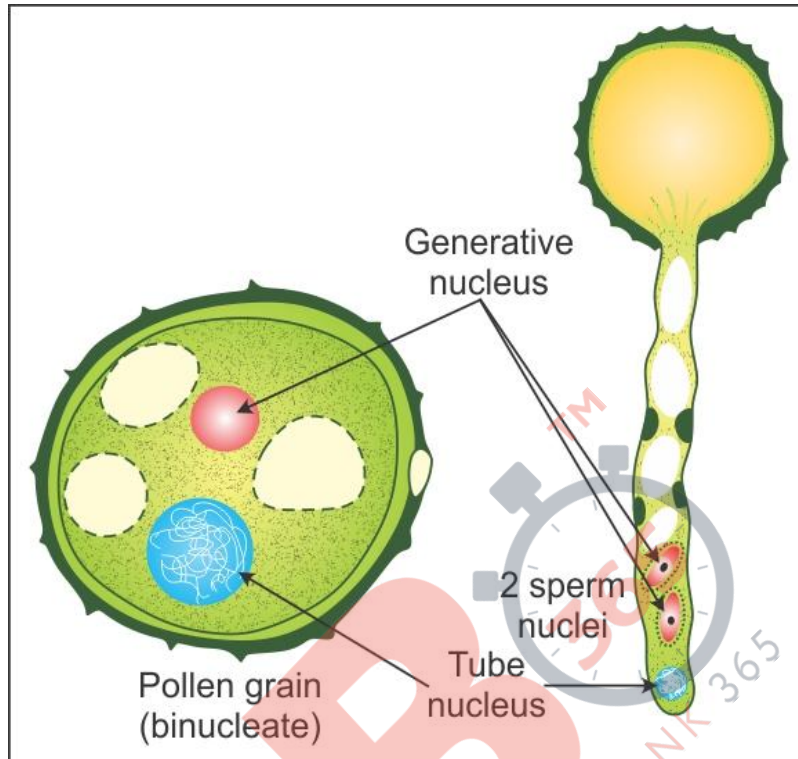
20. Ans.

- (i) Parasitism
- (ii) Mutualism
- (iii) Commensalism
- (iv) Mutualism
- (v) Commensalism
- (vi) Competition

21. Ans. These are the lagging and leading strands of the replication fork.

- (i) During DNA replication, the DNA-directed RNA polymerase synthesises the primer strands of RNA for leading and lagging strands. The synthesis of the continuous strand of DNA is formed in the 5'–3' direction on the 3'–5' DNA template because of the addition of deoxyribonucleotides at the 3' end of primer RNA. This process occurs in the presence of DNA polymerase and ATP. Because one new strand is formed in a continuous stretch in the 5'–3' direction, this strand is called the leading strand.
- (ii) In the second parental strand, the enzyme primase forms the RNA primer. The enzyme DNA polymerase synthesises DNA in the form of short stretches once again in the 5'–3' direction starting from an RNA primer. These DNA short segments are called Okazaki fragments which are joined by the enzyme DNA ligase. This strand is called the lagging strand.

22. Ans.
(a)



(b) Sporopollenin is considered the most resistant organic material because it can withstand high temperatures, strong acids and alkalis and cannot be degraded by any enzyme.

23. Ans.

| Dominance | Co-dominance | Incomplete dominance |
|--|---|---|
| When two different factors or a pair of contrasting forms of a character are present in an organism, only one expresses itself in the F_1 generation and is termed dominant, while the other remains unexpressed and is called the recessive factor. | When both alleles are present together in a heterozygous organism and express their traits independently instead of showing a dominant-recessive relationship, they are called co-dominant alleles and the phenomenon is called co-dominance. | Incomplete dominance is the phenomenon where none of the two contrasting genes or factors are dominant, and the expression of the character in a F_1 hybrid individual is of the intermediate type. |

24.Ans.

- (a) Sickle cell anaemia in humans is a result of a point mutation in which there is a single base change at the sixth position of the β -chain of haemoglobin where glutamic amino acid is substituted by valine.
- (b) The genotypes of both parents would be $Hb^A Hb^S$ and $Hb^A Hb^S$. Marriage between two carriers produces affected, carriers and normal children. So, the ratio produced will be 1:2:1, i.e. one child will be normal, two will be disease-free but carrier and one will be affected.

25.Ans.

