

CBSE
Class XII Biology

Time: 3 hrs

Total Marks: 70

General Instructions:

1. All questions are compulsory.
 2. This question paper consists of five sections A, B, C, D and E. Section **A** contains **5** questions of **one** mark each, Section **B** is of **5** questions of **two** marks each, Section **C** is of **12** questions of **three** marks each, Section **D** is of **1** question of **four** marks and Section **E** 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 weightage. A student has to attempt only one of the alternatives in such questions.
 4. Wherever necessary, the diagrams drawn should be neat and properly labelled.
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Section A

1. Write the location and function of the Sertoli cells in humans. [1]
2. What is biopiracy? [1]
3. State the main function of bioreactors. [1]
4. Define pioneer community. [1]
5. Give two examples of decomposers. [1]

Section B

6. What is parturition? Which hormones are involved in the induction of parturition?[2]
7. Why is the *Drosophila* male fly called heterogametic? [2]
8. If the base sequence of one strand of DNA is CAT, TAG, TAC, GAC, then what will be the base sequence [2]
(a) Of the complementary DNA strand
(b) Of its complementary RNA strand
9. Explain the role of Ti plasmids in biotechnology. [2]
10. Mention the importance of carbon cycle in nature. [2]

OR

How do nuclear power plants upset ecological balance?

Section C

11. How do long pollen grains retain their viability? [3]
12. Draw a labelled diagram of the V.S. of apple. [3]
13. Differentiate between Down's syndrome and Turner's syndrome. [3]
14. In genetics, a reference is made to be an abbreviated expression 'AUG'. Write any three points of scientific information embodied in this combination of three letters.[3]
15. State the theory of biogenesis. How does Miller's experiment support this theory?[3]
16. How does an antigen differ from an antibody? [3]
17. What is the significance of SCP? [3]
18. Identify a, b, c, d, e and f in the table given below. [3]

Organism	Bioactive molecule	Use
1. <i>Monascus purpureus</i> (Yeast)	a	b
2. c	d	antibiotic
3. e	Cyclosporin A	f

19. List the various steps which are involved in plant genetic engineering. [3]
20. Name and describe the technique which helps in separating the DNA fragments formed by using restriction endonuclease. [3]
21. Write a short note on the adaptations of desert animals. [3]
22. Explain the differences between the seral stage and the climax community during succession. [3]

OR

Describe various techniques used in the control of gaseous pollutants.

Section D

23. Rahul always liked to visit a forest near his ancestral village. In addition to a variety of plants, it was inhabited by many birds and animals. He observed that each animal was living in particular sets of conditions. He enquired from his teacher the reason for this specificity. [4]

- (i) What is habitat?
- (ii) What is the ecological importance of variations in habitats?
- (iii) Give an example of habitat specificity.
- (iv) Why did Rahul always like to visit the forest?

Section E

24.

- (a) When and where does spermatogenesis occur in a human male?
- (b) Draw a diagram of a mature human male gamete. Label the following parts:
acrosome, nucleus, middle piece and tail
- (c) Mention the functions of acrosome and middle piece. [5]

OR

Describe briefly the characteristics of flowers pollinated by birds.

25.

- (a) Describe the various steps of Griffith's experiment which led to the conclusion of the 'Transforming Principle'.
- (b) How did the chemical nature of the 'Transforming Principle' get established? [5]

OR

Who proposed the chromosome theory of inheritance? Give the salient features of this theory.

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

OR

- (a) State the objective of animal breeding.
- (b) List the importance and limitations of inbreeding. How can the limitations be overcome?
- (c) Give an example of a new breed each of cattle and poultry.

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Solution

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Section A

1. Ans

Sertoli cells are located in the germinal epithelium of the seminiferous tubules. They provide nourishment for the growing spermatozoa.

2. Ans

It is the unauthorised use of bioresources and traditional knowledge related to bioresources for commercial benefits.

3. Ans

Bioreactors are used to produce vaccines, enzymes, hormones and monoclonal antibodies on large-scale cell cultures.

4. Ans

The assemblage of the pioneer species is called a pioneer community.

5. Ans

Bacteria and fungi

Section B

6. Ans

Parturition is the process of expulsion of the foetus from the uterus. Oxytocin, cortisol and estrogens are involved in the induction of parturition.

