

CBSE
Class XII Biology
Board Paper 2013 - 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. Why is the enzyme cellulase needed for isolating genetic material from plant cells and not from the animal cells? [1]
2. Write the importance of MOET. [1]
3. An anther with malfunctioning tapetum often fails to produce viable male gametophytes. Give any one reason. [1]
4. Why sharing of injection needles between two individuals are not recommended? [1]
5. Name the enzyme and state its property that is responsible for continuous and discontinuous replication of the two strands of a DNA molecule. [1]
6. "Sweet potato tubers and potato tubers are the result of convergent evolution." Justify the statement. [1]
7. Write the equation that helps in deriving the net primary productivity of an ecosystem. [1]
8. Name the type biodiversity represented by the following: [1]
(a) 50,000 different strains of rice in India.
(b) Estuaries and alpine meadows in India

SECTION B

9. Explain why very small animals are rarely found in polar region. [2]
10. Why the pyramid of energy is always upright? Explain. [2]
11. Expand the following and mention one application of each:
- 1) PCR
 - 2) ELISA

OR

- (a) Mention the difference in the mode of action of exonuclease and endonuclease.
- (b) How does restriction endonuclease function? [2]
12. Name any two sources of e-Wastes and write two different ways of their disposal. [2]
13. Explain the steps that ensure cross pollination in an autogamous flower. [2]
14. When and where do chorionic villi appear in humans? State their function. [2]
15. In a cross between two tall pea plants some of the offsprings produced were dwarf. Show with the help of Punnett square how this is possible. [2]
16. A student on a school picnic to park on a windy day started sneezing and having difficulty in breathing in reaching the park. The teacher enquired whether the student was allergic to something.
- (a) What is an allergy?
- (b) Write the two unique characteristics of the system involved in the response observed in the student. [2]
17. Why and how bacteria can be made 'competent'? [2]
- 18.
- (a) Name the deficiency for which first clinical gene therapy was given.
- (b) Mention the cause of and one cure for this deficiency. [2]

SECTION C

19.

- (a) Why is human ABO blood group gene considered a good example of multiple alleles?
- (b) Work out a cross up to F₁ generation only, between a mother with blood group A (Homozygous) and the father with blood group B (Homozygous). Explain the pattern of inheritance exhibited. [3]

20. Describe the structure of RNA polynucleotide chain having four different types of nucleotides. [3]

21.

- (a) Differentiate between inbreeding and outbreeding.
- (b) Explain inbreeding depression and how it can be overcome.
- (c) Mention two advantages of inbreeding programme in cattle. [3]

22.

- (a) Why are the fruit juices bought from market clearer as compared to those made at home?
- (b) Name the bioactive molecules produced by *Trichoderma polysporum* and *Monascus purpureus*. [3]

23. Draw the following diagrams related to human reproduction and label them.

- (a) The zygote after the first cleavage division
- (b) Morula stage
- (c) Blastocyst stage (sectional view) [3]

24. With the help of any two suitable examples explain the effect of anthropogenic actions on organic evolution. [3]

25. How have human activities caused desertification? Explain.

OR

How does algal bloom destroy the quality of a fresh water body? Explain. [3]

26. Explain mutualism with the help of any two examples. How is it different from commensalism? [3]

27.

- (a) Why are transgenic animals so called?
- (b) Explain the role of transgenic animals in (i) Vaccine safety and (ii) Biological products with the help of an example each. [3]

SECTION D

28. A child suffering from Thalassemia is born to a normal couple. But the mother is being blamed by the family for delivering a sick baby. [5]

(a) What is Thalassemia?

(b) How would you counsel the family not to blame the mother for delivering a child suffering from this disease? Explain.

(c) List the values your counselling can propagate in the families.

29.

(a) Draw a diagram of a mature embryo sac of an angiosperm and label the following parts in it. [5]

(i) Filiform apparatus

(ii) Synergids

(iii) Central cell

(iv) Egg cell

(v) Polar nuclei

(vi) Antipodals

(b) Write the fate of egg cell and polar nuclei after fertilization.

