

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) Question paper is divided into five sections – Section A, B, C, D and E.
- (iii) Section A : Questions number 1 to 16 are Multiple Choice Type Questions (MCQs). Each question carries 1 mark.
- (iv) Section B : Questions number 17 to 21 are Very Short Answer (VSA) Type Questions. Each question carries 2 marks.
- (v) Section C : Questions number 22 to 28 are Short Answer (SA) Type Questions. Each question carries 3 marks.
- (vi) Section D : Questions number 29 and 30 are Case Study-based Questions, carrying 4 marks each. Each question has sub-parts with internal choice in one sub-part.
- (vii) Section E : Questions number 31 to 33 are Long Answer (LA) Type Questions. Each question carries 5 marks.
- (viii) There is no overall choice given in the question paper. However, an internal choice has been provided in few questions in all the Sections except Section – A.

Section A

1. The natural source of enzyme barnase and barstar, a system used to achieve male sterile plant is :

- (A) *Bacillus subtilis* (B) *Bartonella henselae*
(C) *Bacillus amyloliquefaciens* (D) *Barnesville coli*

2. Severe combined immunodeficiency disease is caused due to the absence of :

- (A) Adenosine diphosphate (B) Adenosine deaminase
(C) Adenosine cyclase (D) Guanidine nitrate

3. Single nucleotide polymorphisms usually occur in _____ regions.

- (A) Coding (B) Non-coding
(C) Regulatory (D) Exonic

4. Artificial seeds are produced by encapsulating the somatic embryos at the _____ stage in a protective coating.

- (A) Torpedo (B) Globular
(C) Cotyledon (D) Triangular

5. The peptide hormones and growth factors to promote healthy growth of animal cells *in vitro* are often derived from :

- (A) Phenol red (B) Antibiotics
(C) Blood serum (D) Amino acids

6. Identify the vector that infects *E. coli* cells containing F-plasmid and that has a single-stranded circular genome :

- (A) *Agrobacterium tumefaciens* (B) YEp
(C) pBR322 (D) M13

7. An example of secondary metabolites produced by microbial cells include :

- (A) Vitamins (B) Alcohol
(C) Acids (D) Antibiotics

8. When a transgene from a Genetically Modified crop escapes through pollen to a related plant species, it is known as _____.

- (A) Gene transfer (B) Gene pollution
(C) DNA contamination (D) Toxicity transfer

9. A protein ion with a molecular weight of 10,000 Daltons carried a charge of 5^+ and was subjected to mass spectrometric analysis. Calculate its mass to charge ratio.

- (A) 2001 (B) 2000
(C) 2501 (D) 5001

10. Embryonic stem cells derived from blastocyst stage of the embryo are _____ in nature.

- (A) Totipotent (B) Pluripotent
(C) Multipotent (D) Bipotent

11. An improved strain of *Penicillium*, capable of producing higher concentration of antibiotic penicillin is :

- (A) *Penicillium notatum* (B) *Penicillium chrysogenum*
(C) *Penicillium eutrophus* (D) *Penicillium cerevisiae*

12. _____ cultures can be maintained for a prolonged period of time by repeated sub-culturing.

- (A) Ovary (B) Protoplast
(C) Callus (D) Mass cell
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13. **Assertion (A):** Some experts believe that there must be more than 30,000 genes in human genome.

Reason (R): Unreliability of in silico gene prediction is responsible for reporting lesser number of genes in human genome.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is **not** the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Assertion (A) is false, but Reason (R) is true.
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14. **Assertion (A):** The exact chemical composition of complex microbial growth media is known.

Reason (R): Complex nutrient media is used when specific growth requirement of a microorganism is unknown.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is **not** the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Assertion (A) is false, but Reason (R) is true.
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15. **Assertion (A):** The regulation of pH is essential for survival of mammalian cells.

Reason (R): Animal cell cultures mostly make use of Bicarbonate – carbon dioxide buffering system to maintain pH.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is **not** the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Assertion (A) is false, but Reason (R) is true.
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16. **Assertion (A):** During plant tissue culture, the explants are treated with sodium hypochlorite.

Reason (R): Sodium hypochlorite helps in acclimatization of the regenerated plants.

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

17. Illustrate steps to show the construction of a recombinant DNA molecule.

18. What are the advantages offered by creating mouse model with gene knockout ?

19. Name the technique that helps to study the entire protein profile from a given cell type. Briefly explain the principle of this method.

20. Write about any two strategies available to enhance the production of secondary metabolites in plant genetic engineering.

21(a). Give any two drawbacks of animal cell culture in vitro.

OR

21(b). (i) An oncologist is performing colony formation assay on tumour cells from a patient. What is he trying to determine ? (ii) Animal cells growing in culture show the property of contact inhibition. Relate this to what happens in an adult human body.

Section C

22(a). Compare the techniques of FISH with Microarray in terms of principle and applications.

