

Question Paper

Conducted by the Central Board of Secondary Education (CBSE)



Time Allowed: 3 Hours

Maximum Marks: 70

General Instructions

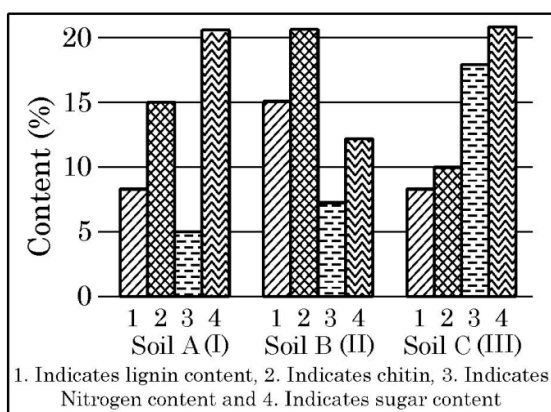
- (i) This question paper contains **33 questions**. All questions are compulsory.
- (ii) Section A: Questions 1 to 16 carry 1 mark each.
- (iii) Section B: Questions 17 to 21 carry 2 marks each.
- (iv) Section C: Questions 22 to 28 carry 3 marks each.
- (v) Section D: Questions 29 to 30 carry 4 marks each.
- (vi) Section E: Questions 31 to 33 carry 5 marks each.
- (vii) Attempt one alternative where an internal choice is provided. Follow the instructions within each question.
- (viii) Draw neat, properly labelled diagrams wherever necessary.

Section A

1. Genetically modified tobacco plants were produced using Agrobacterium vectors. Which property of Agrobacterium helps in carrying nematode specific genes into the host plant?

- | | |
|--|---|
| (A) Infectious for monocot plant; has Ti plasmid | (B) Infectious for dicot plant; has Ti plasmid |
| (C) Infectious for plants and animals; has Ti plasmids | (D) Infectious for monocot and dicot plants; has cry gene |

2. Observe the contents 1, 2, 3 and 4 of soil samples I, II and III shown in the graph. If the temperature and moisture of all soil samples are identical, which soil sample(s) will show faster decomposition?



1. Indicates lignin content, 2. Indicates chitin, 3. Indicates Nitrogen content and 4. Indicates sugar content

- | | |
|---------------------|----------------------------------|
| (A) Soil Sample I | (B) Soil Sample II |
| (C) Soil Sample III | (D) Both Soil Samples II and III |

3. A woman having genes for haemophilia on one X chromosome and a gene for colour blindness on another X chromosome marries a normal man. The progeny will show

- | | |
|---|---|
| (A) 50% haemophilic and colour-blind sons, 50% normal sons. | (B) 50% haemophilic carrier daughter, 50% colour-blind carrier daughters. |
| (C) All sons and daughters colour-blind and haemophilic. | (D) Only haemophilic and colour-blind daughters. |

4. Which of the following is an important parameter for assessing the impact of any biotic or abiotic factor on population growth?

- | | |
|----------------|--|
| (A) Birth rate | (B) K - carrying capacity |
| (C) Death rate | (D) r - Intrinsic rate of natural increase |

5. If a sperm nucleus is injected into an oocyte then all of the following events are bypassed except -

- | | |
|---|--|
| (A) The swimming of sperm to meet the egg in the oviduct. | (B) The sperm's acquisition of motility in the epididymis. |
| (C) A sperm comes in contact with the zona pellucida layer of the ovum. | (D) The complex process like cell division and cell differentiation. |

6. If A = species richness and B = Endemism then biodiversity hotspots have
- (A) low degree of A and low degree of B. (B) low degree of A and high degree of B.
(C) high degree of A and low degree of B. (D) high degree of A and high degree of B.