- (a) Chemical fertilisers are very expensive and contribute significantly to pollution. They also cause eutrophication and change the nature of soil. To avoid these, farmers are enormously using biofertilisers which enrich the nutrient quality of the soil. They do not pollute the environment and are specific in their action.
- (b) Anabaena is a cyanobacterium which lives in the cavities of Azolla leaves. When it is grown in paddy fields, it serves as an important biofertiliser as it can fix atmospheric nitrogen.
Mycorrhiza is the symbiotic association of fungal hyphae and the roots of higher plants. The fungal hyphae absorb phosphorus from the soil and pass it to the plant.

26.Ans.

- (a) Plasmodium enters the human body at the sporozoite stage through the bite of an infected female Anopheles mosquito.
- (b) Life cycle of Plasmodium:
 - (i) Plasmodium sporozoites enter the human body through the bite of the female Anopheles mosquito.
 - (ii) First, it undergoes asexual reproduction when the parasites enter the liver cells, and then, it attacks the RBCs resulting in their rupture.
 - (iii) The rupture of RBCs produces a toxic element called haemozoin which is responsible for the chill and high fever for 3–4 days.
 - (iv) When a female Anopheles mosquito bites an infected person, these parasites enter the mosquito's body and multiply forming sporozoites.
 - (v) These sporozoites are stored in the salivary glands of the mosquito and are released when a healthy person is bitten by the mosquito.
 - (vi) When the mosquito bites a human, the sporozoites are introduced into the body.
Thus, Plasmodium requires two hosts—man and mosquito—to complete its life cycle. The female Anopheles mosquito acts as the vector.
- (c) Haemozoin is a toxic element released when the RBCs rupture. This is responsible for the chill and high fever of 3–4 days.

OR

HIV is a retrovirus which has an RNA genome and it replicates via DNA copies. HIV selectively infects and kills the T helper cells. The depletion of the T helper cells weakens the acquired immune response and the person starts suffering from infections. On infection, the virus enters macrophages where the viral RNA genome is converted to a viral DNA copy with the help of the enzyme reverse transcriptase. This viral DNA copy of HIV is inserted into human chromosomes and replicates with the cell DNA. It may be transcribed to produce RNA copies of the viral genome. The RNA copies are packed and liberated as virus particles. The infected cell is lysed in this process and the released virus particles attack other helper T lymphocytes. This is repeated leading to progressive decrease in the number of T lymphocytes in the body of the infected person.

27. Ans. Inbreeding depression refers to reduced fertility and productivity. It is caused by continued closed inbreeding, i.e. mating of more closely related individuals within the same breed.

Advantages:

- (i) It exposes harmful recessive genes for undesirable characters which are eliminated by selection.
- (ii) It increases homozygosity.

SECTION D

28.Ans.

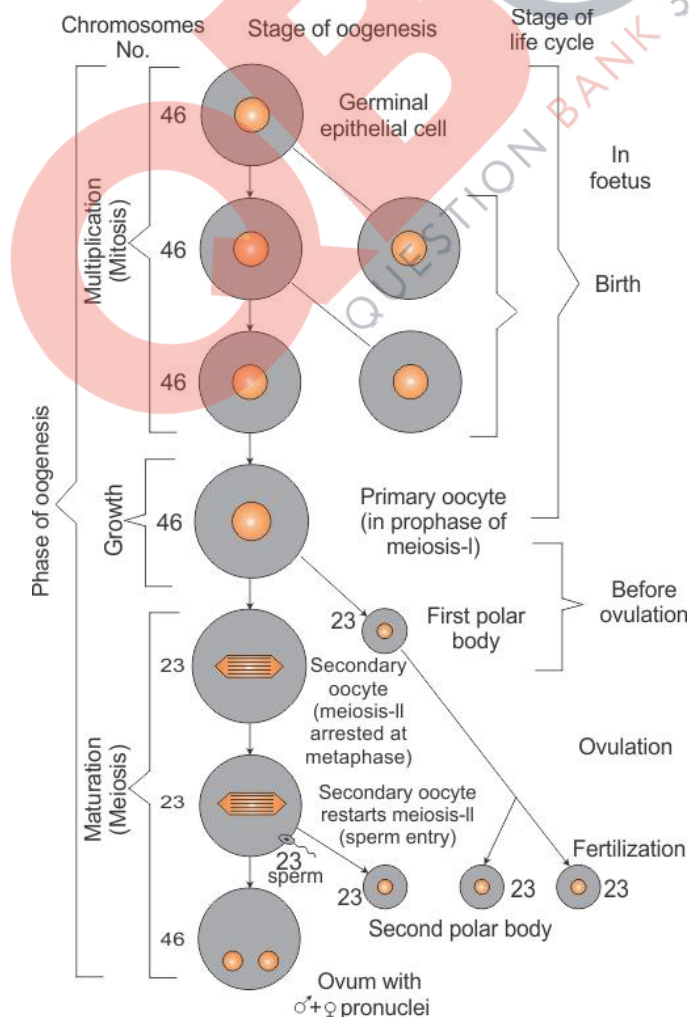
(a) Oogenesis is the process of formation of haploid ova in the Graafian follicles of the ovary. The events which occur during oogenesis are

