

CBSE Class 12 Biotechnology 2023 - Set 99 - Compartment



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. 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. Consumption of which one of the following foods can prevent the kind of blindness associated with Vitamin A deficiency ?

- (A) Flavr Savr Tomato (B) Golden Rice
(C) Bt Brinjal (D) Canola

2. Proteins responsible for contractions of muscles are :

- (A) Haemoglobin and Myoglobin (B) Actin and Myosin
(C) Collagen and Myoglobin (D) Keratin and Collagen

3. To obtain a virus-free plant, what can be used as an explant in micropropagation ?

- (A) Embryo (B) Apical meristem
(C) Axillary meristem (D) Leaf

4. Large-scale characterization of entire protein complement of cell is :

- (A) Proteome (B) Proteomics
(C) Genome (D) Genomics

5. The genetically modified brinjal has been developed for :

- (A) Insect-resistance (B) Enhancing shelf life
(C) Enhancing mineral content (D) Drought resistance

6. Which of the following proteins will you expect to run the fastest through SDS-PAGE gel ?

- (A) Myoglobin – mol.wt. – 8,20,000 Dalton (B) Trypsin – mol.wt. – 25,000 Dalton
(C) Lysozyme – mol.wt. – 15,000 Dalton (D) Albumin – mol.wt. – 70,000 Dalton

7. The Nucleotide sequence in both the DNA strands reads the same in 5' to 3' directions :

- (A) Restriction Site (B) Palindromic Sequence
(C) DNA Coding Strand (D) Cleavage Site

8. Whey protein forms and stabilizes fat emulsions because of which one of the following functional properties ?

- (A) Emulsification (B) Viscosity
(C) Water-binding (D) Browning

9. The most common type of restriction enzyme used in recombinant DNA technology are :

- (A) Type-I restriction enzyme (B) Type-II restriction enzyme
(C) Type-III restriction enzyme (D) Type-IV restriction enzyme

10. The lack of a particular subunit α or β of the oxygen carrying protein haemoglobin results in :

- (A) Mad cow disease (B) Thalassemia
(C) SCID (D) Sickle Cell Anaemia

11. Which primer can be used to amplify the following strand of DNA ? 5' – ATTCGTGTACTGCAT – 3'

- (A) GCAATC (B) TAAGCA
(C) ATGCAG (D) CGATCG

12. When 2 copies of dsDNA molecules are added to PCR, how many copies of dsDNA will be formed after completion of 3 cycles ?

- (A) 4 (B) 8
(C) 32 (D) 16
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13. Assertion (A): Diet of athletes should have more eggs and meat as compared to other sources of protein like whey and soya milk.

Reason (R): Eggs and meat are richer sources of BCAA.

- (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) Both Assertion (A) and Reason (R) are false.
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14. Assertion (A): Baffle flask is used in laboratories for microbial cell culture.

Reason (R): Baffle flask improves the efficiency of oxygen transfer due to increased turbulence of the agitated culture medium.

- (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) Both Assertion (A) and Reason (R) are false.
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15. Assertion (A): In mass spectrometric analysis, protein molecules can be separated on the basis of m/z ratio.

Reason (R): Gas-phase charged molecular ions are generated by MALDI.

- (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) Both Assertion (A) and Reason (R) are false.
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16. Assertion (A): Analysis of mRNA does not provide a direct reflection of the protein content in the cell.

Reason (R): mRNA and protein expression level do not always correlate.

- (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) Both Assertion (A) and Reason (R) are false.
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Section B

17. Why is inverted microscope used in place of compound microscope while observing animal cells in culture ?

18(a). Enlist two reasons to support the statement, “Edible vaccines have advantages over recombinant vaccines.”

OR

18(b). What are the constraints associated with public acceptance of transgenic crops ?

19. Annotation of human genome sequence reveals that our genome contains 30,000 – 33,000 genes. Proteomic analysis indicates that human cells are capable of synthesizing more than 30,000 different proteins. How can this discrepancy be reconciled ?

20. (a) What are the various interactions that stabilize a folded protein ? (b) How can the stability of a protein be changed ?