7. Two plants whose DNA has been sequenced are
- (A) Rice and Wheat (B) Wheat and Maize
(C) Maize and Barley (D) Rice and Arabidopsis

8. Antivenom injection is an example of
- (A) Natural Active Immunity (B) Artificial Active Immunity
(C) Natural Passive Immunity (D) Artificial Passive Immunity

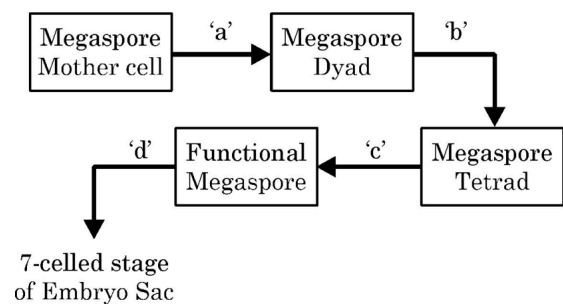
9. To separate repetitive DNA from bulk genomic DNA, which of the following method is used?
- (A) Elution (B) Southern Blotting
(C) Polymerase Chain Reaction (D) Density Gradient Centrifugation

10. What conclusion can be drawn if the forelimbs of an aquatic animal and a terrestrial animal have similar anatomical structure?
- (A) Live in same habitat (B) Share common ancestors
(C) Forelimbs perform same functions (D) Forelimbs are analogous

11. Which of the following is used to visualize DNA bands under UV light after gel electrophoresis?

- (A) Acetocarmine (B) Safranine
(C) Ethidium Bromide (D) Potassium Iodide

12. Given below are stages of embryo sac formation from megaspore mother cell. Identify the correct option for the cell division marked a, b, c and d.



- (A) a - Meiosis-I, b - No division, c - Mitosis, d - Meiosis-II
(B) a - Meiosis-I, b - Meiosis-II, c - No division, d - Mitosis
(C) a - Mitosis, b - Meiosis-I, c - Meiosis-II, d - No division
(D) a - No division, b - Mitosis, c - Meiosis-I, d - Meiosis-II

13. Assertion (A): Pollen grains have a mucilaginous covering on them in most of the water pollinating plants.

Reason (R): Mucilaginous covering help pollen grains to be submerged in water.

Select the correct option:

- | | |
|---|--|
| (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation for Assertion (A). | (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not correct explanation for Assertion (A). |
| (C) Assertion (A) is true, Reason (R) is false. | (D) Assertion (A) is false, Reason (R) is true. |
-

14. Assertion (A): Microbes are used for commercial production of alcohol and beverages.

Reason (R): Yeast converts glucose into ethanol and carbon dioxide during fermentation.

Select the correct option:

- | | |
|---|--|
| (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation for Assertion (A). | (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not correct explanation for Assertion (A). |
| (C) Assertion (A) is true, Reason (R) is false. | (D) Assertion (A) is false, Reason (R) is true. |
-

15. Assertion (A): IUCN Red List helps in identifying and protecting endangered species worldwide.

Reason (R): The list includes the species facing risk of extinction.

Select the correct option:

- | | |
|---|--|
| (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation for Assertion (A). | (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not correct explanation for Assertion (A). |
| (C) Assertion (A) is true, Reason (R) is false. | (D) Assertion (A) is false, Reason (R) is true. |
-

16. Assertion (A): DNA Ligase is used to join DNA fragments.

Reason (R): It catalyses the formation of glycosidic bonds between nucleotides.

Select the correct option:

- | | |
|---|--|
| (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation for Assertion (A). | (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not correct explanation for Assertion (A). |
| (C) Assertion (A) is true, Reason (R) is false. | (D) Assertion (A) is false, Reason (R) is true. |
-

Section B

17(a). Is it possible for a trait to be inherited by an organism but not expressed in its phenotype? Justify and illustrate your answer with a suitable Mendelian Cross.

OR

17(b). Explain the two major approaches used while sequencing the total DNA from a cell.

18. Briefly describe the process of DNA extraction from a fungal cell. Name the chemicals used in the process.

19(a). Differentiate between opioids and cannabinoids on the basis of their Receptor site in human body.

19(b). Differentiate between opioids and cannabinoids on the basis of their Mode of action in human body.

20(a)(i). Name the organ that forms a connection between foetus and the uterus of a pregnant human female.

20(a)(ii). How does it support both nutrition and hormonal regulation?

