

CBSE
Class XII Biology
Board Paper 2013 - Delhi (Set 2)

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. Write the equation that helps in deriving the net primary productivity of an ecosystem. [1]
2. 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
3. Why is the enzyme cellulase needed for isolating genetic material from plant cells and not from the animal cells? [1]
4. Write the importance of MOET. [1]
5. Identify the examples of homologous structures from the following: [1]
(i) Vertebrate hearts
(ii) Thorns in *Bougainvillea* and tendrils of *Cucurbita*.
(iii) Food storage organs in sweet potato and potato.
6. Name the enzyme and state its property that is responsible for continuous and discontinuous replication of the two strands of a DNA molecule. [1]
7. Why sharing of injection needles between two individuals are not recommended? [1]
8. An anther with malfunctioning tapetum often fails to produce viable male gametophytes. Give any one reason. [1]

SECTION B

9. Describe the gene therapy procedure for an ADA-deficient patient. [2]

10. Expand the following and mention one application of each:

- (i) PCR
- (ii) ELISA

OR

- (a) Mention the difference in the mode of action of exonuclease and endonuclease.
- (b) How does restriction endonuclease function? [2]

11. Name any two sources of e-Wastes and write two difference ways of their disposal. [2]

12. Why the pyramid of energy is always upright? Explain. [2]

13. Explain why very small animals are rarely found in polar region. [2]

14.

- (a) How does cleistogamy ensure autogamy?
- (b) State one advantage and one disadvantage of cleistogamy to the plant. [2]

15. When and where do chorionic villi appear in humans? State their function. [2]

16. 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]

17. A young boy when brought a pet dog home started to complain of watery eyes and running nose. The symptoms disappeared when the boy was kept away from the pet. [2]

- (a) Name of type of antibody and the chemicals responsible for such a response in the boy.
- (b) Mention the name of any one drug that could be given to the boy for immediate relief from such a response.

18.

- (a) Explain how to find whether an E. coli bacterium has transformed or not when a recombinant DNA bearing ampicillin resistant gene is transferred into it.
- (b) What does the ampicillin resistant gene act as in the above case? [2]

SECTION C

- 19.**
- (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]
- 20.**
- (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]
- 21.** How have human activities caused desertification? Explain.
- OR**
- How does algal bloom destroy the quality of a fresh water body? Explain. [3]
- 22.**
- (a) Explain how to overcome inbreeding depression in cattle.
 - (b) List three advantages of inbreeding in cattle.
 - (c) Name an improved breed of cattle. [3]
- 23.** Explain mutualism with the help of any two examples. How is it different from commensalism? [3]
- 24.** Describe the structure of RNA polynucleotide chain having four different types of nucleotides. [3]
- 25.**
- (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]
- 26.** With the help of any two suitable examples explain the effect of anthropogenic actions on organic evolution. [3]
- 27.** Draw a diagram of the structure of a human ovum surrounded by corona radiata. Label the following parts: [3]
- (i) Ovum
 - (ii) Plasma Membrane
 - (iii) State the function of Zona Pellucida.

SECTION D

- 28.** 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.

- 29.** 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.

- 30.** [5]

- (a) Draw a labeled schematic diagram of the transverse section of a mature anther of an angiosperm plant.
- (b) Describe the characteristic feature of an insect pollinated flower.

OR

- (a) Describe the events of spermatogenesis with the help of a schematic representation.
- (b) Write two differences between spermatogenesis and oogenesis.

**CBSE
Class XII Biology (Theory)
Board Paper 2013 - (Set 2)
SOLUTION**

Time: 3 hrs

Total Marks: 70

SECTION A

1. **Ans.** The equation of net primary productivity of an ecosystem is
$$\text{NPP} = \text{GPP} - \text{R}$$
where NPP = Net primary productivity
GPP = Gross primary productivity
R = Respiratory rate
2. **Ans.**
(a) 50,000 different strains of rice: Genetic diversity
(b) Estuarine and alpine meadows: Ecological diversity.
3. **Ans.** Cellulase enzyme is used 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.
4. **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.
5. **Ans.** Thorns in Bougainvillea and tendrils of Cucurbita are the homologous organs as both arise in the axillary position.
6. **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.
7. **Ans.** Sharing of injection needles between two individuals is not recommended because it causes fatal and dangerous diseases such as AIDS and hepatitis which are incurable.
8. **Ans.** An anther with a malfunctioning tapetum often fails to produce viable gametophytes because the tapetum provides nutritive materials to the dividing microsporocytes.

SECTION B

9. Ans. 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 the gene 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 a functional ADA gene and reactivate the victim's immune system for life.

10. 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.