OR

(a) Describe the events of Oogenesis with the help of schematic representation.

(b) Write two differences between Oogenesis and spermatogenesis.

30. Describe the asexual and sexual phases of life cycle of *Plasmodium* that causes malaria in humans. [5]

OR

(a) What is plant breeding? List the two steps the classical plant breeding involves.

(b) How has the mutation breeding helped in improving crop varieties? Give one example where this technique has helped.

(c) How has the breeding programme helped in improving the public nutritional health? State two examples in support of your answer.

CBSE
Class XII Biology (Theory)
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SOLUTION

Time: 3 hrs

Total Marks: 70

SECTION A

1. **Ans.** Cellulase enzyme is needed for isolating genetic material from plant cells and not from animal cells because it breaks down the plant cell wall made of cellulose. Animal cells do not have a cell wall.
2. **Ans.** MOET stands for multiple ovulation embryo transfer technology which is a programme for herd improvement. The importance of MOET is to increase herd size in a short time.
3. **Ans.** An anther with malfunctioning tapetum often fails to produce viable gametophytes because the tapetum provides nutritive materials to the dividing microsporocytes.
4. **Ans.** Sharing of injection needles between two individuals is not recommended because it causes fatal and incurable diseases such as AIDS and hepatitis.
5. **Ans.** DNA-dependent DNA polymerase is the enzyme which polymerises the DNA strand in the 5' to 3' direction resulting in continuous and discontinuous replication.
6. **Ans.** Sweet potato tubers and potato tubers are the result of convergent evolution. It is because the basic structure of the sweet potato tuber and potato tuber is different, but their function is similar. Both of them are meant for storage of food and vegetative reproduction.
7. **Ans.** The equation of net primary productivity of an ecosystem is
$$NPP = GPP - R$$
where NPP = net primary productivity
GPP = gross primary productivity
R = respiratory rate
8. **Ans.**
 - (a) 50,000 different strains of rice: Genetic diversity
 - (b) Estuarine and alpine meadows: Ecological diversity

SECTION B

9. Ans. Small animals are cold-blooded organisms. They do not have constant body temperature and need to spend energy to generate heat through metabolism. So, they are rarely found in the polar regions.

10. Ans. The pyramid of energy is a graphical representation of the amount of accumulated energy per unit area in different trophic levels of a food chain. An energy pyramid is always upright because there is a gradual decrease in energy at successive trophic levels. This happens because according to the 10% law of energy transfer—only 10% of the total energy is transferred from one trophic level to another.

11. Ans.

(i) PCR: Polymerase chain reaction

Application of PCR: It is useful to detect genetic disease in the foetus before birth.

(ii) ELISA: Enzyme-linked immunosorbent assay

Application of ELISA: It is useful in the early diagnosis of diseases using antigen–antibody interactions.

OR

(a) Exonucleases remove nucleotides from the ends of the DNA, whereas endonucleases make cuts at specific positions within the DNA.

(b) Each restriction endonuclease inspects the DNA molecule in search of a specific recognition sequence. When it gets its specific recognition sequence, it binds to the site and cuts each of the two strands of the double helix at specific points by hydrolysing the phosphodiester backbones.

12. Ans.

Two sources of e-wastes are

(i) Parts of computers and television sets

(ii) Smartphones and parts of air conditioners and refrigerators

Two ways for disposal of e-wastes are

(i) Recycling of e-wastes

(ii) Incineration of e-wastes, i.e. burning e-wastes completely into ashes

13. Ans. The autogamous flowers are open and can be subjected to cross-pollination. Various agents which help in cross-pollination are wind, insects and birds. However, the steps which ensure cross-pollination in an autogamous flower involve artificial hybridisation techniques called emasculation and bagging. Removal of stamens or anthers of a bisexual flower without affecting the female reproductive organs is called emasculation. The

emasculated flower is immediately enclosed in a bag to avoid pollination by any unwanted pollen. This process is called bagging.

