

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) The question paper is divided into five sections Section A, B, C, D and E.
- (iii) There is no overall choice. However, an internal choice has been provided in 1 question in Section B, 1 question in Section C, 2 questions in Section D and 3 questions in Section E. A candidate has to attempt only one of the alternatives in such questions.

Section A

1. Blue-White selection technique of transformants is based on insertional inactivation of :

- (A) Leu2 gene (B) LacZ gene
(C) X-gal gene (D) Tet-r gene

2. Microbial source of Hind III restriction enzyme is :

- (A) Haemophilus aegyptius (B) Haemophilus influenzae
(C) Haemophilus haemolyticus (D) Haemophilus felis

3. Which of the following statement is **not** correct about DNA sequencing by Sanger Method ?

- (A) Primers can only be extended using the single strand DNA as template. (B) Four ddNTPs — ddATP, ddUTP, ddCTP and ddGTP are needed.
(C) DNA polymerase enzyme is needed. (D) ddNTPs are added to terminate chain (DNA) extending.

4. Charge relay system operating in chymotrypsin enzyme consists of following amino acids at positions 57, 102 and 195 respectively :

- (A) his-asp-ser (B) his-lys-ser
(C) his-lys-asp (D) lys-his-ser

5. Number of predicted genes is 6340 and 70% part of the genome codes for protein in :

- (A) Yeast (B) Caenorhabditis worm
(C) Arabidopsis weed (D) Bacterium E. coli

6. SCID disease is caused by absence of enzyme :

- (A) Adenosine synthase (B) Adenosine deaminase
(C) Adenosine phosphatase (D) Adenosine aminase

7. Technique of introducing colours into DNA by Nick Translation, was developed by :

- (A) Rigby and Paul Berg (B) Rous and Jones
(C) Kary Mullis and Paul Berg (D) Edward Sanger

8. *Alcaligenes eutrophus* is associated with the production of :

- (A) Streptomycin (B) Penicillin
(C) Hepatitis antigen (D) Poly 3-hydroxybutyrate

9. Expression vector has which of the following properties ?

- (A) High copy number and stable (B) Easy to transfer in eukaryote cells
(C) Maximise production of foreign protein (D) Both (a) and (c)

10. Artemisin obtained from *Artemisia* species is used as

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|----------------------|-------------------|
| (A) Antimalarial | (B) Antifertility |
| (C) Anticarcinogenic | (D) Analgesic |

11. Transgenic plants which over-express compounds like sugars, mannitol and proline

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|---|---------------------------------|
| (A) are pest resistant | (B) are abiotic stress tolerant |
| (C) produce more secondary metabolites as drugs and other important metabolites | (D) are weedicide tolerant |

12. Person who lacks the ability to produce Factor VIII has heritable genetic disorder :

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|-----------------------|-------------------|
| (A) Haemophilia A | (B) Haemophilia B |
| (C) Christmas disease | (D) Stroke |

13. **Assertion (A):** Protoplasts are plant cells without cell wall.

Reason (R): Protoplasts can be utilized for producing somatic hybrids.

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

14. **Assertion (A):** Homology is defined as similarity due to common ancestry.

Reason (R): DNA sequences obtained from different individuals of same species show homology due to similarity in DNA sequence.

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

15. **Assertion (A):** Insert and vector DNA are cut with the help of Restriction endonuclease.

Reason (R): Ligase can produce the nick in the recombinant DNA molecule.

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

16. **Assertion (A):** For the expression of eukaryotic proteins, *E. coli* is preferred.

Reason (R): *E. coli* is easy to grow and manipulate, so is used to express eukaryotic proteins.

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

Section B

17. (a) For selection of recombinants having lacZ gene on vector DNA, it was plated on medium containing sucrose with a chromogen dye. (Show sucrose breakdown) No result was obtained. Why ? (b) What can be done to select these recombinants ?

18. How does mosquito repellent work ? Mention its major chemical constituents.

19. "There are about 1.6 million to 3.2 million sites in the human genome, where SNPs can occur, but still they may or may not affect gene function." Justify the statement giving reasons.

20(a). Differentiate between Primary cell cultures and Secondary cell cultures.

OR

20(b). Differentiate between Finite cell lines and Continuous cell lines.

