

# CBSE Class 12 Biotechnology 2026 - Set 99/7 - 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 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. What is the purpose of using olive oil in microbial culture work ?

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|---------------------------------------|--------------------------------------------|
| (A) Increase foam production          | (B) Prevent excessive foam formation       |
| (C) Regulate pH in the culture medium | (D) Provide aeration in the culture medium |

2. Which property defines embryonic stem cells ?

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|-----------------|-----------------|
| (A) Multipotent | (B) Pluripotent |
| (C) Unipotent   | (D) Totipotent  |

3. The technique of fluorescence *in situ* hybridisation works on the principle of :

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|------------------------------------------------|-------------------------------------------------------------------------------------------|
| (A) DNA replication using fluorescent primers. | (B) Hybridization of complementary nucleic acid sequences labelled with fluorescent dyes. |
| (C) Protein-protein interaction detection.     | (D) Enzyme-linked antibody detection.                                                     |

4. In plant tissue culture, which type of explant is commonly used to obtain virus-free plants from virus-infected plants ?

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|--------------|----------|
| (A) Root     | (B) Stem |
| (C) Meristem | (D) Leaf |

5. In microbial culture, baffle flasks are mainly used for :

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|------------------------------------|---------------------------------------------|
| (A) Preventing nutrient absorption | (B) Slowing down cell growth                |
| (C) Preventing contamination       | (D) Creating turbulence for better aeration |

6. Which of the following statements about DNA ligase is correct ?

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|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| (A) DNA ligase creates hydrogen bonds between complementary base pairs.     | (B) DNA ligase creates phosphodiester bonds between adjacent nucleotides in DNA. |
| (C) DNA ligase creates single-stranded random nicks in double-stranded DNA. | (D) DNA ligase synthesizes new DNA strands from template DNA.                    |

7. SNP analysis can be used in population genetics because :

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|-------------------------------------------------------------------------|----------------------------------------------------------------|
| (A) SNPs always remain identical in individuals across all populations. | (B) Some SNPs vary in frequency between different populations. |
| (C) All SNPs occur at exactly the same frequency in every population.   | (D) SNPs cannot be inherited from one generation to the next.  |

8. Two genes are said to be homologous if :

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|-------------------------------------------------------------------------|-------------------------------------------------------------|
| (A) They have descended from a common ancestor.                         | (B) They are duplicated genes within the same genome.       |
| (C) They have completely different functions without a common ancestor. | (D) They have a similar sequence without a common ancestor. |

9. The main molecules that provide a stimulus for immunity are :

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|-------------------|-------------------|
| (A) Proteins      | (B) Lipids        |
| (C) Carbohydrates | (D) Nucleic acids |

10. The pH indicator “phenol red” is very helpful in monitoring the pH of animal cell culture medium in an incubator. Highly acidic conditions turn the colour of phenol red into \_\_\_\_\_.

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|------------|------------|
| (A) Blue   | (B) Pink   |
| (C) Yellow | (D) Orange |

11. Information on nucleotide sequences can be obtained from which of the following databases ?

- (A) UniProt (B) PALI  
(C) PDB (D) EMBL

12. Curd is considered a probiotic because :

- (A) It contains vitamins. (B) It contains live beneficial bacteria.  
(C) It contains lactic acid. (D) It is rich in calcium.

13. **Assertion (A):** It is possible to store animal cells in a culture medium for long periods in the presence of antibiotics.

**Reason (R):** Antibiotics control the growth of bacterial and fungal contaminants.

- (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.

14. **Assertion (A):** Specific growth rate is a measure at which a population of microbial cells in culture grows exponentially.

**Reason (R):** Specific growth rate is calculated during the stationary phase of microbial growth in culture.

- (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.

15. **Assertion (A):** An example of a shuttle vector is the yeast plasmid (YEp).

**Reason (R):** The leucine 2 gene (LEU2) encodes an enzyme essential for the biosynthesis of the amino acid leucine.

- (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.

16. **Assertion (A):** Embryo rescue is a technique used to save hybrid embryos obtained through interspecific and intergeneric crosses that would otherwise die prematurely.

**Reason (R):** The embryo rescue technique is necessary because such incompatible crosses often lead to abnormal endosperm development, resulting in the premature death of hybrid embryos.

- (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.

## Section B

**17(a).** State the importance of an “Origin of replication (ori)” and a “Selectable marker gene (SMG)” present in cloning vectors.