7. Ans

The male *Drosophila* is called heterogametic because it produces two types of gametes, one containing the X sex chromosome (X + 3) and the other the Y sex chromosome (Y + 3).

8. Ans

- (a) The complementary bases of the DNA strand will be GTA, ATC, ATG, CTG.
- (b) The complementary bases of the RNA strand will be GUA, AUC, AUG, CUG.

9. Ans

The Ti plasmid (tumour-inducing plasmid) of *Agrobacterium tumefaciens* has been modified to be used as a cloning vector. The Ti plasmid integrates as a segment of its DNA, T DNA, into the chromosomal DNA of its host plant cells which cause tumour. As gene transfer occurs without any human effort, the bacterium is known as 'natural genetic engineer' of plants. Ti plasmids are used as vectors to transfer the foreign gene of interest into the target plant cells so these are used in the genetic transformation in plants.

10. Ans

Importance of the carbon cycle in nature:

- (i) It helps in maintaining the CO₂ level in the atmosphere.
- (ii) It helps in maintaining proper temperature on the Earth through the greenhouse effect.

OR

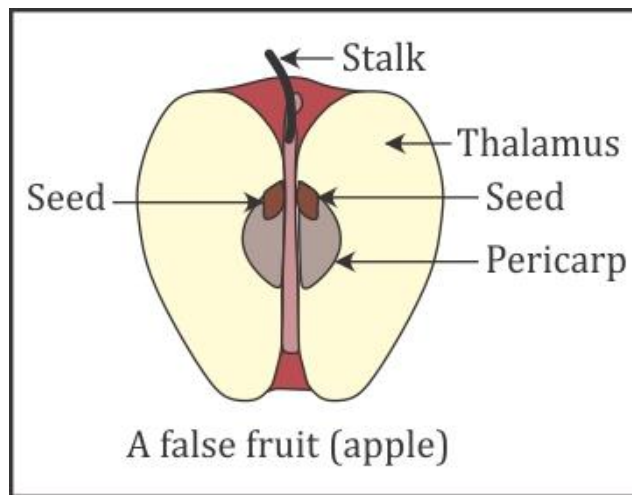
Radioactive wastes from atomic plants are discharged into rivers or streams and affect the aquatic plants and animals to a very great extent. These radioactive wastes enter the food chain and result in their biomagnification. They cause ionisation of various body fluids and kill the members of the food chain. So, they ultimately disturb the ecological balance in nature.

Section C

11. Ans

The period for which pollen grains remain viable is highly variable and depends on the prevailing temperature and humidity. In some species of cereals such as rice and wheat, pollen grains lose viability within 30 minutes. However, in families like Rosaceae and Leguminosae, they maintain viability for months. Pollen grains of a large number of species can be stored for years in liquid nitrogen which can be used as pollen banks.

12. Ans



13. Ans

Down's syndrome	Turner's syndrome
(i) It is an autosomal abnormality.	(i) It is sex-linked chromosomal abnormality.
(ii) It bears 47 chromosomes instead of 46.	(ii) It bears 45 chromosomes instead of 46.
(iii) It is trisomy of 21 chromosomes.	(iii) It is monosomy of the XO type.

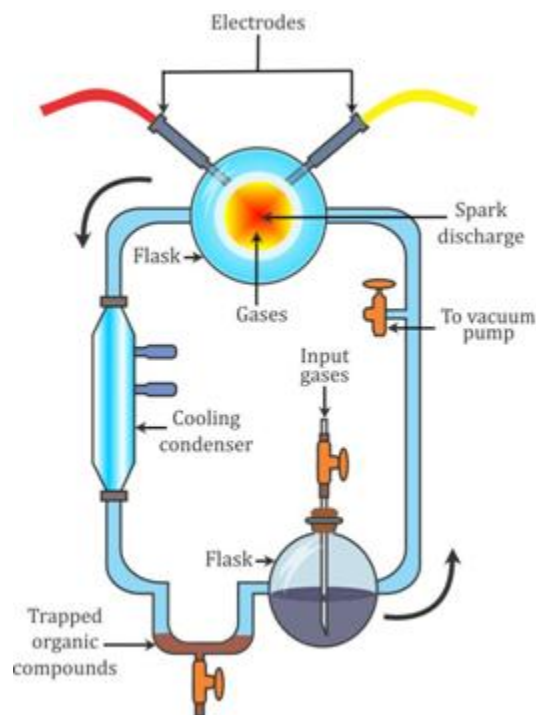
14. Ans

- (i) AUG is a codon.
- (ii) It stands for methionine amino acid.
- (iii) It serves as the initiating codon for the synthesis of the polypeptide chain.