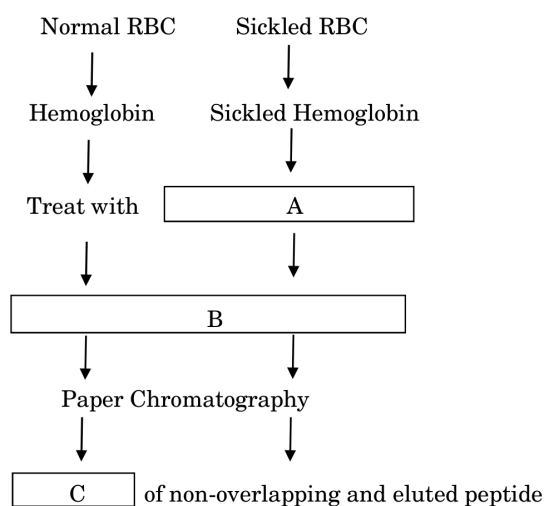
OR

22(b). Differentiate between Expression and Functional Proteomics.

23. Write the therapeutic use and the animal cell line employed in obtaining any three of the following protein pharmaceuticals : (A) Erythropoietin (B) Herceptin (C) Interleukin 2 (D) Tissue plasminogen activator

24. Explain the steps involved in PCR amplification method.

25. A researcher performed protein fingerprinting on hemoglobin from both normal and sickled red blood cells. Complete the flow-chart of the process by filling A, B, and C.



26. Discuss any three ways that can be employed to measure microbial cell growth.

27. What are zymogens ? How is chymotrypsinogen different from chymotrypsin ?

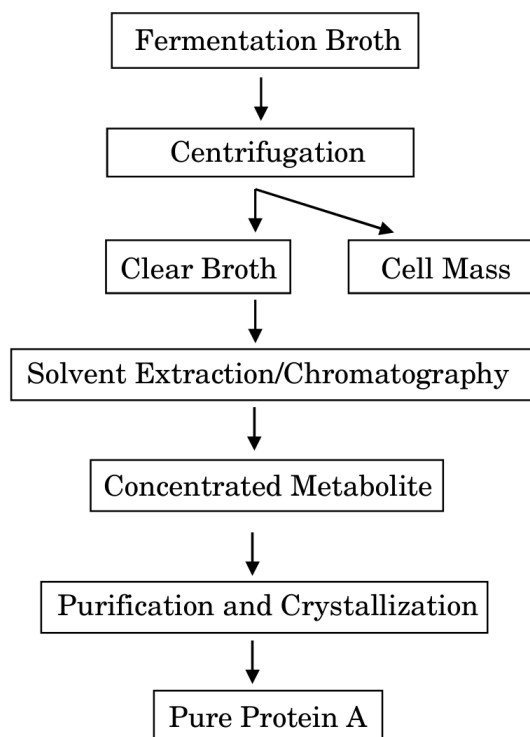
28. Give the names of any three genes that are used as selectable markers in recombinant DNA technology. Also mention the trait/protein they specify.

Section D

29. Carefully read the below mentioned flow-chart and answer the questions that follow:

Flow-chart scheme for isolation of Protein A is as given below:

Isolation of Microbial Product



29(a). Write whether Protein A is of intra or extra cellular origin.

29(b). Which step in the given purification scheme is metabolite specific ?

29(c). Give the purification scheme for isolation of Humulin from *E. coli*

OR

29(c). Why is it advisable to use lesser number of steps for downstream processing ?

30. Consider the following table and answer questions :

Given is a list of ingredients used for preparation of plant nutrient medium.

Plant Growth Media

Ingredients	Amount
NH_4NO_3	1650 mg/L
CaCl_2	440 mg/L
MnSO_4	22 mg/L
FeSO_4	27 mg/L
Glycine	2 mg/L
KNO_3	1900 mg/L
Sucrose	3 g/mL
Inositol	100 mg/L
EDTA	33 mg/L

30(a). Which component in the given list is acting as the carbon source ?

30(b). Which ingredient has been used to fulfill vitamin requirement ?

30(c). Name two phytohormones which are generally added to prepare plant nutrient media.

OR

30(c). Explain how the sterilization of the growth media is achieved in the laboratory.

Section E

31(a)(i). Explain the reason for therapeutic use of whey proteins.

31(a)(ii). Name any two diseases that have been treated with whey.

31(a)(iii). Curd is advised to be administered with antibiotics. Why ?

OR

31(b)(i). Discuss the development of a novel protein.

31(b)(ii). Name any two properties that can be manipulated using Protein Engineering.

32(a)(i). In Sanger's chain termination method, incorporation of ddNTP cause the growing DNA chains to terminate prematurely. Explain how.

32(a)(ii). Briefly write the steps of Sanger's chain termination method of DNA sequencing.

OR

32(b)(i). During DNA sequencing, why is the autoradiogram read from bottom to top to arrive at the original sequence ?

32(b)(ii). Why is single tube DNA sequencing considered better and safer ?

32(b)(iii). To perform DNA sequencing of a strand, we need to clone the sequence in a single-stranded form. Which vector will you prefer for this ?

33(a)(i). Name three database retrieval tools available from the NCBI. What all do they allow us to access ?

33(a)(ii). What kind of information is available in UniProtKB and PDB databases ?

OR

33(b)(i). How is BLAST used to analyses sequence similarity ? Explain.

33(b)(ii). Name the computer programmes that can perform gene prediction for bacterial and eukaryotic genomes.

- End of Question Paper -