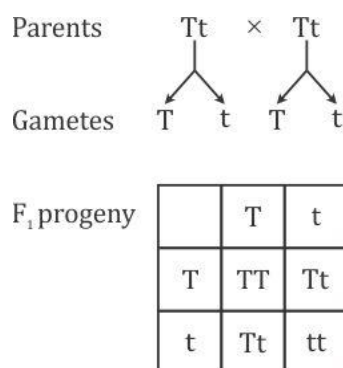
Emasculation is applied only when artificial pollination is carried out in a bisexual flower. It is not required in unisexual flowers. During artificial pollination, the mature and viable pollen grains are collected from the anther of the male parent and are dusted on the stigma of the female parent.

14. Ans. Chorionic villi are finger-like projections which arise from the trophoblast layer and develops in the zygote after it has undergone implantation.

Functions of chorionic villi:

- (a) It takes part in the formation of placenta, which is the connecting link between the mother and the foetus.
- (b) It supplies oxygen and nutrients to the growing embryo.

15. Ans. In a cross between two tall pea plants, some offspring produced were dwarf which ensures that both parents are heterozygous (Tt).



Phenotypic ratio: 3:1

Genotypic ratio: 1:2:1

16. Ans.

(a) An allergy is the hypersensitivity of the body to certain foreign substances called allergens. It is related with the immune system of the body.

(b)

(i) The immune system shows specificity to a particular allergen.

(ii) It exhibits memory, i.e. first exposure to allergen causes primary response but does not cause allergy. When an allergen enters the body the second time, it causes a second immune response reaction and causes allergy and produces antibodies.

17. Ans. Because DNA is a hydrophilic molecule, it can pass through the membranes, so the bacterial cells must be made capable to take up DNA. This is done by treating them with a specific concentration of a divalent cation,

such as calcium which makes the cell wall permeable. Recombinant DNA can be forced into such cells by incubating the cells with recombinant DNA on ice, followed by placing them at 42°C (heat shock) and then putting them back on ice. This enables the bacteria to take up the recombinant DNA.

18. Ans.

(a) The first clinical gene therapy was given in 1990 to a 4-year-old girl with adenosine deaminase (ADA) deficiency.

(b) The patient has defective gene for the enzyme adenosine deaminase (ADA) which causes severe combined immune deficiency (SCID).

It can be cured by gene therapy treatment.

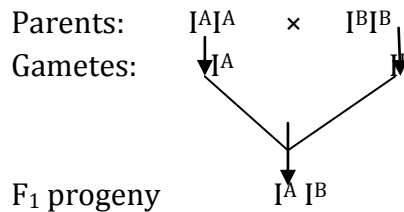
SECTION C

19. Ans.

(a) In multiple allelism, a character is controlled by three or more alleles.

Because the ABO blood group has three alleles— i , I^A and I^B , it is considered a good example of multiple alleles.

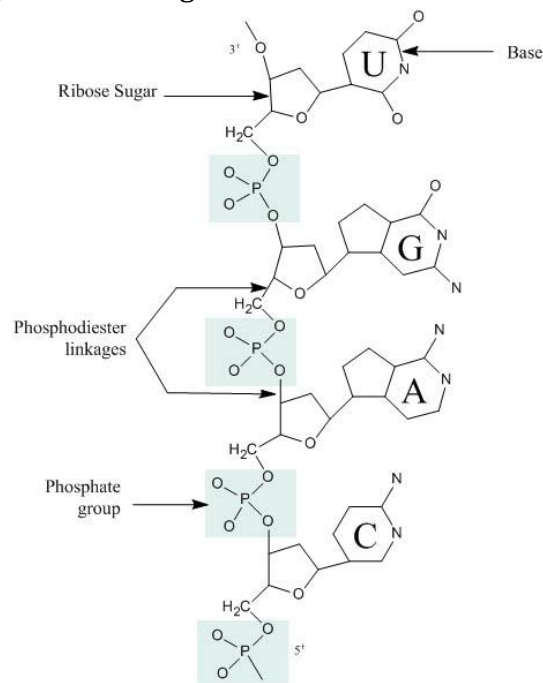
(b) Genotype of mother: $I^A I^A$; Genotype of father: $I^B I^B$



The blood group of the child will be AB. This is due to co-dominance where allele I^A for the A-type blood group is co-dominant with its allele I^B for the B-type blood group.