11. Ans.

Two sources of e-wastes:

- (i) Parts of computers and television sets
- (ii) Smart phones, parts of air conditioners and refrigerators

Two ways for disposal of e-wastes:

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

12. 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 the 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.

13. 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.

14. Ans.

(a) Cleistogamous flowers are bisexual flowers which remain closed, and pollen grains may only pollinate the stigma of the same flower. Example: Lathyrus. Thus, in such flowers, cross-pollination cannot occur and only autogamy occurs. Therefore, cleistogamy ensures autogamy.

(b) Advantage of cleistogamy: It maintains the purity of the race and avoids mixing.

Disadvantage of cleistogamy: Less chances of the production of new species and varieties.

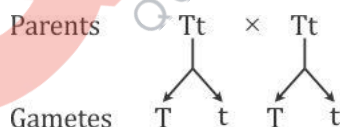
15. Ans. Chorionic villi are finger-like projections which arise from the trophoblast layer and develop in the zygote after it has undergone implantation.

Functions of chorionic villi:

(a) They take part in the formation of the placenta, which is the connecting link between the mother and the foetus.

(b) They supply oxygen and nutrients to the growing embryo.

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



F₁ progeny

	T	t
T	TT	Tt
t	Tt	tt

Phenotypic ratio: 3:1

Genotypic ratio: 1:2:1

17. Ans.

- (a) IgE antibodies are produced in response to the entry of an allergen such as dust, pollen and animal dander. The allergens then combine with the mast cells and cause their bursting. A sufficient quantity of histamine and serotonin is released with the mast cells resulting in an inflammatory response.
- (b) The use of drugs such as anti-histamine, adrenalin and steroids quickly reduce the symptoms of allergy.

18. Ans.

- (a) An *E. coli* bacterium has transformed or not when a recombinant DNA bearing ampicillin-resistant gene is transferred into it is analysed by growing *E. coli* cells on a culture medium containing ampicillin. The genes encoding the resistance to antibiotics such as ampicillin and tetracycline act as selectable markers for *E. coli*, and only the transformed cells will survive as they carry recombinant DNA with ampicillin-resistant gene. The normal cells do not possess the ability of resistance against any of these antibiotics and will die as they are ampicillin sensitive.
- (b) Ampicillin-resistant genes (amp^R) serve as a selectable marker.

SECTION C

19.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 in them.
- (b) The bioactive molecules produced by
 - (i) *Trichoderma polysporum* is cyclosporin A (immunosuppressor).
 - (ii) *Monascus purpureus* is statins (lowers blood cholesterol level).

20.Ans.

- (a) Transgenic animals are so called because they contain a foreign or 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: The transgenic animals are predominantly used for testing of vaccines before they are used on human beings. Example: Transgenic mice are used to test the safety of the 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.

21.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 lack of natural vegetation (forest) and hence lack of plant roots to bind the soil particles together, causing 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 it infertile.

OR

An 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) The algal blooms are sometimes toxic to humans as humans consume aquatic organisms as food.
- (iii) The water body is polluted as the algal bloom spreads over water bodies such as lakes and they produce 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.

22.Ans.

- (a) 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.
- (b) Advantages of inbreeding:
 - (i) It helps in the accumulation of superior genes and elimination of undesirable genes.
 - (ii) It develops a 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.
- (c) Jersey and Holstein are the improved breeds of cattle which produce high yield of milk.

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

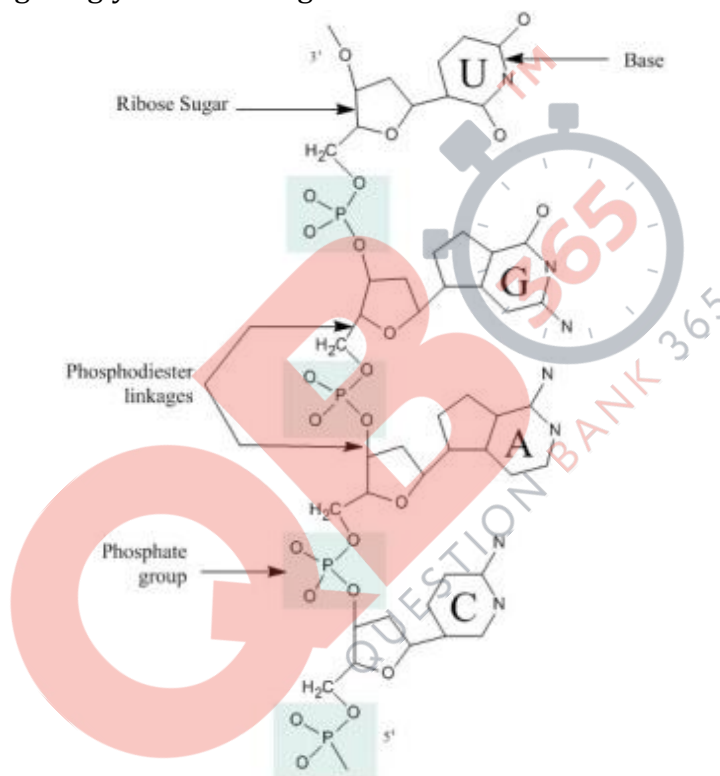
Two examples are

- (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 the plant.
- (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 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. 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. The sucker fish gets free transport and free food left behind by the shark.

