

**SAMPLE QUESTION PAPER**  
**BIOTECHNOLOGY (045)**  
**Class XII (2024-25)**

**Max. Marks: 70**

**Time allowed: 3 hours**

**General Instructions:**

- (i) All questions are compulsory.
- (ii) The question paper has five sections and 33 questions.
- (iii) Section–A contains 12 Multiple choice questions and 4 Assertion-Reasoning based questions of 1 mark each; Section–B has 5 short answer questions of 2 marks each; Section –C has 7 short answer questions of 3 marks each; Section-D has two case-based question of 4 marks; Section-E has three long answer questions of 5 marks each.
- (iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
- (v) Wherever necessary, neat and properly labeled diagrams should be drawn.

**Section - A**

**Q. No. 1 to 12 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.**

1	An approach that utilises analysis of genome present in different environment to screen presence of variety of molecules. A. Metagenomics B. Proteomics C. Strain preservation D. Mutant selection	1
2	In animal cell culture, the CO <sub>2</sub> levels in the incubator is usually maintained at- A. 1-2% B. 3-4% C. 5-10% D. 11-15%	1
3	Even if we know where the genes are in each genome, it's difficult to count them due to: (i) splice variants (ii) overlapping genes (iii) Post – transcriptional events (iv) Mutations  A. (i), (iii) B. (i), (ii) C. (iii), (iv) D. (ii), (iv)	1

4	<p>Avocado growers in Kerela want to find a way to genetically engineer their crop to prevent it from ripening during shipping. This can be achieved by introducing-</p> <p>A. genes for carotenoid biosynthesis.          B. gene from <i>Bacillus amyloliquefaciens</i>.          C. ethylene forming gene(s).          D. gene for protein containing sulphur rich amino acids.</p>	1
5	<p>Microbial species used for commercial production of citric acid is-</p> <p>A. <i>Saccharomyces cerevisiae</i>          B. <i>Aspergillus niger</i>          C. <i>Streptomyces griseus</i>          D. <i>Aspergillus oryzae</i></p>	1
6	<p>To reduce the possibility of religation of vector without picking insert, the following method or methods may be used-</p> <p>(i) Use of DNA Ligase          (ii) Use of Alkaline Phosphatase          (iii) Use of two different Restriction enzymes for cloning          (iv) Hybridoma technology</p> <p>Select the correct answer from options below</p> <p>A. (i), (iv)          B. (ii), (iii)          C. (iii), (iv)          D. (ii), (iv)</p>	1
7	<p>In a comparative cDNA microarray, the cDNA obtained from the normal and diseased cells are labelled with red and green fluorescent dyes respectively. The yellow colour of the spot indicates-</p> <p>A. Gene is expressed only in normal cells.          B. Gene is not expressed either in normal cells or in diseased cells.          C. Gene expressed only in diseased cells.          D. Gene expressed in equal measure in both types of cells.</p>	1
8	<p>Which disease has its locus on chromosome no 1 and 6?</p> <p>A. Huntington's disease          B. Migraine          C. Alzheimer's disease          D. Cystic fibrosis</p>	1
9	<p>A molecular disease which leads to increased hydrophobic interactions within the haemoglobin protein is-</p> <p>A. Thalassemia          B. Sickle Cell anaemia          C. Mad Cow          D. SCID</p>	1
10	<p>Interleukin-2 produced using CHO cell line is used for-</p> <p>A. anaemia therapy.          B. cancer therapy.          C. stroke.          D. treatment of autoimmune disease.</p>	1

11	<p>Proteome of a given cell is dynamic because:</p> <p>A. In response to internal and external changes the biochemical machinery of the cell could be changed.</p> <p>B. In response to internal and external changes the biochemical machinery of the cell could not be changed.</p> <p>C. No direct relationship exists between internal and external changes in the biochemical machinery of the cell.</p> <p>D. Indirect relationship exists between internal and external in changes the biochemical machinery of the cell.</p>	1
12	<p>A novel gene that codes for the epitope has been introduced into yeast cells to produce-</p> <p>A. Hepatitis B Vaccine</p> <p>B. Subtilisin</p> <p>C. EPO</p> <p>D. tPA</p>	1

**Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:**

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

13	<p><b>Assertion (A)</b> - Patients who are administered monoclonal antibodies against CD3, can accept renal allograft.</p> <p><b>Reason (R)</b> - Monoclonal antibodies block T cell function</p>	1
14	<p><b>Assertion (A)</b> - Foaming is a problem in most microbiological cultures.</p> <p><b>Reason (R)</b> - It is caused due to the presence of fatty acids and silicones in the culture medium.</p>	1
15	<p><b>Assertion (A)</b> - Yeast cells having YEp plasmid can grow on a medium lacking leucine and hence can be selected</p> <p><b>Reason (R)</b> - <i>LEU2</i> gene codes for an enzyme required for the synthesis of amino acid leucine.</p>	1
16	<p><b>Assertion (A)</b> - Long-term callus and cell suspension cultures and plants developed from such cultures may have chromosomal variations called somaclonal variations.</p> <p><b>Reason(R)</b> - Somaclonal variations may lead to improvement in crops like disease resistance in potatoes.</p>	1

### Section - B

- 17 The following table lists the common cloning vectors with the size of insert that can be cloned into them. Mark A, B, C and D in the table.

Vector Type	Insert size (kb)
Plasmid	0.5-8
A	9-23
Cosmid	B
C	50-500
YAC	D

- 18 Based on microscopic observation, how can pathologist differentiate between cancerous and non-cancerous cells? 2

- 19 Attempt either option A or B. 2
- A. What is inverted microscope and why is it used instead of compound microscope for observing animal cells in culture?
- OR**
- B. Why are B lymphocytes fused with myeloma cells in hybridoma technique? Give an important application of this technique.

- 20 Why is 2D Gel Electrophoresis considered a suitable technique for studying Proteomics? 2

- 21 Which database was created to manage the redundancy in EST data? What is the role of the curator in Bioinformatics? 2

### Section - C

- 22 A. Why has sickle cell trait been selected in population where malaria is endemic?  
B. What is the molecular basis of sickle cell anaemia?  
C. How can we differentiate between a normal RBC and Sickle cell RBC? 3

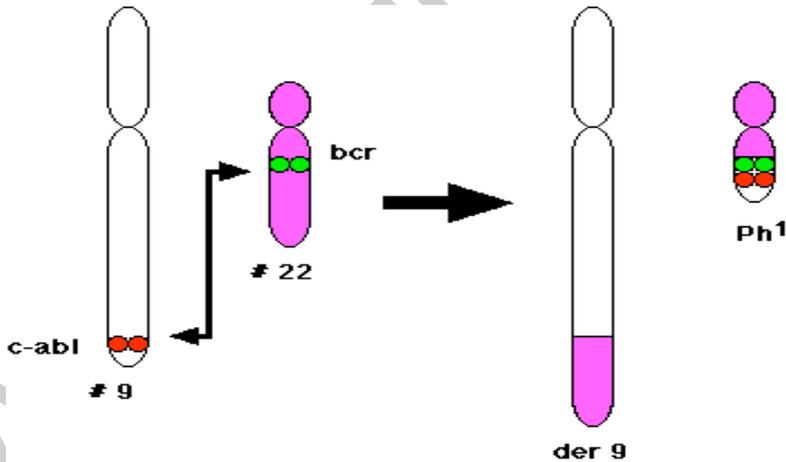
- 23 Why is the nutrient medium autoclaved before using it for culturing microbes? How would you sterilize a heat-labile substance such as antibiotic solution? 3

- 24 A. Identify (a), (b), (c) and (d) in the following table showing some industrially important plant secondary metabolites, their plant source and uses- 3

Product	Plant source	Uses
Vincristine	(a)	Anticarcinogenic
(b)	Papaver spp	Analgesic
Quinine	Cinchona officinalis	(c)
Taxol	Taxus spp.	(d)

	B. The indiscriminate use of such valuable medicinal and other plants has brought them to near extinction. Suggest a possible solution to this .	
25	How does the charge relay system operate in chymotrypsin?	3
26	The gene for a eukaryotic polypeptide hormone was isolated, cloned and over-expressed in a bacterium. After the polypeptide was purified from the bacterium, it failed to function in the organism from which the gene was isolated. Suggest all the possibilities why the recombinant protein was inactive.	3
27	Illustrate essential steps involved in raising a chimeric mouse using stem cell technology.	3
28	<p><u>Attempt either option A or B.</u></p> <p>A. Selection is an important step in genetic engineering. You are given ampicillin and tetracycline antibiotics. Using these antibiotics, which selection technique could be used to differentiate between recombinant and non-recombinant cells?</p> <p style="text-align: center;"><b>OR</b></p> <p>B. Which microbial cells have been used extensively for functional expression of eukaryotic genes and why?</p>	3