20. Ans. RNA molecule is a single chain polynucleotide. Each nucleotide is composed of three main components—a nitrogenous base, a 5-carbon ribose sugar and a phosphate group.

- (i) The axis or backbone of a polynucleotide chain is formed of alternate residues of phosphate and ribose sugar.
- (ii) Phosphate combines with carbon of its sugar and carbon 3' of the next sugar.
- (iii) Nitrogenous bases are purines (adenine and guanine) and pyrimidines (cytosine and uracil). Nitrogenous base is linked to the ribose sugar through N-glycosidic linkages.



21. Ans.

(a)

Inbreeding	Outbreeding
It refers to the mating of closely related individuals within the same breed for 4–6 generations.	It refers to the breeding of unrelated animals which may be between individuals of the same breed but having no common ancestors for 4–6 generations or between different breeds or different species.

(b) Continued inbreeding usually reduces fertility of animals and even their productivity. This condition is called inbreeding depression. It can be overcome by mating them with unrelated superior animals of the same breed. Such type of mating usually helps restore fertility and yield.

(c) Advantages of inbreeding:

- (i) It helps in the accumulation of superior genes and elimination of undesirable genes.
- (ii) It develops homozygous pureline in an animal; thus, it increases homozygosity to evolve a pureline in any animal.
- (iii) It exposes harmful recessive genes for undesirable characters which are eliminated by selection.

22. Ans.

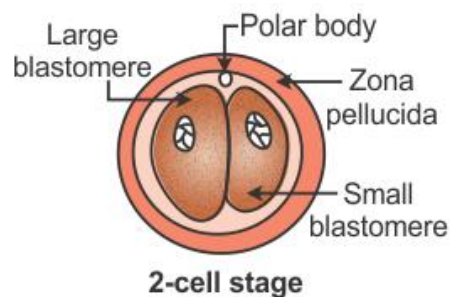
(a) The fruit juices bought from the market are clearer as compared to those made at home because of the addition of proteases and pectinases.

(b) Bioactive molecules produced by

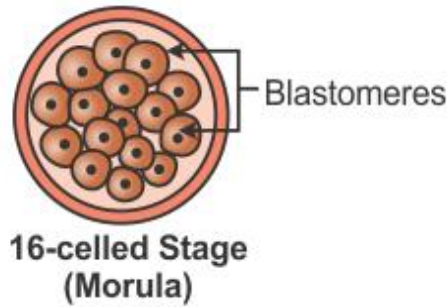
- (i) *Trichoderma polysporum* is cyclosporin A (immunosuppressor).
- (ii) *Monascus purpureus* is statins (lowers blood cholesterol level).

23. Ans.

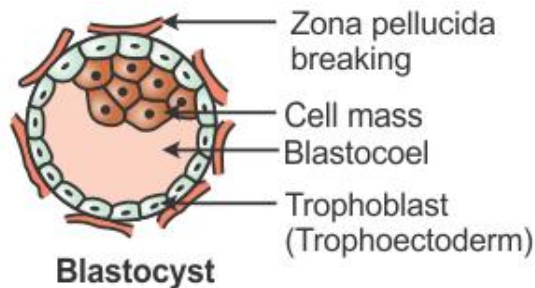
(a)



(b)



(c)



24. Ans. Effect of anthropogenic actions on organic evolution can be explained by the following examples:

- (i) Use of chemicals such as mosquito repellents, pesticides and fungicides has enabled the selection of mosquito and pest species which are better adaptive to the environment. Because of the anthropogenic action, the rate of evolution has increased, and as a result, in a very short time, a new species has evolved which can resist the chemicals.
- (ii) Use of antibiotics has increased the rate of evolution of bacteria and virus. Among many species of bacteria, mutation occurred in a few individuals. Because of selection using antibiotics, individuals with resistive properties got selected and produced a large number of progeny.