24.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.

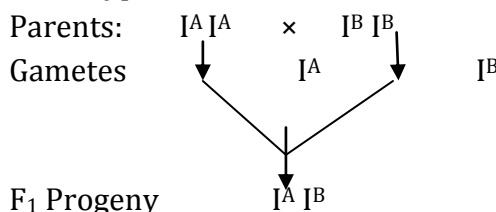
- (i) The axis or backbone of a polynucleotide chain is formed of alternate residues of phosphate and ribose sugar.
- (ii) Phosphate combines with carbon of its sugar and carbon 3' of the next sugar.
- (iii) Nitrogenous bases are purines (adenine and guanine) and pyrimidines (cytosine and uracil). The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



25. 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: $I^B I^B$



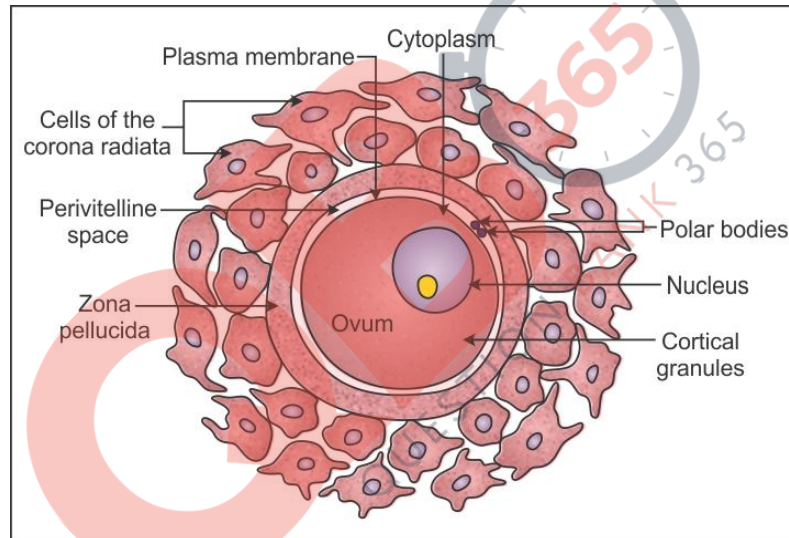
Blood group of the child will be AB. This is due to co-dominance where allele I^A for the A-type blood group is co-dominant with its allele I^B for the B-type blood group.

26.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 few individuals. Because of selection using antibiotics, those individuals with resistive properties got selected and produced a large number of progeny.

27. Ans.

- (i) and (ii)



- (iii) Zona pellucida is a thick non-cellular membrane surrounding the plasma membrane of the mammalian egg.

Its functions are

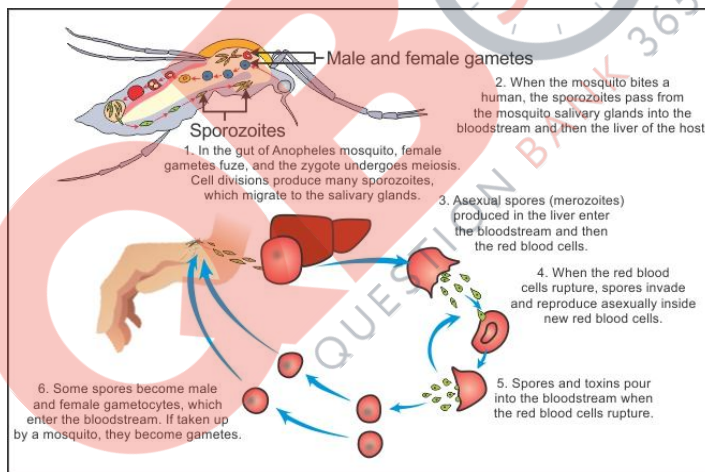
- (a) It initiates the acrosomal reaction between the sperm and the egg at the time of fertilisation.
- (b) It prevents polyspermy by inducing changes in the membrane of the ovum, thus ensuring the entry of one sperm inside the ovum and blocking the entry of additional sperms.

