# CBSE
## Class XII Biology (Theory)
## Board Paper 2010 – 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.

### SECTION A

**1.** Mention one positive and one negative application of amniocentesis. [1]

**2.** How do animals like fish and snails avoid summer related unfavourable conditions? [1]

**3.** In a pond there were 200 frogs. 40 more were born in a year. Calculate the birth rate of the population. [1]

**4.** Mention two functions of the codon AUG. [1]

**5.** Name a molecular diagnostic technique to detect the presence of a pathogen in its early stage of infection. [1]

**6.** Name the scientist who disproved spontaneous generation theory. [1]

**7.** What is it that prevents a child to suffer from a disease he/she is vaccinated against? Give one reason. [1]

**8.** Why is the enzyme cellulose used for isolating genetic material from plant cells but not for animal cells? [1]

## SECTION B

**9.** Where does triple fusion take place in a flowering plant? Why is it so called? Mention its significance. [2]

**10.** Why certain regions have been declared as biodiversity "hot spots" by environmentalists of the world? Name any two "hot spot" regions of India. [2]

**11.** A moss plant produces a large number of antherozoids but relatively only a few egg cells. Why? [2]

**12.** Why is the introduction of genetically engineered lymphocytes into a ADA deficiency patient not a permanent cure? Suggest a possible permanent cure. [2]

**13.** Study the given food chain and answer the questions that follow: [2]


(a) Give reasons why there is a continuous increase in the DDT content in different trophic levels of the chain.

(b) Name the phenomenon responsible for the increase in DDT content.

**14.** Honey collection improves when beehives are kept in crop-fields during flowering season. Explain. [2]

**OR**

How does addition of a small amount of curd to fresh milk help formation of curd? Mention a nutritional quality that gets added to the curd.

**15.** Name the type of food chains responsible for the flow of larger fraction of energy in an aquatic and a terrestrial ecosystem respectively. Mention one difference between the two food chains. [2]

**16.** Name the host and the site where the following occur in the life-cycle of a malarial parasite: [2]

(a) Formation of gametocytes

(b) Fusion of gametocytes

**17.** Why are $F_2$ phenotypic and genotypic ratios same in a cross between red-flowered snapdragon and white-flowered snapdragon plants.
Explain with the help of a cross. [2]

**18.** How does the floral pattern of Mediterranean orchid *Ophrys* guarantee cross pollination? [2]

## SECTION C

**19.** During his studies on genes in *Drosophila* that were sex-linked T.H. Morgan found $F_2$ – population phenotypic ratios deviated from expected 9:3:3:1. Explain the conclusion he arrived at. [3]

**20.** Describe the termination process of transcription in bacteria. [3]

**21.** How does RNA interference help in developing resistance in tobacco plant against nematode infection? [3]

**22.** Draw a longitudinal section of a post – pollinated Pistil showing entry of pollen tube into a mature embryo-sac. Label filiform apparatus, chalazal end, Hilum, antipodals, male gametes and secondary nucleus. [3]

**OR**

Draw a labelled sectional view of seminiferous tubule of a human male.

**23.** Explain the efforts which must be put in to improve health, hygiene and milk yield of cattle in a dairy farm. [3]

**24.** Explain convergent and divergent evolution with the help of one example of each. [3]

**25.** Eco RI is used cut a segment of foreign DNA and that of a vector DNA to form a recombinant DNA. Show with the help of schematic diagrams. [3]

(i) The set of palindromic nucleotide sequence of base pairs the Eco RI will recognise in both the DNA segments. Mark the site at which Eco RI will act and cut both the segments.

(ii) Sticky ends formed on both the segments where the two DNA segments will join later to form a recombinant DNA.

**26.** An antibody molecule is represented as $H_2L_2$. Explain. [3]

**27.** Identify a, b, c, d, e and f in the table given below: [3]

| Organism | Bioactive molecule | Use |
|---|---|---|
| **1.** *Monascus perpures* (Yeast) | a | b |
| **2.** c | d | antibiotic |
| **3.** e | Cyclosporin A | f |

**28.** When and where are primary oocytes formed in a human female? Trace the development of these oocytes till ovulation (in menstrual cycle). How do gonadotropins influence this developmental process? [5]

**OR**

(a) Explain the events taking place at the time of fertilization of an ovum in a human female.

(b) Trace the development of zygote up to its implantation in the uterus.

(c) Name and draw a labelled sectional view of the embryonic stage that gets implanted.