15. Ans

The theory of biogenesis was proposed by Louis Pasteur. He proposed that all living things arise from pre-existing life. These cells further originated from organic compounds. So, life could have come from non-living matter and these were formed from the inorganic constituents.

Urey and Miller in 1953 demonstrated that the electrical discharge or heat energy can form the complex organic substances from the mixture of water (H_2O), methane (CH_4), ammonia (NH_3) and hydrogen (H_2). The chemicals were all sealed inside a sterile array of glass flasks and flasks connected in a loop, with one flask half-full of liquid water and another flask containing a pair of electrodes. The liquid water was heated to induce evaporation, sparks were fired between the electrodes to simulate lightning through the atmosphere and water vapour, and then the atmosphere was cooled again so that the water could condense and trickle back into the first flask in a continuous cycle. They observed the production of acetic acid, urea, fatty acids, lactic acid and amino acids such as glycine, alanine and aspartic acid. Other investigators observed the formation of sugars and nitrogen bases by using UV light. Hence, this experiment supported that life has evolved from pre-existing non-living organic molecules.



16. Ans

Antigen	Antibody
(i) It is a substance which induces an immune response when introduced into an organism.	(i) It is a plasma protein which is produced in response to the entry of antigen in the body.
(ii) It is a large molecule of protein or polysaccharide.	(ii) It is a plasma protein.
(iii) It is found on the cell walls of bacteria or on the coats of viruses.	(iii) It circulates in the body fluids and fights against antigens to neutralise their effects.

17. Ans

Significance of SCP:

- (i) SCP is rich in high quality protein and is rather poor in fats; hence, it is a valuable supplement in human diet. Its use bridges the gap between the requirement and supply of proteins in human diet.
- (ii) It reduces the pressure on agricultural production systems for the supply of required proteins.
- (iii) SCP production based on industrial effluents helps in reducing environmental pollution.

18. Ans

a = Statins

b = Blood cholesterol lowering agents

c = Penicillium notatum

d = Penicillin

e = Trichoderma polysporum

f = Immunosuppressant drug

19. Ans

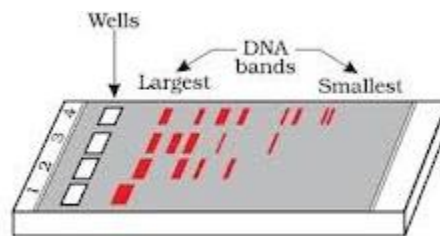
Various steps involved in plant genetic engineering are

- (i) Identification and isolation of agronomically important gene
- (ii) Cloning the isolated gene in a plant transformation vector
- (iii) Introduction of the gene into plant protoplasts, cells or tissues using gene transfer methods
- (iv) Culture and regeneration of complete plants from genetically transformed cells on suitable selection medium
- (v) Demonstration of the integration and expression of the foreign gene in transgenic plants by using molecular techniques

20. Ans

Gel electrophoresis is a technique of separating DNA fragments, formed by the action of restriction endonucleases.

The fragments of DNA are placed in a typical agarose gel under an electric field. The DNA fragments move towards the anode as these fragments are negatively charged molecules. The DNA fragments separate according to their size through the sieving effect provided by the agarose gel. The smaller the fragment size, the farther it moves. The separated DNA fragments are stained with ethidium bromide followed by exposure to UV radiation. The DNA fragments are seen as orange coloured and are cut out from agarose gel and extracted from the gel piece. This step is called elution.



21. Ans

The desert animals have the ability to concentrate their urine so that minimal volume of water is used to remove excretory products. The Kangaroo rat in North American deserts can meet all its water requirements through its internal fat oxidation in which water is a by-product. Desert animals such as camel can store water in its body and use it at the time of need. The desert animals such as rat and snake have the ability to hide under the earth to escape the scorching heat.