OR

20(b)(i). Give reasons for:

All copulations do not lead to pregnancy.

OR

20(b)(ii). Give reasons for:

Meiosis I in spermatogenesis and oogenesis are markedly different.

21(a). In some cases, measuring population density by counting individuals may not be feasible. Mention two other parameters that can be used and justify their use with suitable examples.

OR

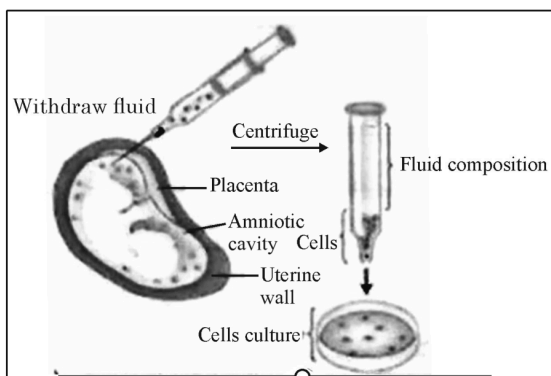
21(b). What factors contribute to the Amazonian rain forests in South America being the most biodiverse regions on Earth?

Section C

22(a). A person inhales dust and pathogens but does not always fall sick. Explain how the body protects against such infections.

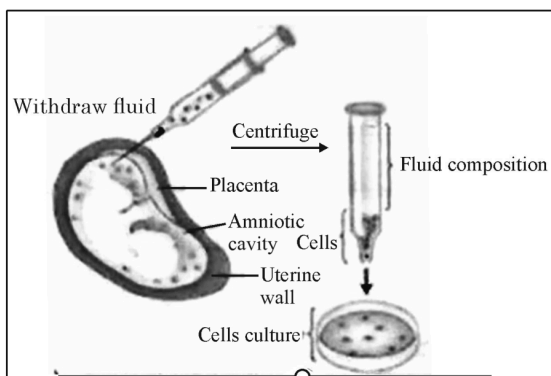
22(b). Name and describe any two barriers involved in this protection.

23(a). Study the diagram given below:



Name and explain the procedure shown in the diagram. Mention one of its advantage and one disadvantage.

23(b). Study the diagram given below:



How is 'Saheli' different from other oral pills in terms of its composition and advantage?

24. Chasmogamous flowers remain open and expose their reproductive parts. Explain how this structural feature supports different types of pollination.

25(a). What is a genetic code?

25(b). Why did scientists feel the need to propose a genetic code?

25(c). Genetic code is said to be 'Universal'. Why?

26(a). There are limitations of traditional breeding techniques that led to promotion of micro-propagation.

Mention two advantages of micropropagation.

26(b). There are limitations of traditional breeding techniques that led to promotion of micro-propagation.

Give two examples where it is commercially adopted.

27(a). Give the scientific name of the organism used by Morgan to study sex-linked traits.

27(b). Write any four reasons why this organism made it an ideal experimental model.

28(a). S.L. Miller conducted an experiment in 1953 to simulate the conditions of early earth in a laboratory setup. Answer the following questions based on the experiment:

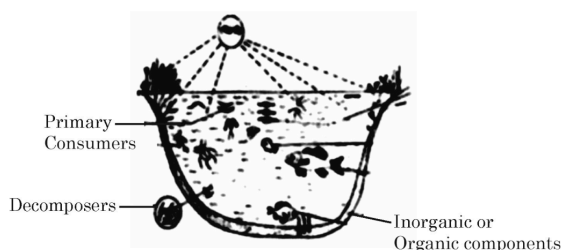
What was the aim of his experiment?

28(b). S.L. Miller conducted an experiment in 1953 to simulate the conditions of early earth in a laboratory setup. Answer the following questions based on the experiment:

Name the gases used and the source of energy.