**29.** Draw and explain a logistic curve for a population of density (N) at time (t) whose intrinsic rate of natural increase is (r) and carrying capacity is (k). [5]

**OR**

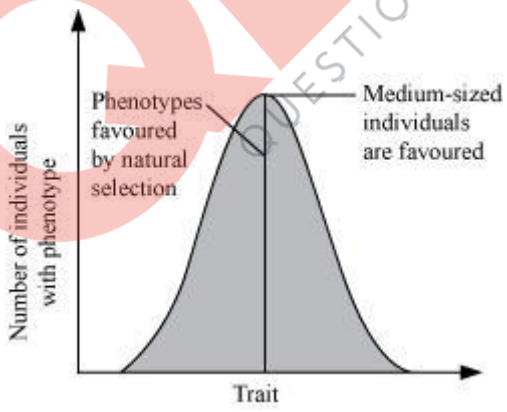
Describe the process of decomposition of detritus under the following heads:
Fragmentation; leaching; catabolism; humification and mineralization.

**30.** Write the symptoms of haemophilia and sickle-cell anaemia in humans.
Explain how the inheritance pattern of the two diseases differs from each other. [5]

**OR**

(a) Write Hardy-Weinberg principle.

(b) Explain the three different ways that natural selection can affect the frequency of a heritable trait in a population shown in the graph given below.



# CBSE
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# SOLUTION

**Time: 3 hrs** **Total Marks: 70**

## SECTION A

1. **Ans.** Positive application of amniocentesis:
   Amniocentesis helps find genetic and metabolic disorders of the foetus.
   Negative application of amniocentesis:
   It is used to kill the normal female foetus.

2. **Ans.** Animals like fish and snails avoid summer-related unfavourable conditions like heat and desiccation by the process called aestivation or summer sleep and become inactive during summer.

3. **Ans**. The birth rate of population per capita would be
   40/200 = 0.2 offspring per frog per year

4. **Ans**. AUG has dual function.
   (i) It codes for Methionine (Met).
   (ii) It also acts as initiator codon.

5. **Ans**. Different viral and bacterial DNA in a host body can be detected by polymerase chain reaction (PCR). PCR can detect very low amounts of DNA. PCR is now usually used to detect HIV in suspected AIDS patients. It is a good technique to identify many other genetic disorders.

6. **Ans**. Louis Pasteur disproved the spontaneous generation theory. According to this theory, life originated repeatedly from non-living materials spontaneously. However, according to Louis Pasteur, life originated from pre-existing organisms of their own kind.

7. **Ans**. On exposure to antigens or vaccines, the antibodies produced in the body neutralise the pathogenic agent during infection. The vaccines generate memory B cells and T cells during primary response. When the vaccinated person is attacked by the same pathogen, the existing memory T or B cells recognise the antigen quickly and attack the invaders with a massive production of lymphocytes and antibodies.

8. **Ans**. Cellulase is used for isolating genetic material from plant cells because the cell wall of plants is made of cellulose. Animal cells do not have a cell wall or cellulose, so cellulase is not required for isolating genetic material from animal cells.

## SECTION B

9. **Ans**. Triple fusion occurs inside the embryo sac (female gametophyte) of angiosperms.
   It is called so because one male gamete fuses with two polar nuclei (secondary nucleus) to form a triploid primary endosperm nucleus.
   Significance of triple fusion:
   Endosperm is a highly nutritive tissue formed as a result of triple fusion and provides nourishment to the developing embryo.

10. **Ans**. Certain regions have been declared as biodiversity 'hotspots' by environmentalists of the world because these areas are of high endemism and high level of species richness. In India, biodiversity hotspots are the Western Ghats and the Himalayas.

11. **Ans**. The eggs are located in the archegonium in moss. For fertilisation to take place, antherozoids swim in water to reach the eggs. Moss produces a large number of antherozoids to increase the chance of fertilisation.

12. **Ans.** Adenosine deaminase deficiency can be cured by enzyme replacement therapy, but the cure is not permanent even after infusion of genetically engineered lymphocytes into a patient as the cells are not immortal. The patient does not have functional T-lymphocytes so they cannot provide immune responses against invading pathogens. The patient requires periodic infusion of such genetically engineered lymphocytes. However, if the gene isolated from bone marrow cell-producing ADA is introduced into cells at early embryonic stages, it could prove to be a permanent cure.

