

CBSE
Class XII Biology (Theory)
Board Paper 2011 – Delhi (Set 1)

Time: 3 hrs

Total Marks: 70

General Instruction:

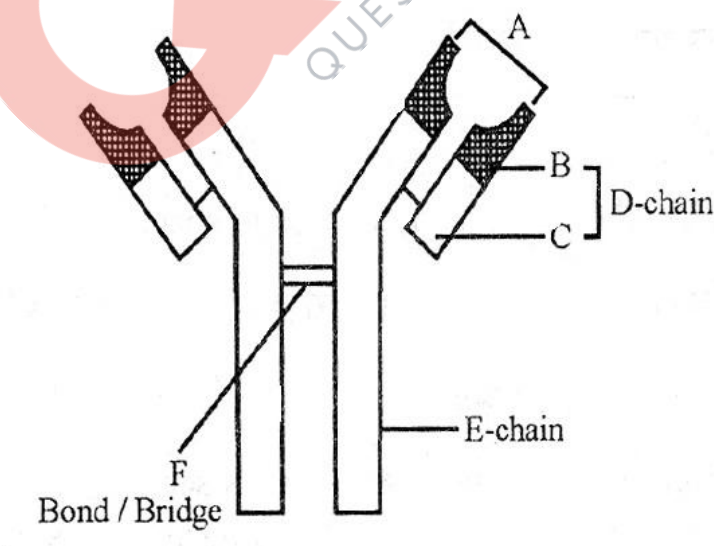
1. All questions are compulsory.
2. This question paper consists of four Sections A, B C and D. Section A contains 8 questions of one mark each, Section B is of 10 questions of two marks each, Section C is of 9 questions of three marks each, and Section D is of 3 questions of five marks each.
3. There 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.

SECTION A

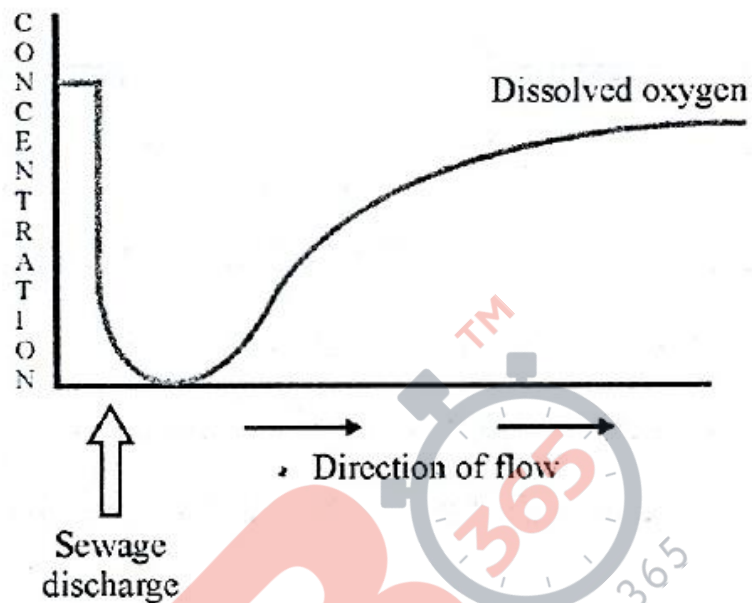
1. Name the type of cell division that takes place in the zygote of an organism exhibiting haplontic life cycle. [1]
2. Write the scientific name of the microbe used for fermenting malted cereals and fruit juices. [1]
3. Write the unit used for measuring ozone thickness. [1]
4. Name the event during cell division cycle that results in the gain or loss of chromosome. [1]
5. How can bacterial DNA be released from the bacterial cell for biotechnology experiments? [1]
6. Write the importance of cryopreservation in conservation of biodiversity. [1]
7. Mention the role of the codons AUG and UGA during protein synthesis. [1]
8. 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]

