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FOR CBSE CLASS 12 PREPARATION

CBSE Class 12 Sample Paper 2027 for Biotechnology

EXAM	YEAR	TYPE	SUBJECT
CBSE Class 12	2027	Sample Paper	Biotechnology

BIOTECHNOLOGY – CODE NO. 045
SAMPLE QUESTION PAPER*
CLASS – XII (2026-27)

Maximum Marks: 70 **Time allowed: 3 Hrs**

General Instructions:

(i) All questions are compulsory.
(ii) The question paper has five sections.
(iii) Section A contains 16 Multiple choice 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.*

Q. No.	SECTION A	Marks
1.	An organism has 20% of its genome as genes and the genome is divided into four chromosomes. Identify this organism. A. *Arabidopsis thaliana* B. Humans C. Drosophila D. Yeast	1
2.	Subtilisin is inactivated due to oxidation of amino acid A. histidine B. methionine C. aspartate D. serine	1
3	The charge relay system in serine proteases helps in A. stabilising the substrate by forming disulfide bonds. B. activating the serine residue for nucleophilic attack. C. lowering the pH of the active site. D. transporting electrons through the electron transport chain.	1
4	What is the main characteristic of a turbidostat in a continuous microbal culture system? A. Maintains a constant rate of nutrient feed B. Promotes maximum biomass accumulation C. Increases nutrient supply over time D. Ensures constant cell concentration	1
5	Meristem is used as an explant for : A. Obtaining virus resistant plants B. Promoting somaclonal variations C. Producing commercially important secondary metabolites D. Producing Virus free plants	1

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6	A student is interested in amplifying a specific region of genome of an organism. Which of the following would actually help her in targeted amplification? A. Probes B. Primers C. rNTPs D. ddNTPs	1
7	There is no increase in the cell concentration in the lag phase due to the following reason - A. Exhaustion of the medium. B. Space constraint C. Accumulation of toxic products D. Acclimatization to the new environment	1
8	How does the inclusion of phenol red in many cell culture media demonstrate a practical application of understanding the medium's properties? A. Phenol red directly contributes to cell growth by providing essential nutrients. B. Phenol red acts as a visual indicator, simplifying pH monitoring and maintenance of optimal cell culture conditions. C. Phenol red is essential for maintaining the correct osmolality of the medium. D. Phenol red is a necessary cofactor for many enzymatic reactions within the cell.	1
9	Somatic embryos are A. identical with zygotic embryos and without seed coats B. identical with zygotic embryos and with seed coats C. non-identical with zygotic embryos and without seed coats D. non-identical with zygotic embryos and with seed coats	1
10	Which of the following protein pharmaceutical is not produced by CHO cell line? A. Erythropoietin B. Factor IX C. Interleukin 2 D. Monoclonal antibody	1
11	The correct sequence of steps in the technique of Microarray is: (i) Choosing a cell population (ii) Conversion to cDNA molecules	1

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	(iii) Extraction of mRNA molecules (iv) Fluorescent labelling (v) Scanning and interpretation A. (i), (ii), (iv), (iii), (v) B. (i), (ii), (iii), (v), (vi) C. (i), (iii), (iv), (ii), (v) D. (i), (iii), (ii), (iv), (v)	
12	The vectors suitable for transformation of animal cells are: A. SV 40 vectors and papilloma virus vectors B. Cauliflower mosaic virus (CMV) vector and Gemini vectors C. Lambda phage and M13 phage vectors D. T4 phage vectors	1
For Questions number 13 to 16, two statements are given one labelled as **Assertion** (A) and the other labelled as **Reason** (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below. 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.		
13	**Assertion**: Proteins have been engineered to show minimum deleterious effects. **Reason**: Proteins are the main molecules which provide stimulus for immunity.	1
14	**Assertion**: The Somatic cell hybridization offers an excellent alternative for obtaining distant hybrids. **Reason**: Somatic hybrids are created by fusing intact cells of distantly related plants.	1
15	**Assertion**: Auxins are added to the culture medium if callus induction is desired. **Reason**: Nature and quantity of auxin added depends on source of explant.	1
16	**Assertion**: Genetic variation between individuals is exploited in DNA fingerprinting. **Reason**: Not all genetic variations are useful in DNA fingerprinting.	1
SECTION B		
17	What is specific growth rate in microbial growth kinetics? Write the relation between specific growth rate and doubling time.	2
18	***Attempt either option A or B.***	2