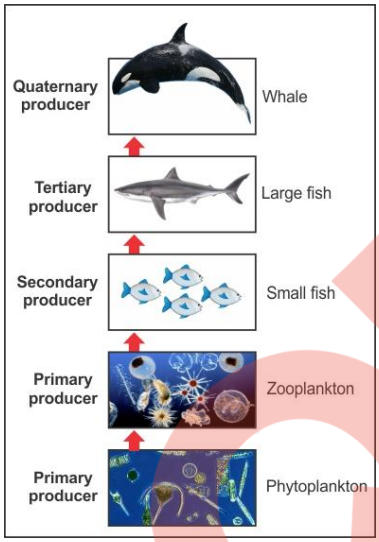
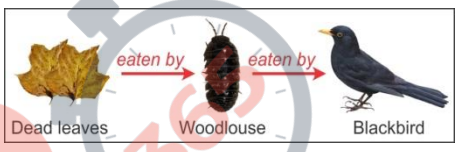
13. **Ans.**
   (a) There is a continuous increase in the DDT content in different trophic levels of the chain because it accumulates in the fat of the body.
   (b) The phenomenon responsible for the increase in DDT content in different trophic levels is called biomagnification.

14. **Ans**. Bee farms or apiaries are established in an area where abundance of wild shrubs, fruit orchards and cultivated crops is available in a 1–2 km radius. Availability of flowering plants for the collection of nectar and pollen is called pasturage. It plays an important role in the quality and quantity of honey. The beehives when kept in the fields of sunflower, *Brassica*, apple and pear increase the pollination efficiency of flowering plants and improve the yields.

**OR**

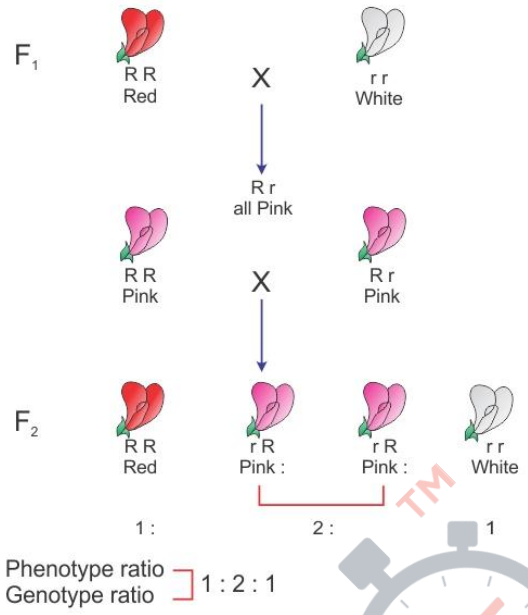
When a small amount of curd is added to milk, the fermentation process begins. During this process, the lactose sugar of milk is converted to lactic acid which acidifies the fermenting medium. The acidic medium helps in coagulating milk protein by partially digesting it so that a thick concentrated curd is prepared.
Lactic acid bacteria improve its nutritional quality by increasing vitamin $B_{12}$.

**15. Ans**. Aquatic ecosystem: Pond ecosystem
Terrestrial ecosystem: Detritus food chain

| Aquatic Ecosystem | Terrestrial Ecosystem |
|---|---|
| It describes the ecosystem in water. Example: Pond ecosystem   | It describes the ecosystem on land. Example: Detritus food chain   |

**16. Ans.**
(a) Formation of gametocytes occurs in the red blood cells of the human host.
(b) Fertilisation of gametocytes occurs in the mosquito's stomach.

**17. Ans**. In Snapdragon, when two types of pure breeding plants bearing red flower and white flower are crossed, the $F_1$ generation plants neither bear red nor white flowers. They bear pink flowers exhibiting incomplete dominance.
On self-breeding, the pink flowers yield a progeny consisting of three types of plants—red, pink and white, i.e. 1:2:1, both phenotypically and genotypically.
So, we conclude that when genotypic and phenotypic ratios are the same, the alleles show incomplete dominance.




**18. Ans**. The Mediterranean orchid Ophrys has a very strange relationship with its insect pollinator *Colpa aurea* (a hairy wasp). The orchid bears flowers which resemble the female wasp in colour, odour and appearance. The male wasp matures first and leaves the burrow about four weeks before the females come out for open air mating. The inexperienced males try to pseudocopulate the orchid flowers presuming them as their female partners and bring about pollination.