SECTION-B

9. How do histones acquire positive charge? [2]
10. Why is CuT considered a good contraceptive device to space children? [2]
11. Differentiate between albuminous and non-albuminous seeds, giving one example of each. [2]
12. Explain the process of RNA interference. [2]
13. List the key tools used in recombinant DNA technology. [2]
14. 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.
15. Justify with the help of an example where a deliberate attempt by humans has led to the extinction of a particular species. [2]
16. Identify A, D, E and F in the diagram of an antibody molecule given below : [2]



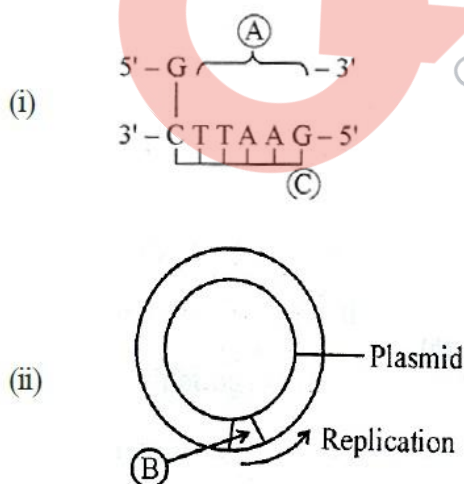
17. Study the graph given below. Explain how is oxygen concentration affected in the river when sewage is discharged into it. [2]



18. Explain how a hereditary disease can be corrected. Give an example of first successful attempt made towards correction of such diseases. [2]

SECTION-C

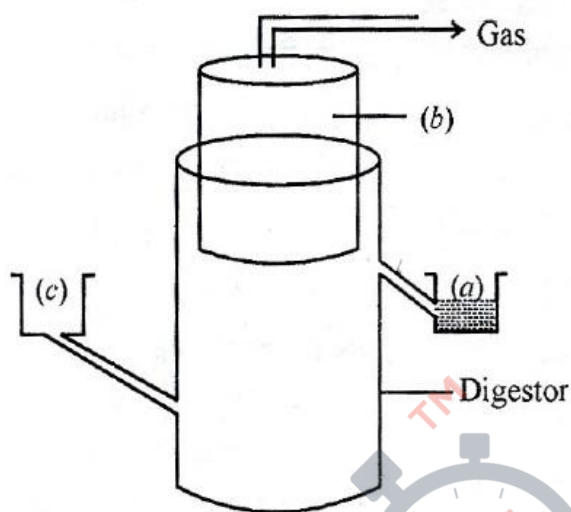
19. Draw a diagram of a male gametophyte of an angiosperm. Label any **four** parts. Why is sporopollenin considered the most resistant organic material? [3]
20. How are dominance, codominance and incomplete dominance patterns of inheritance different from each other? [3]
21. The base sequence in one of the strands of DNA is TAGCATGAT [3]
(i) Give the base sequence of its complementary strand.
(ii) How are these base pairs held together in a DNA molecule?
(iii) Explain the base complementarity rules. Name the scientist who framed this rule.
22. [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.
23. What is inbreeding depression and how is it caused in organisms? Write any two advantages of inbreeding. [3]
24. [3]
(a) Identify (A) and (B) illustrations in the following :



- (b) Write the term given to (A) and (C) and why?
(c) Expand PCR. Mention its importance in biotechnology.

25.

[3]



The diagram above is that of a typical biogas plant. Explain the sequence of events occurring in a biogas plant. Identify a, b and c.

26. How can crop varieties be made disease resistant to overcome food crisis in India? Explain. Name one disease resistant variety in India of: [3]

(a) Wheat to leaf and stripe rust

(b) *Brassica* to white rust

OR

Write the source and the effect on the human body of the following drugs:

(i) Morphine

(ii) Cocaine

(iii) Marijuana

27. 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.

SECTION-D

28. [5]

- (a) Draw a labelled diagram of the human female reproductive system.
- (b) Enumerate the events in the ovary of a human female during :
 - (i) Follicular phase
 - (ii) Luteal phase of menstrual cycle

OR

- (a) Write the specific location and the functions of the following cells in human males:
 - (i) Leydig cells
 - (ii) Sertoli cells
 - (iii) Primary spermatocyte
- (b) Explain the role of any **two** accessory glands in human male reproductive System.