Section D

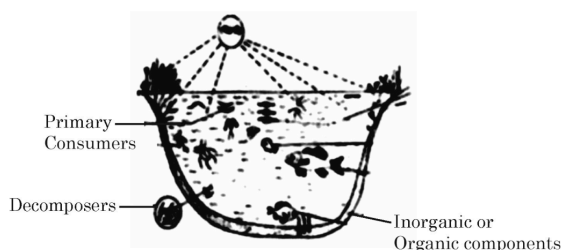
29(a). Below is shown a pond that represents a self-sustaining natural ecosystem with both biotic and abiotic components interacting in a balanced food web.



Based on the diagram, answer the questions:

Mention two abiotic components of a pond ecosystem.

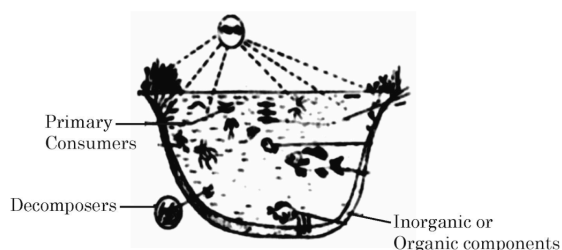
29(b). Below is shown a pond that represents a self-sustaining natural ecosystem with both biotic and abiotic components interacting in a balanced food web.



Based on the diagram, answer the questions:

Differentiate between the roles of producers and decomposers in such an ecosystem.

29(c). Below is shown a pond that represents a self-sustaining natural ecosystem with both biotic and abiotic components interacting in a balanced food web.

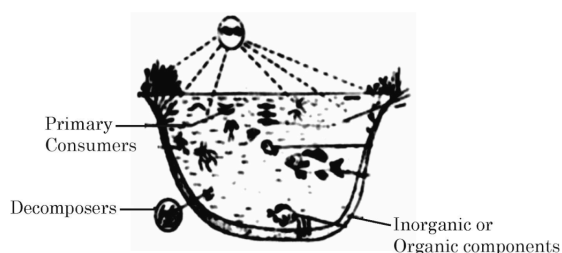


Based on the diagram, answer the questions:

Draw a simple food chain operating in such an ecosystem and label each trophic level.

OR

29(c). Below is shown a pond that represents a self-sustaining natural ecosystem with both biotic and abiotic components interacting in a balanced food web.



Based on the diagram, answer the questions:

Why is transfer of energy not 100% efficient between trophic levels?

30(a). Gene manipulation is a fast emerging science. It started with the development of recombinant DNA molecules. This technology which mostly involves cutting and pasting of desired DNA fragments is based on two most important discoveries in bacteria - presence of plasmid and restriction endonucleases. The science of r-DNA technology took birth when Cohen and Boyer (1973) were able to produce a piece of gene containing foreign DNA introduced into plasmid of *E. coli*.

Name one core technique of biotechnology that alters the genetic material.

30(b). Gene manipulation is a fast emerging science. It started with the development of recombinant DNA molecules. This technology which mostly involves cutting and pasting of desired DNA fragments is based on two most important discoveries in bacteria - presence of plasmid and restriction endonucleases. The science of r-DNA technology took birth when Cohen and Boyer (1973) were able to produce a piece of gene containing foreign DNA introduced into plasmid of *E. coli*.

What is a plasmid? Mention its importance in biotechnology.

30(c). Gene manipulation is a fast emerging science. It started with the development of recombinant DNA molecules. This technology which mostly involves cutting and pasting of desired DNA fragments is based on two most important discoveries in bacteria - presence of plasmid and restriction endonucleases. The science of r-DNA technology took birth when Cohen and Boyer (1973) were able to produce a piece of gene containing foreign DNA introduced into plasmid of *E. coli*.

Which gene was isolated by Cohen and Boyer and from which bacteria?

OR

30(c). Gene manipulation is a fast emerging science. It started with the development of recombinant DNA molecules. This technology which mostly involves cutting and pasting of desired DNA fragments is based on two most important discoveries in bacteria - presence of plasmid and restriction endonucleases. The science of r-DNA technology took birth when Cohen and Boyer (1973) were able to produce a piece of gene containing foreign DNA introduced into plasmid of *E. coli*.

How is the action of exonuclease different from that of endonuclease?