#### Section - D

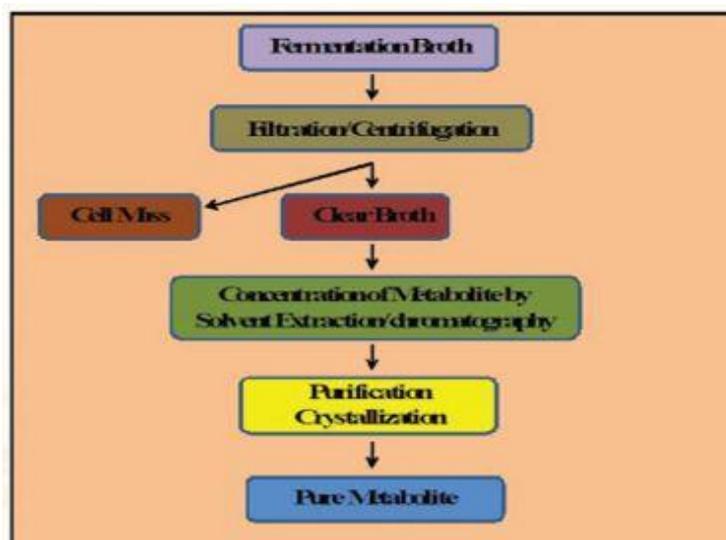
29	<p>The below figure depicts a process used in diagnosis of a disease.</p>  <p>A. Identify the mutation and the disease shown in the diagram. (1)          B. Which technique can help in the identification of this technique? (1)</p> <p><u>Attempt either subpart C or D.</u></p> <p>C. Write down the steps occurring during nick translation. (2)  <b>OR</b>          D. How do extent of severity of the disease be detected in the above process?</p>	4
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### Isolation of microbial product

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Once the fermentation is complete, it is necessary to recover the desired metabolite. Minimally, this will involve separation of the cells from the fermentation broth. But it may also include, purification of the metabolite with or without cell disruption; cell disruption will be necessary if the metabolite is intracellular. Such operations are referred to as downstream processing. The steps involved in isolation of the desired microbial product are: (1) separation of cells from the fermented broth, (2) cell disruption if the product is intracellular or concentration of the broth if the product is extracellular (3) initial purification of the metabolite, (4) metabolite-specific purification in which the metabolite of interest is purified to a high degree, and (5) polishing of the metabolite (bringing it to 98 -100% purity) where it is further concentrated and formulated for use.



- A. Cite an example of pure metabolite that can be obtained from above depicted flow chart.
- B. Suggest a suitable term which includes all the steps mentioned above.

Attempt either subpart C or D.

- C. In the second step mentioned above, "Which part will you use to isolate intracellular product?"

**OR**

- D. Why is it generally recommended to have minimum number of steps in these isolation processes?

### Section - E

31

Attempt either option A or B.

5

- A. A protein with molecular weight of 10,000 contains 4, 3, 2, and 1 charge. Calculate the m/z ratio of protein ions at which Mass spectrometer detects them. Draw the Mass spectrum corresponding to the above mentioned ions.

	<b>OR</b>	
	B. A doctor has to prescribe a protein rich diet to sportsmen to improve their performance. What are the three parameters that the doctor should consider while prescribing these protein sources?	
32	<p><u>Attempt either option A or B.</u></p> <p>A. Write the basic steps with principles (starting from an explant) involved in obtaining a regenerated plant. Suggest any two applications of plant tissue culture.</p> <p style="text-align: center;"><b>OR</b></p> <p>B. Indicate how intergeneric somatic hybrids can be made. Give an example. What are cybrids? How are edible vaccines advantageous over recombinant vaccines produced by bacterial fermentation?</p>	5
33	<p><u>Attempt either option A or B.</u></p> <p>A. Who invented the dideoxynucleotide chain termination method? Schematically explain the method.</p> <p style="text-align: center;"><b>OR</b></p> <p>B. Why is the dye termination method considered better than chains termination technique? (Any two) Why is the autoradiogram read from bottom to top (anode to cathode)? Why do bacteria produce restriction enzymes and how do they protect their own DNA from its action?</p>	5

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