21. (a) What are stem cells ? (b) For which medical conditions can stem cells be used ? Mention any two.

Section C

22(a). (i) Curd and whey are categorised as nutraceutical proteins. Why ? (ii) Give an example of novel recombinant vaccine developed by India.

OR

22(b). Complete the table by filling the Mode of Action/Functional Properties indicated as A, B, C, D, E and F

Functional Properties	Mode of Action
Whipping	A
B	Formation/Stabilizing of fat emulsions
C	Protein matrix formation
Viscosity	D
E	Hydrogen bonding of water
Solubility	F

23. Suggest a genetic engineering strategy for each of the following traits in transgenic crops :
(a) Delayed ripening (b) Pest resistance (c) Abiotic stress tolerance

24. Make a schematic diagram and show how ES cells can be used for making Chimeric mouse.

24-VI. What is ES Cell culture ? Mention its four advantages.

25. Expand “BLAST”. Explain the process involved in comparison of DNA sequences using this tool.

26. Name three enzymes used in cloning and write one function of each.

27. The microarray technique can be used to compare gene products between normal and cancer cells. Explain the technique.

28. The technique of DNA fingerprinting is very much in the news these days. Why ? Highlight its principle.

Section D

29. Enzyme chymotrypsin is synthesised in the pancreas and through the pancreatic duct released into the duodenum. The enzyme is made up of a linear chain of 245 amino acids interrupted into three peptides – A, B, C. The protein folds into a globular structure. Chymotrypsin is synthesised as inactive harmless precursors known as Zymogens which are then activated when required, only in the duodenum.

29(a). Name the two protein molecules that have a reactive serine residue which is central to the catalytic mechanism.

29(b). “Chymotrypsin allows bulky aromatic hydrophobic amino acid to bind.” Justify.

29(c). What is In-situ activation of Chymotrypsinogen ?

OR

29(c). Explain the mode of action of Chymotrypsin.

30. Continuous culture is a continuous process where nutrients are continually added to the bioreactor and the culture broth is removed at the same time. The volume of the culture is constant due to a constant feed-in and feed-out rate. In continuous culture, parameters such as pH, oxygen, the concentration of excretion products and population densities can easily be monitored and controlled.

30(a). What do you mean by ‘steady state’ ?

30(b). What is continuous culture used for ?

30(c). In continuous culture, cells can be grown at a particular _____ for an _____ period of time.

OR

30(c). For a continuous culture, draw a graph to illustrate the variation of cell density [X], concentration of substrate [S] and the cell specific substrate turnover rate [QS] with time.

Section E

31(a). (i) An enriched medium containing glucose, peptone, salts and vitamins was made and a commercially available animal cell line was introduced. However, the cells began dying. What could be the reason for this ? (ii) Why is r-HuEPO preferred over blood transfusion in a person with blood loss due to an accident ? (iii) While growing animal cells in a laboratory, osmolality of a medium is always maintained around 300 m OSM. Why ?

OR

31(b). (i) A cell culture laboratory has different types of equipments. Write the use of the following equipments : I. Tissue culture hood II. CO₂ Incubator (ii) How are monoclonal antibodies (mAbs) different from polyclonal antibodies ? Write one therapeutic application of mAbs.

32(a). How is the blue-white selection method used to screen the transformed host cells ? Describe any two methods of introducing recombinant DNA into host cells.

OR

32(b). (i) With the help of a suitable example, explain the nomenclature of restriction enzyme. (ii) What is the role of 'cos' site in phage λ ? (iii) How can LEU2 gene be used as a selectable marker ?

33(a). (i) Illustrate any two methods of measuring microbial growth. (ii) In which phase of growth is the specific growth rate of microbial cells calculated ? (iii) Calculate the doubling time of a bacterial population in which the number of bacteria increases from 10^4 /mL to 10^7 /mL during three hours of exponential growth.

OR

33(b). (i) What is the difference between a synthetic medium and complex medium ? (ii) How does the metagenomics approach help to identify novel genes present in the environment ? Explain this process.

- End of Question Paper -