Section E

31(a)(i). A 30 year old man was admitted to a hospital with recurrent infections, weight loss, prolonged fever. His blood report showed a decline in count of T-Lymphocytes thus affecting immune system.

Identify the disease and its causative agent.

31(a)(ii). A 30 year old man was admitted to a hospital with recurrent infections, weight loss, prolonged fever. His blood report showed a decline in count of T-Lymphocytes thus affecting immune system.

How did the pathogen affect the immune system once it entered the body? Explain.

31(a)(iii). A 30 year old man was admitted to a hospital with recurrent infections, weight loss, prolonged fever. His blood report showed a decline in count of T-Lymphocytes thus affecting immune system.

Mention two major modes of its transmission.

OR

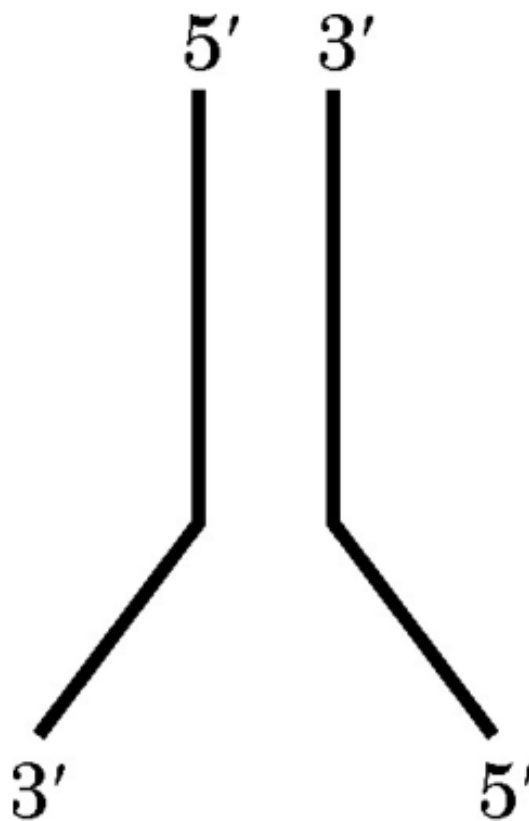
31(b)(i). Why are microbes considered effective biocontrol agents in sustainable agriculture?

OR

31(b)(ii). Explain the role of the following as biocontrol agents naming the pests or diseases they help to control:

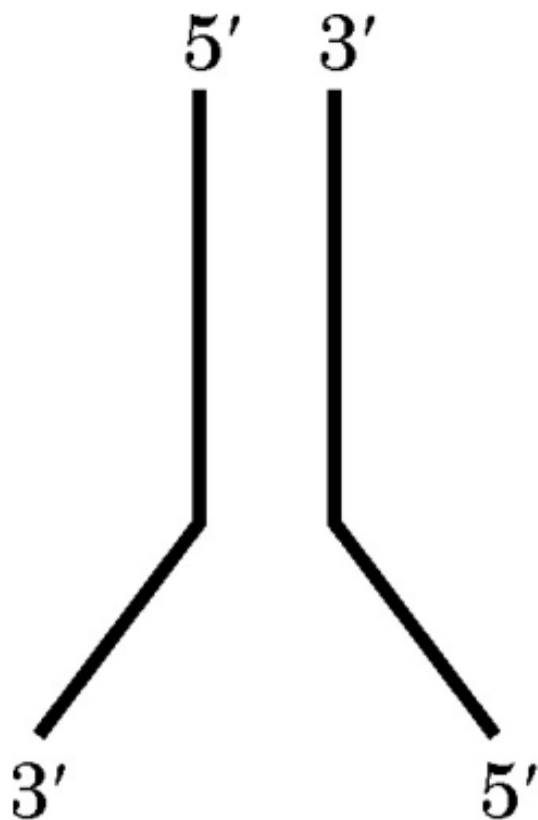
- (1) A Bacterium
- (2) A Fungus
- (3) Virus

32(a)(i).