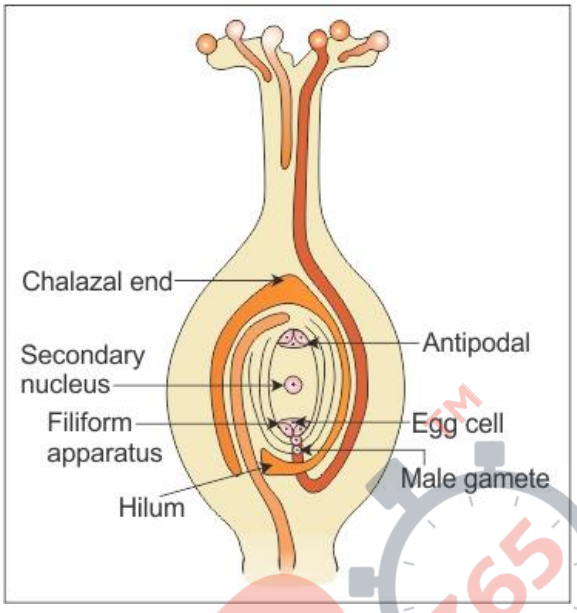
## SECTION C

**19. Ans**. Morgan attributed this to the physical association or linkage of the two genes and coined the term linkage to describe the physical association of genes on a chromosome and the term recombination to describe the generation of non-parental gene combinations. Morgan and his co-workers also found that even when genes were grouped on the same chromosomes, some genes were very tightly linked which showed very low recombination, while others were loosely linked and showed higher recombination. For example, he found that genes for white and yellow body colour were tightly linked and showed only 1.3% recombination, while white and miniature wing showed 37.2% recombination.

**20. Ans.** Process elongation during transcription remains continued until it reaches the terminator sequence in the sense DNA strand (3′–AAAAAAT–5′). At this point, another protein particle, the rho (ρ) factor, forms a complex with RNA polymerase. This causes the enzyme to go off the DNA track and thus new mRNA is released.

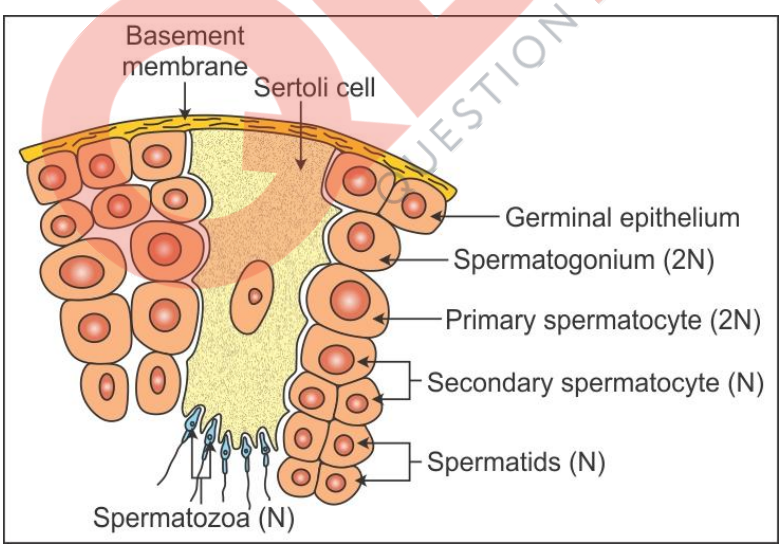

**21. Ans**. A nematode (*Meloidogyne incognita*) infects the roots of tobacco plants and reduces its yield. A method of cellular defence, RNA interference (RNAi) takes place in all eukaryotic organisms which involves silencing of a specific mRNA. Agrobacterium vectors were used for introducing nematode-specific genes into the host plant. 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 (silencing) of the nematode. The parasite does not survive in a transgenic host expressing specific interfering RNA. The transgenic plant therefore gets itself protected from the parasite.

**22. Ans**. Longitudinal section of a post-pollinated pistil:




**OR**

Sectional view of the seminiferous tubule of a human male:




**23. Ans.** Efforts to improve health, hygiene and milk yield of cattle in a diary farm are

(i) Selection of good breeds of dairy farm animals having high-yielding potential.

(ii) Selection of disease-resistant breeds.

(iii) Sufficient water and feed is to be provided so that animals are properly nourished.

(iv) Animals should be kept in a clean place under a shadow or in an open area free from dirt and pollution.

(v) Regular inspections with proper record keeping.

(vi) Regular visits by a veterinary doctor should be mandatory.