25. Ans. Causes of desertification:

- (i) Improper farming practices: Farming practices are improper when crops are continually grown, harvested and the soil is not given enough time to replace its nutrients. This leads to loss of fertility of soil.
- (ii) Soil erosion: Excessive ploughing of land may also cause soil erosion. Animal grazing may also cause the lack of natural vegetation (forest), and hence, lack of plant roots to bind the soil particles together, and this will cause soil erosion.
- (iii) Deforestation: Human beings cut down trees to serve their own purpose such as construction of houses and roads. Increase in industrialisation also increases deforestation.
- (iv) Mining: Mining activities and leaching of minerals destroy soil quality and make soil infertile.

OR

Algal bloom destroys the quality of a freshwater body in the following ways:

- (i) Aquatic life is affected when algae consume dissolved oxygen from the water body.
- (ii) Algal blooms are sometimes toxic to humans as humans consume aquatic organisms as food.
- (iii) A water body is polluted as the algal bloom spreads over the water body such as lakes and produces a foul smell.
- (iv) They block sunlight which does not reach submerged aquatic plants which may have a role in supplying necessary nutrients to other aquatic life forms.

26. Ans. Mutualism is the relationship between two organisms where both are benefited for food, shelter and substratum for attachment. Two examples are

- (i) Mycorrhiza is the mutualistic relationship between fungi and roots of higher plants. The fungus helps in mineral nutrition of the plant with which they are associated and obtains in turn carbohydrates from plants.
- (ii) The association of *Trichonympha* and termite is symbiotic. *Trichonympha* lives in the gut of termites and digests the cellulose of wood for them, and in turn, termites provide food, shelter and a constant internal environment to *Trichonympha*.

Commensalism is a type of interaction between two organisms where one is benefited and the other is neither harmed nor benefited. For example, the sucker fish bears a sucker on the dorsal side of its head which helps it to attach itself to the body of the shark. It benefits the sucker fish with free transport and free food left behind by the shark.

27. Ans.

- (a) Transgenic animals are so called because they contain a foreign or a transgene and have been modified by insertion of recombinant DNA. Positive traits have been inserted in them to produce products which are beneficial to humans.
- (b) The role of transgenic animals in
 - (i) Vaccine safety: Transgenic animals are predominantly used for testing of vaccines before they are used on human beings. For example, transgenic mice are used to test the safety of polio vaccine.
 - (ii) Biological products: Many human diseases are controlled by biological products. The transgenic animals which produce these products are introduced with DNA which codes for a particular product such as human protein (α -I-antitrypsin) for treating emphysema. In 1997, the first transgenic cow Rosie was produced. She was capable of secreting human protein-enriched milk. The milk contained human alpha-lactalbumin and was nutritionally a more balanced product for human babies than cow milk.