(i) **Multiplicative phase:** During this phase, the follicle cells are differentiated from the germinal epithelium of the ovary because of repeated mitotic divisions. Some follicle cells become large and are known as egg mother cells. These cells again multiply by mitosis to form oogonia which grow in the follicles.

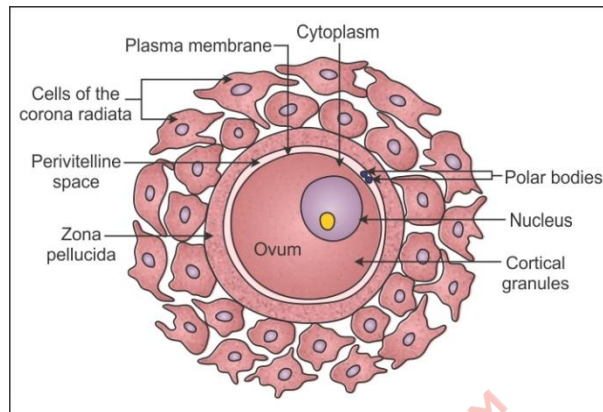
(ii) **Growth phase:** During this phase, the oogonium grows into large primary oocytes by getting nourishment from follicle cells. Each primary oocyte then gets surrounded by a layer of granulosa cells to form a primary follicle.

(iii) **Maturation phase:** This phase involves meiosis. In meiosis I, large haploid oocytes and a small polar body are formed.

Now, the follicle ruptures to release the secondary oocyte. Meiosis II occurs after sperm entry and forms a haploid large ovum and a small polar body. Polar bodies have no function and degenerate.



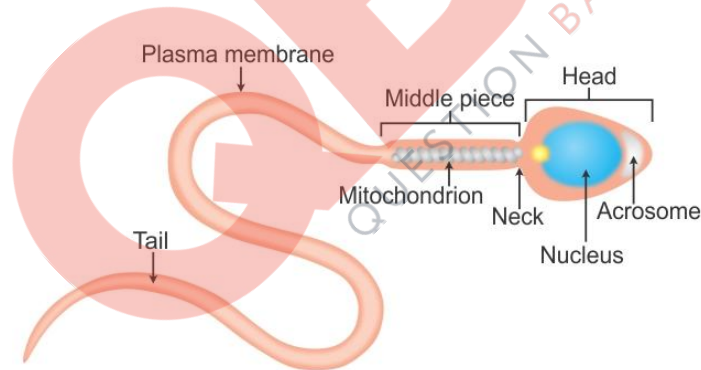
(b)



OR

(a) Spermatogenesis is the process where sperm mother cells in the seminiferous tubules of the testes change into haploid spermatozoans. It occurs in the seminiferous tubules of the testes in males and begins at puberty.

(b) Structure of human sperm:



(c)

(i) Acrosome: It is a cap-like covering or structure which is present at the tip of the sperm (male gamete). The acrosome contains the hydrolytic enzyme hyaluronidase, which helps the sperm to penetrate the ovum during fertilisation by dispersing the cells of the corona radiata.

(ii) Middle piece: The middle piece in human sperm contains several mitochondria which produce energy for the motility of sperms.

29. Ans.

(a) Primary productivity is the rate of biomass or organic matter produced per unit area by plants during photosynthesis. It is expressed in terms of $\text{g m}^{-2} \text{yr}^{-1}$ or $\text{kcal m}^{-2} \text{yr}^{-1}$.