SECTION D

28.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 sporozoites.
- (v) These sporozoites are stored in the salivary glands of mosquito and are released when the 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 the crop 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 a 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

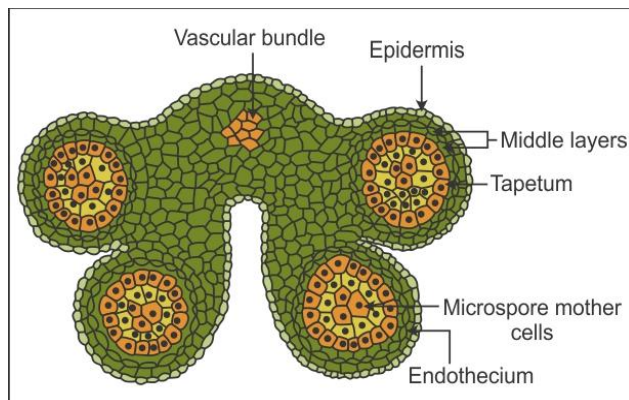
- (i) Atlas 66, with high protein content, has been used as a donor for improving cultivated wheat.
- (ii) IARI, New Delhi, has produced protein-enriched beans such as lablab and broad beans.

29. Ans.

- (a) Thalassaemia is a form of an inherited autosomal recessive blood disorder 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 which is a major symptom of thalassaemia.
- (b) Because thalassaemia is an autosomal recessive disorder, it will only be caused in the child if both parents are heterozygous and mutation is carried on any one of the autosomes which acts as carriers. So, it has an equal probability from mother or father. So, it is unjustified to blame only the mother for the abnormality in the child.
- (c) List of values which can be used to counsel families with a child with thalassaemia:
 - (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.

30. Ans.

(a)



- (b) Characteristic features of an insect-pollinated flower are
 - (i) They produce nectar and fragrance.
 - (ii) Flowers are bright coloured, large and showy.
 - (iii) The stigma and pollen grains are sticky.

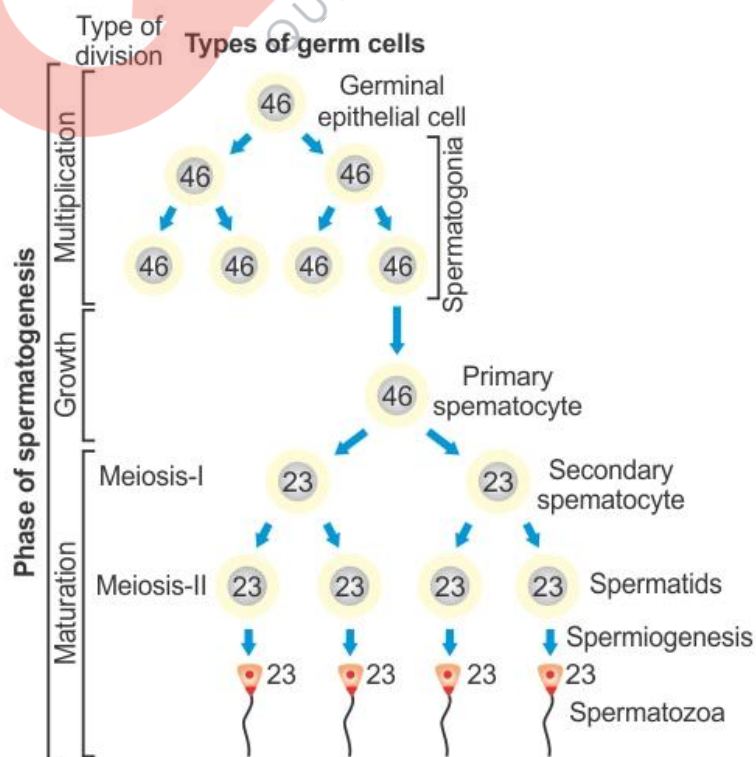
- (iv) The exine of the pollen grains has viscous and sticky substance called pollen kit.

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.

Various events which take place during spermatogenesis are

- Multiplicative phase:** During this phase, the sperm mother cells are differentiated from the germinal epithelium of the seminiferous tubules of the testes. They divide repeatedly by a number of mitotic divisions to form several daughter cells called spermatogonia.
- Growth phase:** During this phase, the diploid spermatogonia undergo the process of spermatocytogenesis where they derive nourishment from the nursing cells. They grow and increase in size because of accumulation of nutritive material. Each spermatogonium is a primary spermatocyte bearing a diploid number of chromosomes.
- Maturation phase:** During this phase, the primary spermatocytes undergo two maturation divisions. The first meiotic division differentiates the primary spermatocyte into two haploid secondary spermatocytes. The second meiosis differentiates each secondary spermatocyte into two spermatids. Thus, four haploid spermatids are formed by each spermatocyte which later get transformed into flagellated sperms by the process of spermiogenesis.



(b)

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