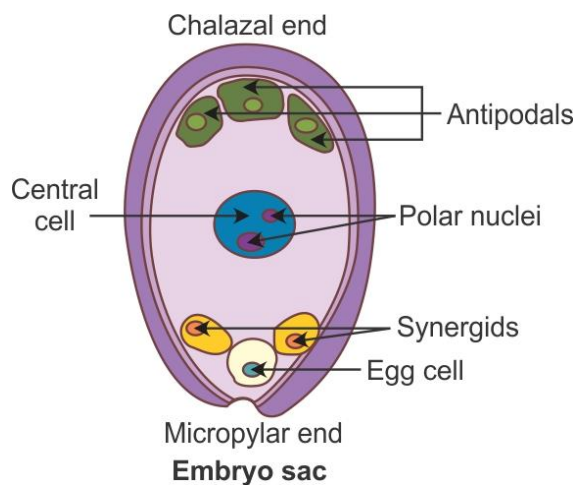
SECTION D

28. Ans.

- (a) Thalassaemia is a form of inherited autosomal recessive blood disorders which is caused by the weakening and destruction of red blood cells. It is caused by the deletion or mutation of gene in any of the α or β chains of haemoglobin leading to the synthesis of improper folded haemoglobin which results in anaemia, a major symptom of thalassaemia.
- (b) Because thalassaemia is an autosomal recessive disorder, it will only be caused in a child if both parents are heterozygous and the mutation is carried on any one of the autosome which acts as a carrier. It has an equal probability of being transmitted from mother or father. So, it is unjustified to blame only the mother for the abnormality in the child.
- (c) The list of values which can be counselled in the families for thalassaemia cases are
 - (i) Giving proper nutritional content to the child.
 - (ii) Encouraging the child to follow medical treatment regularly.
 - (iii) Support the child emotionally when the child faces fear, anxiety and depression.
 - (iv) Treat the mother with dignity and respect.

29. Ans.

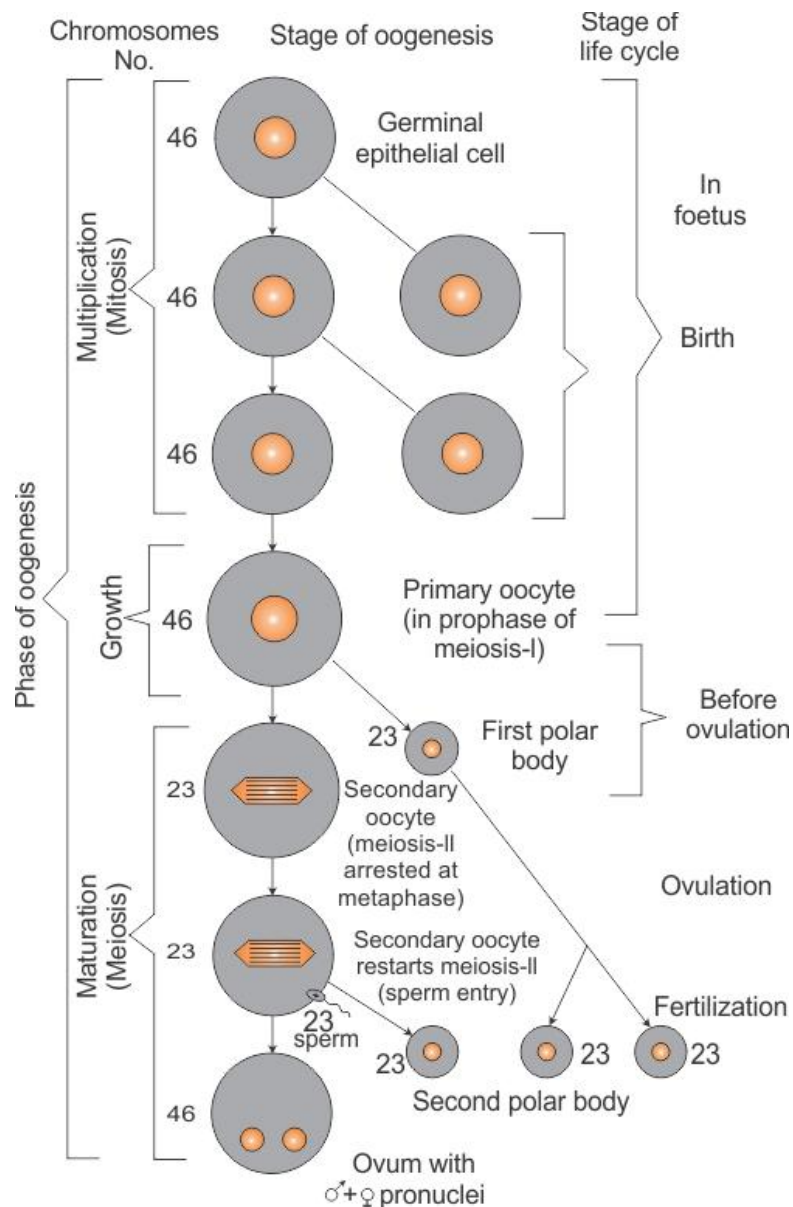
(a)