21. How will you perform laboratory screening for micro-organism producing an antibiotic ?

Section C

22. Give reason for the following : (a) Baffle flasks have V-shaped notch. (b) Excess foaming in microbiological processes is a problem. (c) Slaughter-house wastes are used to prepare media for microbiological processes.

23(a). How are mouse models created ? Write two major applications in the field of stem cell technology.

OR

23(b). Complete the flowchart for creating gene knockout by filling A, B and C.

Selection of a gene of interest for knockout

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Place in plasmid

↓

Inject plasmid into [A]

↓

Homologous recombination

↓

Selection with [B]

↓

Injecting it into [C]

23(b)-VI. For visually impaired candidates only, in lieu of Question 23(b).

What is BLAST ? What are the principles involved in this search program ?

24. *Pichia pastoris* is the most suitable host to express eukaryotic gene. Support the statement giving three reasons.

25. Transgenic crops are facing challenges globally. What are the major concerns about these GM crops ?

26. (a) Among all the biomolecules, proteins have maximum diversity in function. Why ? (b) Proteome of a given cell is dynamic. Why ? (c) mRNA and protein expression levels in a cell do not always correlate. Why ?

27. How is MALDI (Matrix Assisted Laser Desorption Ionisation) used to volatilise and protonate peptides and proteins ?

28. (a) What are the essential features that a vector should possess ? (b) What are shuttle vectors ?

29. Read the passage and answer the question that follows :

Single nucleotide polymorphisms (SNPs) are common genetic variations among people. Each SNP represents a difference in a single nucleotide and normally occur throughout a person's DNA. SNPs can help scientists to locate genes associated with disease. Research is going on to identify SNPs associated with diseases like diabetes, cancer etc.

29(i). How can SNPs help physicians ?

29(ii). SNPs can decide our susceptibility to, or protection from all kinds of diseases. Give any one example to support the same.

29(iii). Why is SNP analysis used in population genetics ?

OR

29(iii). Do SNPs occur only in coding regions of human genome or in both coding and non-coding regions ?

30. Animal cell culture

Animal cells can be grown in glass or plastic vessels with nutrient medium. These need to be given fresh medium periodically. The infant animal cells grow only to adulthood and not any further. While growing, they show phenomenon of contact inhibition, but cancer cells don't show this characteristic.

30(i). What is contact inhibition ?

30(ii). Which property of cells is studied by oncologists to determine whether cells are normal or cancerous ?

30(iii). As in vivo environment is different from in vitro environment, how does it affect cells grown in culture ? Mention any two.

OR

30(iii). Mortality is associated with all normal animal cells. Justify giving reason.

Section E

31(a). (i) Differentiate between primary and secondary metabolites. (ii) Name three industrially important plant secondary metabolites produced through cell and tissue culture, along with their use.

OR

31(b). (i) According to WHO estimates, approximately 228 million children are affected due to Vitamin A deficiency. How has genetic engineering provided/developed a solution to the same ? Explain. (ii) Why is nutritional quality of cereals and legumes limited ? (iii) Name two essential amino acids which are deficient in pulses.

32(a)(i). Draw diagram showing schematic representation of the basic steps in Recombinant DNA Technology.

32(a)(i)-VI. For visually impaired candidates only, in lieu of Question 32(a)(i).

Write all the four defined steps of Recombinant DNA Technology in correct sequence. Name any two scientists who were involved in generation of first Recombinant DNA molecule. Name two products produced commercially using this technology.

32(a)(ii). Why are Type II restriction enzymes preferred in the above mentioned technology ?

OR

32(b). (i) Describe the technique to detect microbes from environmental samples present in very small numbers. (ii) Why is this technique getting popular in diagnostics ?

33(a). (i) How are conventional vaccines different from recombinant vaccines ? (ii) What are epitopes ? (iii) What are the advantages of preparing vaccines using epitopes ?

OR

33(b). (i) Branched Chain Amino acids (BCAA) are essential for the biosynthesis of muscle protein. How ? Explain. (ii) What is Biological value of proteins ? (iii) What is Protein Efficiency Ratio ? Arrange the following proteins in decreasing order of protein efficiency ratio : Milk, Casein, Soya, Wheat, Whey

- End of Question Paper -