**24. Ans.**

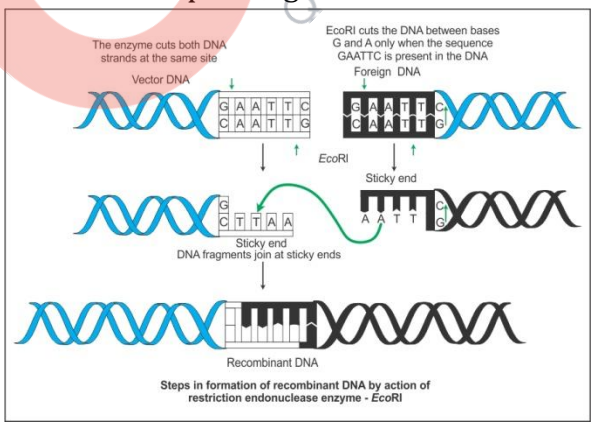
(i) Convergent evolution: The organs which have arisen in the evolutionary process through adaptation of quite different organisms to a similar mode of life is called convergent evolution. Analogous organs are the result of convergent evolution. Example: The wing of an insect and the wing of a bird are analogous organs. Both these organs are used for flying in the air but are different in structure.

(ii) Divergent evolution: The homologous structures seen in successive generations indicate actual relationship and the possessors are the diverse descendants of common ancestry is called divergent evolution. Homologous organs are the result of divergent evolution. Example: Forelimbs of vertebrates such as man, cheetah, whale and bat are homologous organs as they are built on the same plane but perform different functions.

**25. Ans.**

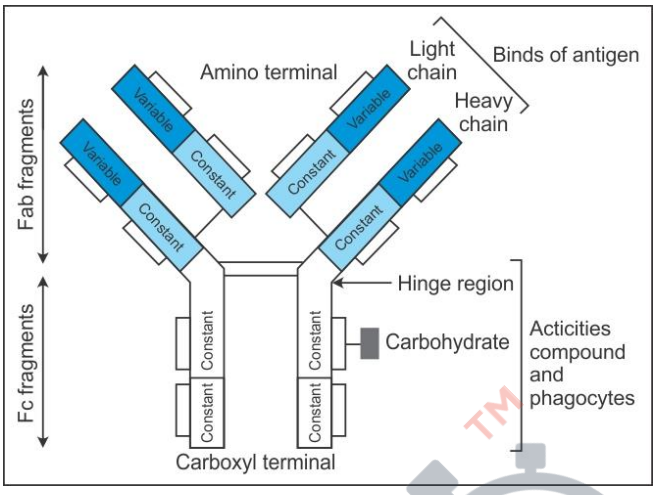
i. Restriction endonuclease functions by recognising its specific sequence. It binds to the DNA and cuts each of the two strands of the double helix at specific points in their sugar phosphate backbones. Each restriction endonuclease recognises a specific palindromic nucleotide sequence in the DNA.

ii. Restriction enzymes cut the strand of DNA between the same two bases on the opposite strands leaving a single-stranded portion at their ends. These overhanging stretches are called sticky ends on each strand. The enzyme DNA ligase functions depending on the stickiness of these ends.




**26. Ans.** Each antibody is a combination of two heavy and two light polypeptide chains. The polypeptide has a 'Y'-shaped structure in which the stem consists of the heavy chain of polypeptide, while the arms consists of the heavy and light polypeptide chains running parallel to each other. The attachment and binding occur by the disulphide bonds. Light chains are of two types—kappa and lambda. Heavy chains are of five types and are distinct of each of the five immunoglobulin classes. These five types are gamma, mu, alpha, delta and epsilon. L and H chains are subdivided

into variable regions and constant regions. An L-chain consists of one variable and three constant regions.




**27. Ans.**

a = Statins
b = Blood cholesterol-lowering agents
c = *Penicillium notatum*
d = Penicillin
e = *Trichoderma polysporum*
f = Immunosuppressant drug

## SECTION D

**28. Ans**. Primary oocytes are formed in the female ovary. In the multiplicative phase of oogenesis, certain cells in the germinal epithelium of the ovary divide by mitosis and produce millions of egg mother cells or oogonia in each ovary. These oogonia multiply mitotically to form primary oocytes.

The menstrual cycle consists of the following phases:

(i) Menstrual phase: It is also called the bleeding phase. The production of luteinising hormone (LH) from the anterior lobe of the pituitary gland is considerably reduced. The withdrawal of this hormone causes degeneration of the corpus luteum and therefore progesterone production is reduced. Production of oestrogens is also reduced in this phase. The endometrium of the uterus breaks down and menstruation begins.