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OR

**17(b).** Why is pUC19 considered an efficient vector for the blue-white selection method in recombinant DNA technology ?

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**18.** Name the therapeutic monoclonal antibody used during organ transplantation. Also, state the mode of action of this immunosuppressant drug.

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**19.** What is contact inhibition ? Which type of mammalian cells show this property in culture ?

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**20.** How did Linus Pauling study the molecular basis of sickle cell anaemia, and what did he discover ?

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**21.** Briefly describe the process of the nick translation technique.

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## Section C

**22.** Explain the role of the charge relay system in the catalytic action of the enzyme chymotrypsin. Name the three amino acids that form the catalytic triad in the active site of chymotrypsin.

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**23.** Explain how an extracellular protein is purified from a microbial fermentation medium by illustrating the steps in a flowchart, with a suitable example.

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**24.** What is the process of producing edible vaccines ? What advantages do edible vaccines have over vaccines produced by bacterial fermentation ?

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**25.** Describe the key steps involved in the separation of proteins using O'Farrell's technique. Highlight the basis of separation at each step, and the significance of this technique.

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**25-VI. For visually impaired candidates only, in lieu of Question 25.**

Expand the acronym MALDI. Briefly explain its procedure used to volatilize and protonate peptides.

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**26.** On which principle is the Restriction Fragment Length Polymorphism (RFLP) technique based ? Explain the steps involved in this analysis.

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**27.** State the importance of maintaining optimum osmolality in an animal cell culture medium. List the factors contributing to it. How is the osmolality of culture medium checked directly ?

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**28(a).** The type of DNA cleavage produced by a restriction enzyme is important in cloning experiments. Explain with palindromic sequences the DNA cutting mechanisms of the restriction enzymes AluI and EcoRI.

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OR

**28(b).** Describe the nomenclature of restriction enzymes (REs) with EcoRI as an example. Why is EcoRI classified as a Type II RE ?

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## Section D

**29.** The term 'proteome' refers to the complete protein set of a cell. Proteomics refers to the large-scale characterization of the entire protein complement of cells, tissues and even whole organisms. The proteome of a cell is dynamic. In addition to the identification of proteins, one of the major goals of proteomics is to characterize post-translational modifications of proteins.

**29(a).** Give reason: The proteome of a cell is dynamic.

**29(b).** Which branch of proteomics deals with the identification of disease-specific proteins ?

**29(c)(i).** Define structural proteomics and write its application.

OR

**29(c)(ii).** Define functional proteomics and write its application.

**30.** Certain practical problems must be taken care of before a foreign gene may be expressed in a microorganism to make it commercially viable. To maximize the production of foreign protein in a host microorganism :

- The expression vector should be such that it replicates to a high copy number and is stable.
- The foreign gene may be put under the control of a regulatory switch.

**30(a).** Why does an expression vector ensure protein production from a foreign gene ?

**30(b).** What is the role of a regulatory switch in gene expression ?

**30(c)(i).** Suggest how the stability of an expression vector influences foreign protein production.

OR

**30(c)(ii).** Discuss any two challenges that may occur during the expression of a foreign gene in a host microorganism.

## Section E

**31(a).** Explain how protein engineering was applied to modify the native enzyme subtilisin. Why is recombinant subtilisin preferred over the native enzyme for use in the detergent industry ?

OR

**31(b).** Discuss the importance of branched-chain amino acids (BCAAs) in the diet of athletes. What is meant by the biological value of proteins ?

**32(a).** Describe the steps involved in isolation and culture of protoplasts. How is protoplast fusion carried out, and how are heterokaryons selected ?

OR

**32(b).** Why is it important to introduce pest resistance in plants ? Describe the method used to achieve this, and give an example of a genetically modified plant with such resistance.

**33(a).** Draw a well-labelled schematic representation showing the basic steps of recombinant DNA technology (RDT). What are the advantages of using alkaline phosphatase in this process ?

OR

**33(b).** Dideoxynucleotides (ddNTPs) are used in Sanger's method of DNA sequencing. Briefly explain the principle of this technique. Write the set of primers (5bp long) used in Sanger's method while sequencing the following DNA fragment: 5'-A T C C G C T A C-3'

**33(a)-VI. For visually impaired candidates only, in lieu of Question 33(a).**

Write the steps involved in recombinant DNA technology (RDT). What are the advantages of using alkaline phosphatase in this process ?

- End of Question Paper -