- (b) The filiform apparatus present at the micropylar end of the synergids guides the entry of pollen tubes which carries two male gametes. Of the two gametes, one fuses with the egg cell to form a zygote and the other gamete fuses with two polar nuclei to form the primary endosperm nucleus (triple fusion). Such type of fertilisation is called double fertilisation.

OR

- (a) Oogenesis is the process of formation of haploid ova in the Graafian follicles of the ovary. The events which occur during oogenesis are
- 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 grows in the follicles.
 - Growth phase:** During this phase, oogonium grows into large primary oocytes by getting nourishment from follicle cells.
 - 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 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.



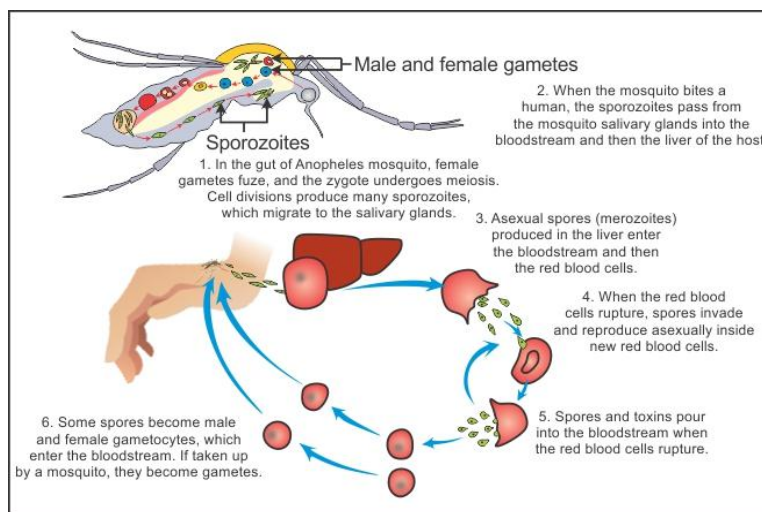
(b)

Oogenesis	Spermatogenesis
(i) It takes place in the follicle cells of the ovaries.	(i) It takes place in the seminiferous tubules of the testes.
(ii) Each primary oocyte divides by meiosis and forms only one haploid ovum.	(ii) Each primary spermatocyte divides by meiosis and forms 4 haploid spermatozoans.

30. Ans. 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 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 the sporozoites.
- (v) These sporozoites are stored in the salivary glands of mosquito and are released when a healthy person is bitten by this mosquito.
- (vi) When these mosquitoes bite a human, the sporozoites are introduced into the body of human beings.

Thus, plasmodium requires two hosts—man and mosquito—to complete its life cycle. The female Anopheles mosquito acts as the vector.



OR

- (a) Plant breeding is the genetic improvement of crops to create desired plant types which are better suited for cultivation.

Classical plant breeding involves two steps—hybridisation and artificial selection.

- (b) Traits such as disease resistance against bacterial, viral and fungal diseases can be induced by mutation using gamma radiations. They cause changes in the DNA structure and forms new traits which are not part of the parental traits having desirable characteristics.

Example: Mung beans have been made resistant against yellow mosaic virus and powdery mildew.

- (c) Breeding of crops with high levels of vitamins and minerals is the step taken to improve public health. This is called biofortification. Its objectives are

- (i) Protein content and quality
- (ii) Oil content and quality
- (iii) Vitamin content
- (iv) Micronutrient and mineral content

Two examples are

- (i) Atlas 66, with high protein content, has been used as a donor for improving cultivated wheat.
- (ii) IARI, New Delhi, has produced protein-enriched beans such as lablab and broad beans.