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Factors influencing primary productivity:

- (i) Solar radiation: Sunlight is the ultimate source of energy. Maximum light is available in tropics, whereas the poles receive minimum light. Because of this, photosynthesis and net primary productivity are maximum in the tropics and average in the temperate forests. Productivity is less in aquatic ecosystems than in terrestrial ecosystems. It is limited by light which decreases with increasing water depth.
 - (ii) Temperature: Temperate forests have lesser productivity than tropical rainforests because of cold climate which severely limits primary productivity.
 - (iii) Nutrients: Nutrients are essential for the growth of producers. Nitrogen is deficient in oceans which limit the productivity in marine ecosystems. Desert soils are deficient in nutrients and therefore are less productive. Estuaries and coral reefs are highly productive as the nutrient supply is rich.
- (b) Decomposition is largely an oxygen-requiring process. The rate of decomposition is controlled by the chemical composition of detritus and climatic factors. Detritus rich in lignin, cellulose and chitin has a slower decomposition rate. Detritus rich in nitrogen and water-soluble substances like sugars has a faster decomposition rate. Availability of oxygen determines the aerobic and anaerobic types of decomposers. Anaerobic decomposers carry out partial or incomplete decomposition, whereas aerobic decomposers decompose the detritus completely.

OR

- (a) Increase in the level of greenhouse gases has resulted in the rise of atmospheric temperature. The temperature of the Earth has risen by 0.6°C in the 20th century, most of it during the last three decades. This rise in temperature is leading to deleterious changes in the environment and results in odd climatic changes like the El Nino effect. This leads to increased melting of polar ice caps and Himalayan snow caps. The moisture-carrying capacity of air will increase. Precipitation will increase at higher latitudes both in summer and winter. Frequency of droughts and floods will increase. Threat to human health will increase in tropical and subtropical countries because of changed ranges of disease vectors and water-borne pathogens.

The El Nino effect will result in a rise in sea level which can submerge many coastal areas. After these coastal areas are submerged, the biodiversity found there will be lost because of loss of habitat for organisms living in that area.

- (b) Measures to reduce environmental pollution as an individual:

- (i) We should plant more trees to decrease the increasing amount of carbon dioxide in the atmosphere.
- (ii) We should reduce consumption of fossil fuels.

- (iii) Tall chimneys should be installed and used to reduce the concentration of pollutants on the Earth.
- (iv) Proper disposal of biodegradable and non-biodegradable wastes.
- (v) Discourage the use of plastic bags, pesticides, herbicides and fungicides.

30. Ans. Hugo de Vries put forward a theory of evolution called the mutation theory. The theory states that evolution is a jerky process where new varieties and species are formed by mutations which function as raw material for evolution. The salient features of the mutation theory are

- (i) Mutations or discontinuous variations are the raw material of evolution.
- (ii) Mutations appear all of a sudden. They become operational immediately.
- (iii) Unlike Darwin's continuous variations or fluctuations, mutations do not revolve around the mean or normal character of the species.
- (iv) The same type of mutations can appear in several individuals of a species.
- (v) All mutations are inheritable.
- (vi) Mutations appear in all conceivable directions.
- (vii) Useful mutations are selected by nature. Lethal mutations are eliminated. However, useless and less harmful mutations can persist in the progeny.
- (viii) Accumulation of variations produces new species. Sometimes, a new species is produced from a single mutation.

According to Hugo de Vries, mutations are directionless and random. De Vries believed that mutation caused speciation and hence called it saltation (single-step large mutation).

According to Darwin's theory of natural selection, evolution took place because of minor variations which were heritable. According to him, these variations are small and directional. According to Darwin, evolution was a gradual process, while de Vries believed that a sudden mutation causes speciation.

OR

About 15 million years ago, primates called Dryopithecus and Ramapithecus existed.

Characteristics of Dryopithecus:

- (i) Its forehead was man-like, but its canines were long and pointed like apes.
- (ii) It had a large brain.
- (iii) Arms and legs were almost equal sized.
- (iv) They had a semi-erect posture.

Characteristics of Ramapithecus:

- (i) It was an arboreal primate having man-like feeding habits.
- (ii) It resembled man in having an erect posture.
- (iii) Its jaws and teeth were like those of human beings.

(a)

- (i) The first man-like animal found was *Homo habilis*.

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- (ii) Neanderthal man appeared on the Earth with a brain size of 1400 cc. *Homo erectus* had a large brain of about 900 cc. *Homo habilis* had a brain capacity of 650–800 cc.
- (iii) *Homo sapiens* appeared about 25,000 years ago. They first arose in Africa and moved across continents and developed into distinct races.