29. 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?

30. [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.

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SOLUTION

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SECTION A

1. **Ans.** Meiosis occurs in the zygote of an organism exhibiting the haplontic life cycle to produce haploid individuals.
2. **Ans.** Brewer's yeast (*Saccharomyces cerevisiae*) is used for fermenting malted cereals and fruit juices.
3. **Ans.** Dobson unit (DU) is used for measuring ozone thickness.
4. **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 addition of chromosomes is called heteroploidy.
5. **Ans.** DNA is enclosed within membranes, so it is released by breaking the cell. 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).
6. **Ans.** Cryopreservation is preservation at -196°C in liquid nitrogen. It is useful in sperms, eggs, cells and embryonic tissues of animals.
7. **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, and this causes the dissociation of ribosomal subunits.
8. **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 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.

SECTION B

9. Ans. In eukaryotic nucleosomes, DNA packaging is carried out with the help of positively charged basic proteins called histones. Histones are low molecular weight proteins rich in basic amino acid residues of lysine and arginine which carry positive charges in their side chains; therefore, histones are positively charged.

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

11. 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.	(i) The seeds which are without endosperms are called non-endospermic or non-albuminous seeds.
(ii) Examples: Wheat, maize	(ii) Examples: Pea, gram

12. 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 a double-stranded RNA which binds to and prevents translation of mRNA.

13. Ans. The tools used in recombinant DNA technology are

- (i) Enzymes: Many kinds of specific enzymes are employed in genetic engineering to perform specific functions. These include lysing enzymes, cleaving enzymes, synthesising enzymes, joining enzymes and alkaline phosphatases.
- (ii) Vehicle or vector DNA: The DNA used as a carrier for transferring a fragment of foreign DNA into a suitable host is called vehicle DNA or vector DNA.
- (iii) Passenger DNA: It is the DNA which is transferred from one organism into another by combining it with the vehicle DNA.

14. Ans. The two types of immune system in 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) in promoting 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 transplanted kidney. It also protects the body from its own cells which have become cancerous.

OR

Elephantiasis is caused by the filarial worm *Wuchereria* (*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.

15. 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 Nile Perch, not finding any food, died too.

16. Ans.

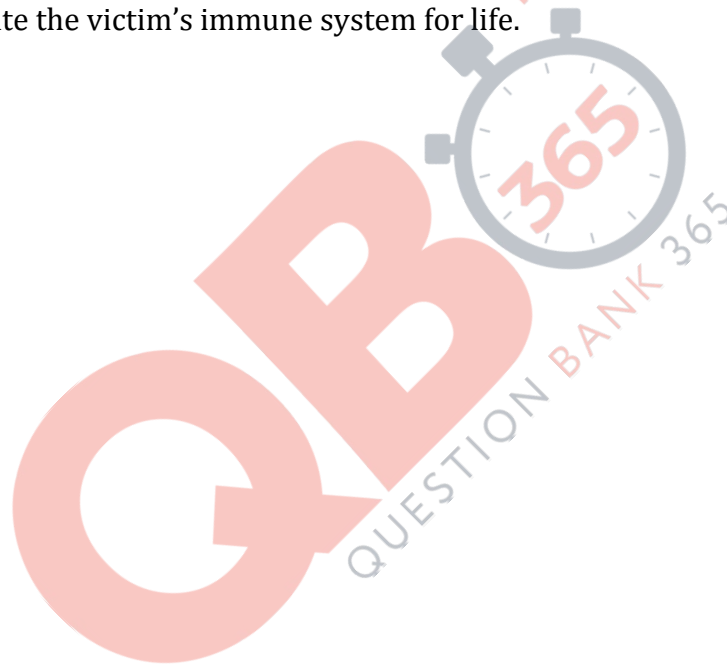
- A: Antigen-binding site
- D: Light chain
- E: Heavy chain
- F: Disulfide bond