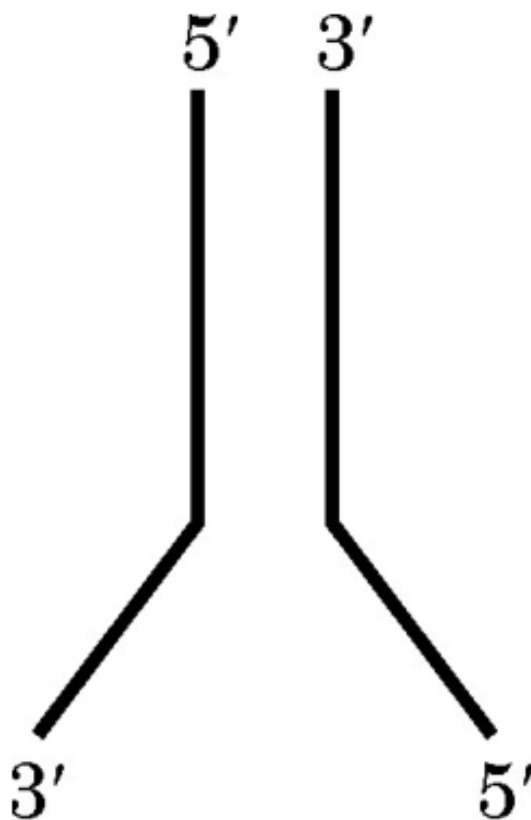
Identify the structure shown above and name the process taking place.

32(a)(ii).



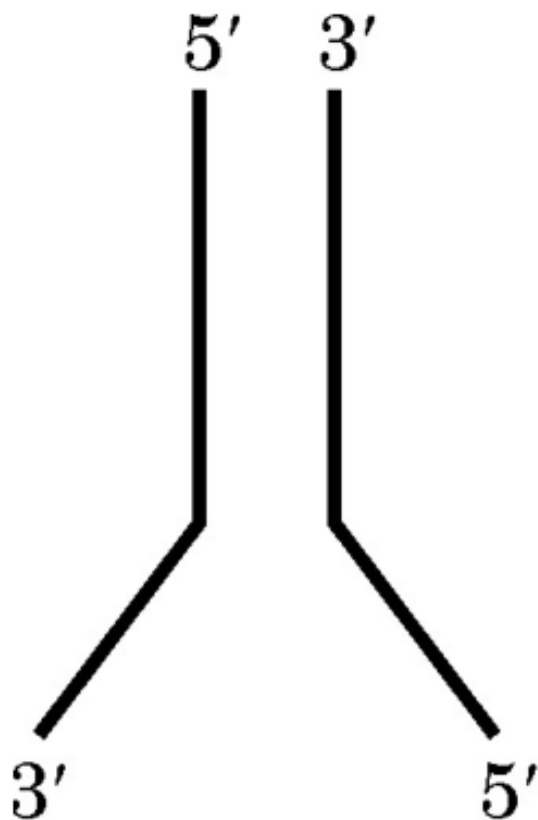
Write the source of energy for the process and list the enzymes involved.

32(a)(iii).



Mention the difference in the process based on polarity. What terms are used for such synthesis?

32(a)(iv).



Redraw the structure after completion of the process and label the newly synthesised parts.

OR

32(b)(i). How would you find out whether a given tall garden pea plant is homozygous or heterozygous? Substantiate your answer with the help of Punnet square.

OR

32(b)(ii). Given below are F_2 phenotypic ratios of two independently carried monohybrid crosses.

(1) 1 : 2 : 1

(2) 3 : 1

Mention what does each ratio suggest.

33(a)(i). Explain the role of stigma in pollen pistil interaction.

33(a)(ii). Describe the post pollination events leading to double fertilization in angiosperms starting with 2-celled pollen grain.

OR

33(b)(i). Explain menstrual phase in the menstrual cycle of human female.

OR

33(b)(ii). Why is follicular phase also called proliferative phase?

OR

33(b)(iii). Explain the events that occur in Graafian follicle at the time of ovulation and thereafter.

OR

33(b)(iv). Draw a Graafian follicle and label - Antrum and secondary oocyte.

- End of Question Paper -