(ii) Follicular phase: It is also called the proliferative phase. In this phase, the follicle-stimulating hormone (FSH) secreted by the anterior lobe of the pituitary gland stimulates the ovarian follicle to secrete oestrogens which stimulate the proliferation of the endometrium of the uterine wall.

(iii) Ovulatory phase: In this phase, LH is secreted rapidly which induces rupturing of the Graafian follicle and thereby release of ovum. This is called ovulation. Thus, LH causes ovulation.

(iv) Luteal phase: It is also called secretory phase. The remaining cells of the ovarian follicles are stimulated by the LH to develop the corpus luteum. The corpus luteum secretes a large amount of progesterone.

Hormonal control of menstrual cycle:

Gonadotropin-releasing hormone (GnRH), also called gonadotropin-releasing factor (GnRF), is secreted by the hypothalamus of the brain, which stimulates the release of FSH and LH. FSH stimulates the ovarian follicles to produce oestrogen during the proliferative phase. LH causes ovulation during the ovulatory phase and stimulates the corpus luteum of the ovary to secrete progesterone.

**OR**

(a) The process of fusion of a haploid male gamete (sperm) and a haploid female gamete (ovum) to form a diploid zygote is called fertilisation. The male discharges semen in the female's vagina close to the cervix during coitus. This is called insemination. Certain activities of the female reproductive tract help the sperms reach the site of fertilisation. Immediately after the fusion of sperm and egg plasma membrane, the egg shows a cortical reaction to further check the entry of more sperms. In this reaction, the cortical granules present beneath the egg's plasma membrane fuse with the plasma membrane and release enzymes

between the plasma membrane and the zona pellucida. These enzymes harden the zona pellucida which block the entry of additional sperms and prevent polyembryony.

(b) Implantation is the attachment of the blastocyst to the uterine wall.

Cleavage in the human zygote occurs during its passage through the fallopian tube to the uterus.

(i) It divides the zygote and the blastomeres completely into daughter cells. The first cleavage takes about 30 hours after fertilisation and produces two blastomeres, one slightly larger than the other.

(ii) The second cleavage occurs within 60 hours after fertilisation and divides each blastomere into two by forming a mitotic spindle in each.

(iii) The third cleavage takes place about 72 hours after fertilisation.

(iv) Cleavage produces a solid ball of small blastomeres called morula. It consists of 16–32 cells but is not larger than the zygote.

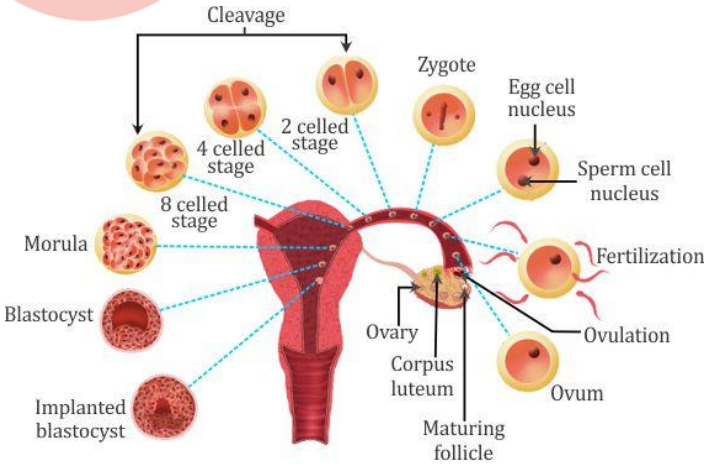
(v) The morula reaches the uterus about 4–6 days after fertilisation and remains surrounded by the zona pellucida to prevent its sticking to the uterine wall.

(vi) The outer layer of the cells of the morula absorbs the nutritive fluid secreted by the uterine mucous membrane and is called trophoblast.

(vii) The fluid absorbed by a trophoblast collects in a cavity called blastocoel or blastocyst cavity.