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

18. 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:

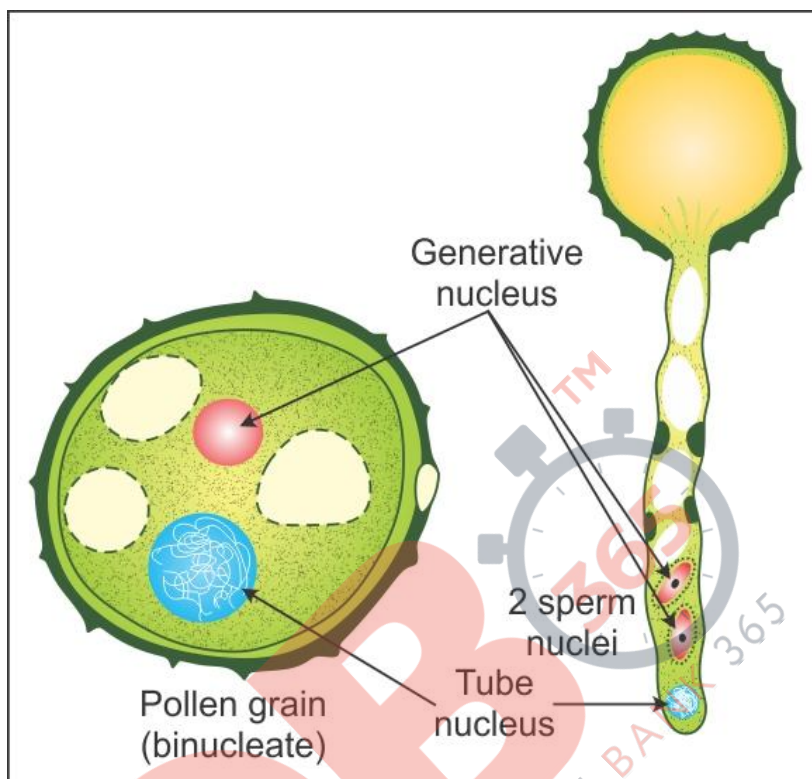
- (i) The patient lacks functional T-lymphocytes and therefore fails to fight the infecting pathogens.
- (ii) Lymphocytes are extracted from the patient's bone marrow and a normal functional copy of gene coding for ADA is introduced into these lymphocytes with the help of retrovirus.
- (iii) The cells 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.



SECTION C

19. 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.

20. 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 recessive.	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 is dominant and the expression of the character in a F_1 hybrid individual is the intermediate type.

21. Ans.

- (i) The base sequence of the complementary strand is ATCGTACTA.
- (ii) The base pairs are held together by two hydrogen bonds in a DNA molecule. A and T are held together by two hydrogen bonds, while G and C are held together by three hydrogen bonds.
- (iii) Watson and Crick framed the base complementarity rule. The rule states that the ratios between adenine, thymine, guanine and cytosine are constant and equal.

22. Ans.

- (a) Sick cell anaemia in humans is a result of 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.

23. 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.

24. Ans.

- (i) A – AATTC (Recognition site of the restriction endonuclease); B – Ori (Origin of replication).
- (ii) A and C depict the 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 to have cancer.

25. Ans. Sequence of events occurring in a biogas plant:

- (a) Slurry of animal dung is fed into the digester.
- (b) In the digester, microbes break down or decompose the complex compounds of biomass in the slurry.
- (c) The anaerobic microbes do not require oxygen, so the digesters are designed like a sealed chamber.
- (d) The process takes a few days and gases such as methane, carbon dioxide, hydrogen and hydrogen sulphide are produced.
 - (i) The biogas plant has an outlet which is connected to a pipe to supply biogas.
 - (ii) The spent slurry is removed through another outlet and is used as fertiliser.
 - a: Sludge tank
 - b: Gas holder
 - c: Dung + Water