22. Ans

Seral	Climax
(i) The species composition at the seral stage is determined by the habitat conditions.	(i) The species composition at the climax stage is determined by the regional climate, local conditions, soil, topography and water availability.
(ii) Size of individuals remains small.	(ii) Size of individuals remains large.
(iii) Ecological niches are few and generalised.	(iii) Ecological niches are many and specialised.

OR

Various techniques used in the control of gaseous pollutants:

- (i) Combustion: In this process, oxidisable gaseous pollutants are completely burnt at a high temperature. Petrochemical, fertiliser, paint and varnish industries use combustion control of gaseous pollutants.
- (ii) Absorption: In this technique, gaseous pollutants are absorbed in suitable absorbent material.
- (iii) Adsorption: This technique is applied to control toxic gases, vapours and inflammable compounds which could not be efficiently removed or transferred by the aforesaid techniques. Such air pollutants are adsorbed on large solid surfaces.

Section D

23. Ans

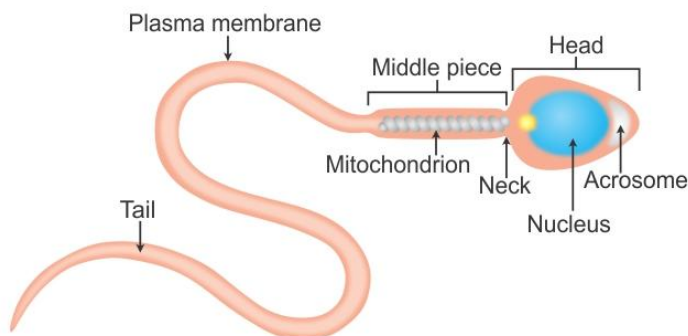
- (i) It refers to a specific place where a species or population normally lives in nature.
- (ii) Variations in habitats help in avoiding competition among species.
- (iii) Animals often live in specific habitats having particular environmental conditions. Example: Amphibians occur in freshwater only.
- (iv) Rahul had love for nature and was curious to know about the natural phenomena which help species populations to live in varied habitats.

Section E

24. Ans

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

(b) Structure of human sperm:



(c)

- (i) Acrosome: It is a cap-like covering or structure which is present at the tip of the sperm (male gamete). The acrosome contains the hydrolytic enzyme hyaluronidase, which helps the sperm to penetrate the ovum during fertilisation by dispersing the cells of corona radiata.
- (ii) Middle piece: Middle piece in human sperm contains several mitochondria which produce energy for the motility of sperms.

OR

Characteristics of bird-pollinated flowers (ornithophily):

- (i) Flowers produce abundant nectar.
- (ii) Flowers are usually bright coloured—red, yellow, orange or blue—to attract birds from long distances.
- (iii) Some bird-pollinated flowers have funnel-shaped corollas.
- (iv) The floral parts are commonly feathery.
- (v) Scent is often absent.

Examples: Bombax (red silk cotton), coral tree, bottle brush

25. Ans

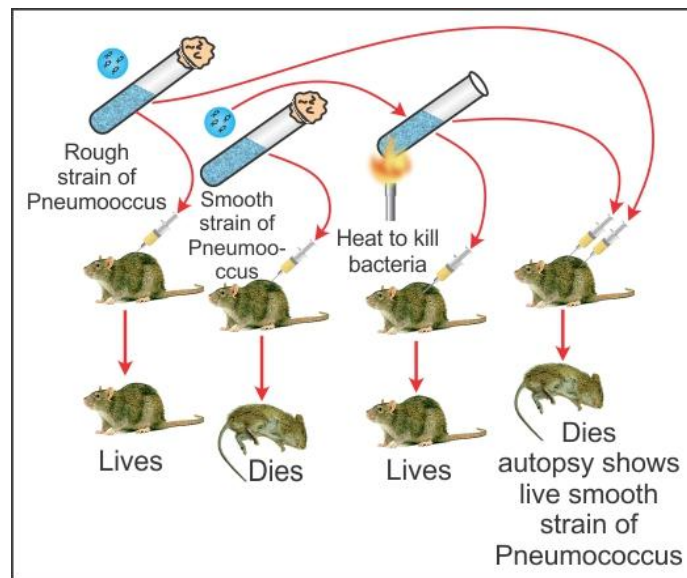
- (a) S. F. Griffith demonstrated bacterial transformation experimentally by performing experiments on *Diplococcus pneumoniae*. It has two distinct forms—one form secretes a polysaccharide capsule which gives the colonies a smooth appearance and another form is non-capsulated which gives the colonies a rough appearance. The capsule of the smooth form (S) is virulent

and gives an infected animal pneumonia; the rough form (R) is not virulent. The main steps are as follows:

- (i) Griffith conducted his experiments on *Diplococcus pneumonia* which causes pneumonia in mice. He injected the 'S' type living bacteria into mice, and they died due to pneumonia.
- (ii) He then injected live non-virulent bacteria (R) into mice, and they did not suffer from pneumonia.
- (iii) He then injected heat-killed virulent 'S' type bacteria into mice, and they survived equally well.
- (iv) In the last, he injected a mixture of heat-killed 'S' and live 'R' simultaneously, and the mice died with the symptoms of pneumonia.

Living 'S' type bacteria were recovered from their bodies.

This happened because of something from the dead bacteria had entered the live ones and made them virulent. This means the 'R' type of bacteria has been transformed to the 'S' type and this process is called transformation. Thus, transformation is the transferring of characters from one strain to another using the DNA extract of the former.



- (b) Oswald Avery, Colin MacLeod and Maclyn McCarty concluded that DNA is the hereditary material. They discovered that the protein-digesting enzymes (proteases) and RNA-digesting enzymes (RNases) did not affect transformation, so the transforming substance was neither protein nor RNA. However, digestion with DNase inhibited transformation. Thus, they concluded that DNA is the hereditary material.

OR

Walter Sutton and Theodor Boveri proposed the chromosome theory of inheritance.

Its main features are

- (i) Each chromosome carries several specific determiners which play an essential role in the development of an organism. A loss of complete chromosome or its fragment leads to deviation in the structure and function of an organism.
- (ii) The somatic cell of an organism bears two identical sets of chromosomes (diploid), one received from the mother (maternal chromosomes) and the other from the father (paternal chromosomes). Two chromosomes of one type constitute a homologous pair.
- (iii) The paired homologous chromosomes separate during meiosis, and each gamete receives one chromosome of each homologous chromosome pair.
- (iv) The paired condition of both chromosomes is maintained during fertilisation.
- (v) Each chromosome contains numerous genes and the position assigned to each gene is called locus. These genes help the organism to develop from the zygote.
- (vi) Each chromosome retains its individuality, uniqueness and continuity throughout the life of an organism and from generation to generation. They never get lost or mixed but behave as units.

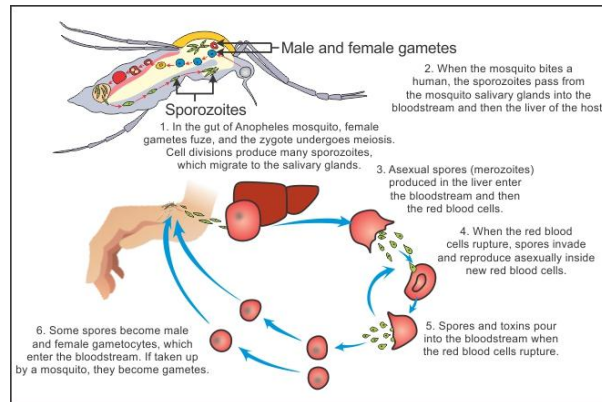
(Any five points)

26. 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 of 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 a healthy person is bitten by this mosquito.
- (vi) When these mosquitoes bite a human, the sporozoites are introduced into the body.

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



OR

(a) Objectives of animal breeding:

- (i) Improved growth rate
- (ii) Increased production of milk, meat, eggs and wool
- (iii) Superior quality of milk, meat, eggs and wool
- (iv) Improved resistance to various diseases
- (v) Increased productive life
- (vi) Increased or, at least, acceptable reproduction rate

(b) Breeding between animals of the same breed for 4–6 generations is called inbreeding.

Importance 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.

Limitation:

Continued inbreeding reduces fertility and even productivity. This is called inbreeding depression.

(c)

- (i) Karan Swiss and Sunandini are new breeds of cattle.
- (ii) White Leghorn and New Hampshire are improved breeds of chicken.