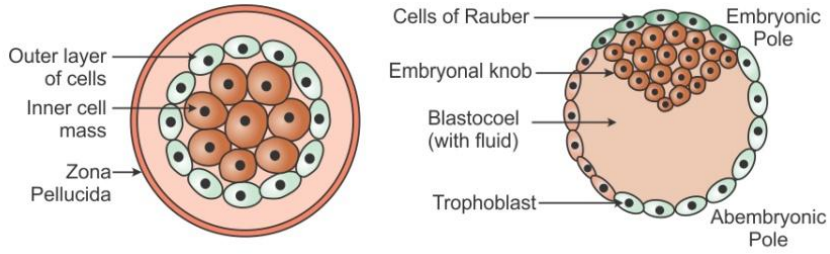
(viii) As the quantity of the fluid increases, the morula enlarges to form a blastocyst. The zona pellucida becomes thinner and finally disappears.

(ix) The blastocyst sinks into a pit formed in the endometrium which grows around it. Thus, implantation involves the activities of both blastocyst and uterus.

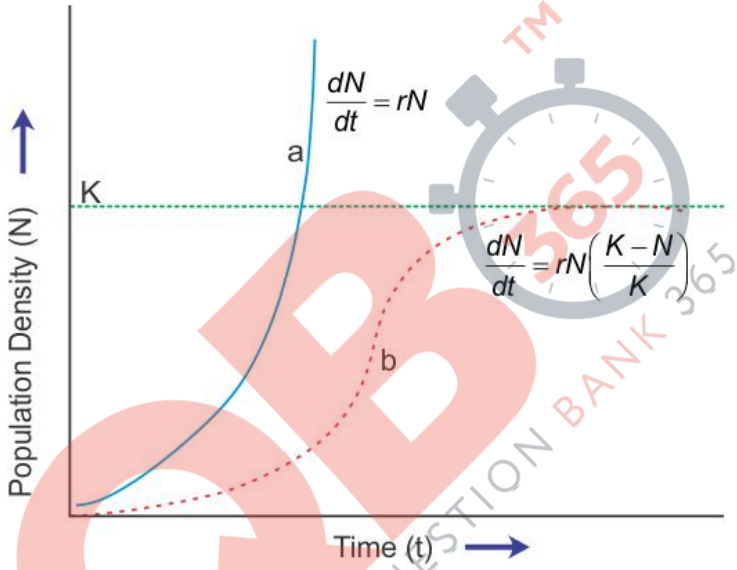



**Development of the embryo**

(c)




**29. Ans.**




In nature, a given habitat has resources to support a certain number of individuals of a population beyond which no further growth is possible. This limit is called nature's carrying capacity (K) for that species in that habitat.

A population growing in a habitat with limited resources shows initially a lag phase, followed by phases of increase and decrease, and finally the population density reaches the carrying capacity.

A plot of N in relation to time (t) results in a sigmoid curve. This type of population growth is called Verhulst–Pearl logistic growth. It is explained by the following equation:

$$dN/dt = rN\left(\frac{K - N}{K}\right)$$

where N = population density at a time t, r = intrinsic rate of natural increase and K = carrying capacity

Because resources for growth for most animal populations becomes limiting sooner or later, the logistic growth model is more realistic. It is also called the S or sigmoid growth curve.

**OR**

Decomposition is the process of breaking down of a substance into its constituent parts. Dead remains of plants and animals are called detritus.

Decomposition is a complex, enzymatic process which involves stepwise degradation of detritus. It involves the following steps:

(i) Fragmentation: It is the process of breaking of the detritus into smaller particles or fragments by detritivores. Fragmentation increases the surface area of detritus particles for microbial action.

(ii) Leaching: Soluble substances formed during decomposition pass into soil along with percolating water to be made available to the roots of plants for absorption.

(iii) Catabolism: This process is carried out by decomposers which release extracellular enzymes to decompose detritus particles to simpler compounds and inorganic substances.

(iv) Humification: It is the process by which simplified detritus is converted to a dark-coloured amorphous substance called humus in the soil.

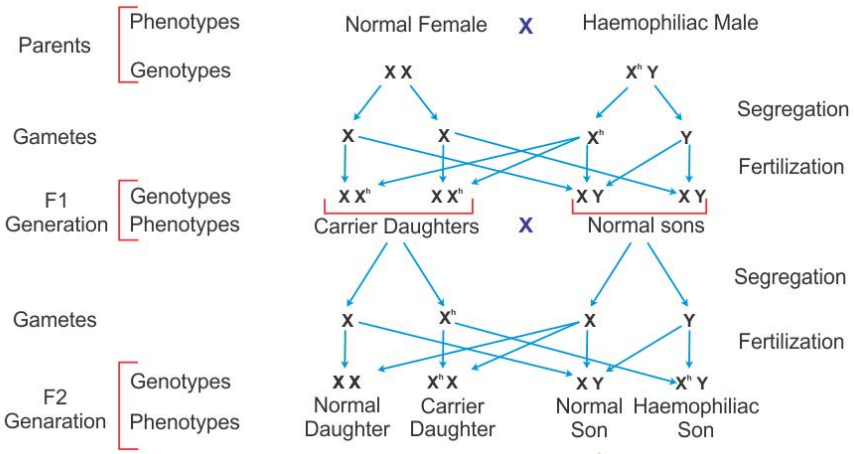
(v) Mineralisation: It is the process resulting in the release of inorganic substances such as carbon dioxide, water and nutrients.