26. Ans. Crop varieties are made disease resistant by conventional breeding or mutation breeding.

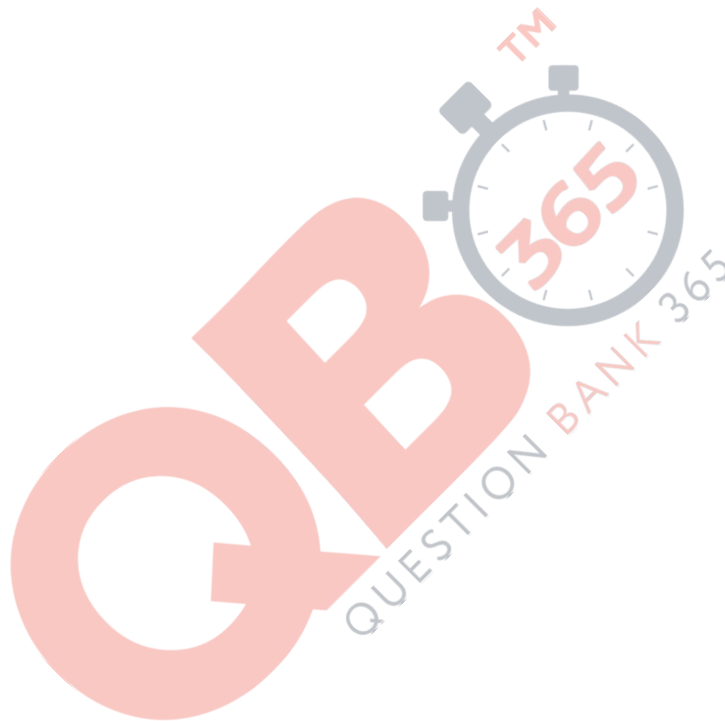
- (a) Conventional breeding includes hybridisation and selection. The various sequential steps involved are
 - (i) Screening germplasm for resistance sources
 - (ii) Hybridisation of selected parents
 - (iii) Selection and evaluation of the hybrids, testing and release of new varieties
- (b) Mutation breeding is the sudden and heritable change in a character of an organism.
It is done artificially through the use of chemicals or physical mutagens.
Disease-resistant varieties of wheat and *Brassica* are Himgiri and Pusa swarnim.

OR

- (i) Morphine: It is the main constituent of opium. It is a strong analgesic and has sedative and calming effects. It suppresses brain functions and relieves intense pain during fracture, burn or surgery.
- (ii) Cocaine: It is obtained from the leaves of coca plant (*Erythroxylum coca*). It interferes with the transport of the neurotransmitter dopamine. It is a powerful CNS stimulant. It induces a sense of well-being and pleasure and delays fatigue. It increases heartbeat, blood pressure and body temperature. Its excessive dosage may lead to headache, insomnia, loss of appetite and hallucination.
- (iii) Marijuana: It is obtained from the direct inflorescence and top leaves of the female *Cannabis sativa* plant. Marijuana interferes with short-term memory, impairs thoughts and reasoning, changes the perception of time and produces mild euphoria. It lowers the levels of sex hormones, suppresses the immune system and may cause psychosis.

27. Ans.

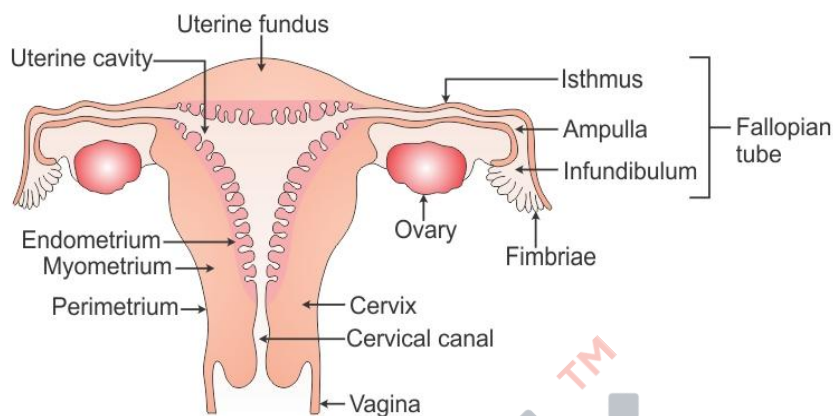
- (i) Parasitism
- (ii) Mutualism
- (iii) Commensalism
- (iv) Mutualism
- (v) Commensalism
- (vi) Competition