**30. Ans**. Symptoms of haemophilia: Haemophilia is also called bleeder's disease, and a single cut can lead to non-stop bleeding. It prevents the clotting of blood. A seriously affected person may bleed to death after even a minor skin cut.

Symptoms of sickle cell anaemia: In this disease, red blood cells become elongated and curved under low oxygen tension. Individuals with this disease suffer attacks because of aggregation of red blood cells. These erythrocytes are destroyed more rapidly than normal red blood cells leading to anaemia.

Inheritance pattern of haemophilia:

This is a sex-linked recessive disease which shows its transmission from unaffected carrier female to some male progeny. It shows criss-cross inheritance. The heterozygous female (carrier) for haemophilia may transmit the disease to the sons. The possibility of a female becoming a haemophilic is extremely rare because the mother of such a female has to be at least a carrier and the father should be haemophilic.

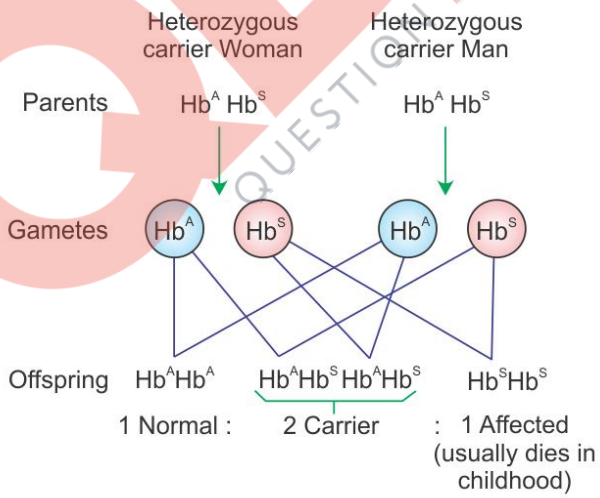



Inheritance pattern of sickle cell anaemia:

It is an autosomal hereditary disease which can be transmitted from parents to offspring when both partners are carriers for the gene (heterozygous).

It is controlled by a single pair of alleles $Hb^A$ and $Hb^S$.

Of the three possible genotypes $Hb^A$ $Hb^A$, $Hb^A$ $Hb^S$ and $Hb^S$ $Hb^S$, only the last one shows the diseased phenotype. Heterozygous ($Hb^A$ $Hb^S$) individuals appear apparently unaffected, but they are a carrier of the disease as there is 50% probability of transmission of the mutant gene to the progeny, thus exhibiting the sickle cell trait.




**OR**

(a) The Hardy–Weinberg principle states that the relative frequency of alleles in the population of sexually reproducing organisms remains constant from generation to generation as long as

(i) The population is large enough and changes in allele frequencies because of chance or accident are insignificant.

(ii) Mating occurs at random.

(iii) Mutation does not occur. If it does occur, then it must reach a state of equilibrium.

(iv) All the members of the population survive and have equal reproductive rates.

(b) Natural selection specifically adapts populations to their immediate environment. There are three types of natural selection:

(i) Stabilising selection: In stabilising selection, the average phenotype is the most adaptable, and selection favours it over extreme phenotypes in either direction, i.e. more individuals acquire mean character value. For example, in the human population, individuals have a range of heights, but majority of them are likely to be of average height than very tall or very short.

(ii) Directional selection: This type of selection occurs when an extreme phenotype is favoured and the distribution curve shifts in that direction, i.e. more individuals acquire a value other than the mean character value. Example: Pesticide resistance in mosquitoes.

(iii) Disruptive selection: It is just the opposite of stabilising selection. The extremes have more adaptable phenotypes than the average ones. Consequently, the original population is disruptive into two or more separate groups which later evolve into a new species.