SECTION D

28. Ans.

(a)



(b)

(i) The following events occur in the follicular phase:

- (a) The primary follicles in the ovary grow to form a fully mature Graafian follicle.
- (b) The secretion of gonadotropin (LH and FSH) gradually increases.
- (c) Under the influence of FSH, the Graafian follicle cells secrete oestrogen by the anterior lobe of the pituitary gland, which regenerates the uterine endometrial lining.
- (d) Oestrogen causes increase in the thickness of the endometrium about three folds.

(ii) The following events occur in the luteal phase:

- (a) The parts of the Graafian follicle remaining after rupture transform as the corpus luteum.
- (b) The corpus luteum secretes large amounts of progesterone.
- (c) The uterine endometrium shows hypertrophy and its additional thickening takes place for the implantation of the fertilised ovum.
- (d) The presence of progesterone inhibits the secretion of FSH to prevent maturation of follicular cells and ovulation.
- (e) This phase lasts for 13–14 days, and if there is no fertilisation, then the corpus luteum degenerates and progesterone secretion is inhibited, leading to fresh start of the menstrual cycle.

OR

(a)

- (i) Leydig cells: Leydig cells are found in the connective tissue around the seminiferous tubules. They secrete testosterone into the blood.
- (ii) Sertoli cells: Sertoli cells are found in the seminiferous epithelium within the seminiferous tubules of the testes. They provide nutrition and shape to the developing germ cells and spermatozoa.
- (iii) Primary spermatocytes: Primary spermatocytes are found in the lumen of the seminiferous tubule. It undergoes meiosis, producing haploid cells, secondary spermatocytes and then spermatids. Spermatids metamorphose into spermatozoa.

(b) Accessory glands in the human male reproductive system are

- (i) Seminal vesicles: These are paired, tubular, club-shaped structures situated just above the prostate gland and near the base of the urinary bladder and at the interior of the rectum. The ducts from the seminal vesicles join the posterior part of the vas deferens and form the common ejaculatory duct. The seminal vesicles secrete clear, alkaline, yellowish, viscous fluid which contains globulin, citrate, inositol fructose and flavins. Fructose provides energy to facilitate the motility of sperms after ejaculation.
- (ii) Prostate gland: It is the largest auxiliary gland which is chestnut shaped and situated around the 1st part of the urethra below the urinary bladder. It secretes milky, thin and alkaline fluid containing citric acid, bicarbonate ions, lipids and acid phosphatase which gives the characteristic seminal odour and alkalinity to the ejaculate. It increases the motility of sperms and neutralises the acidity of urine.

29. 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 mutations 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

- (a) About 15 million years ago, primates called Dryopithecus and Ramapithecus existed.

Characteristics of Dryopithecus:

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

(b)

- (i) The first man-like animal found was *Homo habilis*.
- (ii) Neanderthal man appeared on Earth with a brain size of 1400 cc. *Homo erectus* had a large brain about 900 cc. *Homo habilis* has the 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.

30.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 $\text{kcal m}^{-2} \text{yr}^{-1}$.

Factors influencing primary productivity:

- (i) Solar radiation: Sunlight is the ultimate source of energy. Maximum light is available in the tropics, whereas poles receive minimum light. Because of this, photosynthesis and net primary productivity are maximum in the tropics and average in 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 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 chemical composition of detritus and climatic factors. Detritus rich in lignin, cellulose and chitin has a slower decomposition rate, while 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. The 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.