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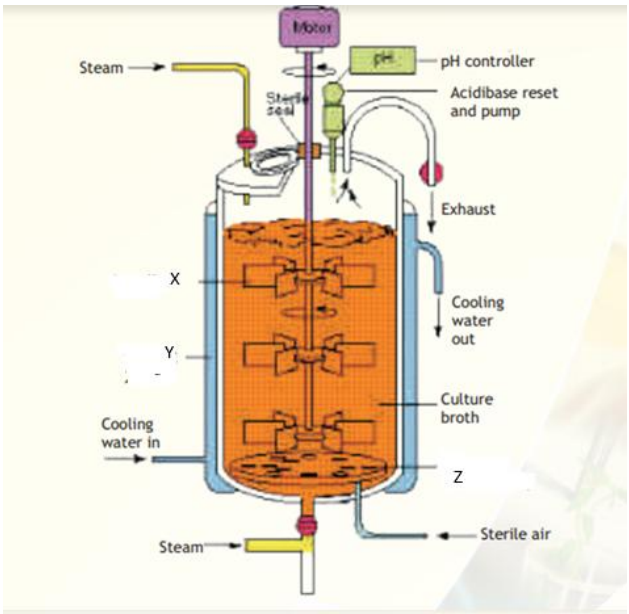
	A. Give any four requirements to carry out the polymerase chain reaction. **OR** B. Describe any two methods to directly introduce foreign DNA into the host cells.	
19	A researcher is using baffle flasks for small scale microbial culture in the lab. How are baffle flasks different from ordinary flasks?	2
20	What is protoplast culture? Write any two of its uses.	2
21	Explain the key difference between polyclonal and monoclonal antibodies in terms of their binding specificity to antigens. How does this difference arise from their cellular origins?	2
	SECTION C	
22	A kidney transplant patient is prescribed OKT3 to prevent acute rejection. Explain how OKT3 modifies T-cell activity?	3
23	Write about any three ways that allow us to perform gene analysis using Bioinformatics.	3
24	A. Identify the parts of fermenter which are labelled as X, Y and Z.  B. "A transgene may be added, which encodes an enzyme to modify a metabolite produced by the organism to yield a new product of interest". Will this be considered as strain improvement? Justify giving an example. - - - - - - - - - - - - - - - - - - - *For Visually impaired students* A. What is the capacity of a small scale biofermentor used in laboratories? Mention any two uses of such bioreactors. B. "A transgene may be added, which encodes an enzyme to modify a	3

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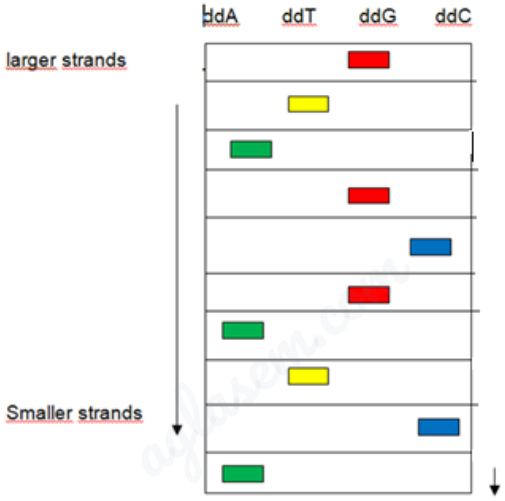
	metabolite produced by the organism to yield a new product of interest". Will this be considered as strain improvement? Justify giving an example.	
25	***Attempt either option A or B.*** A. A group of Indian scientists observed that group of patients feeding on whey are responding better to retro-viral therapy as compared to those who are not taking it. What could be the possible scientific explanation for this therapeutic effect? **OR** B. Write about the three parameters that define the dietary value of proteins.	3
26	A. Illustrate the steps involved in the generation of RFLP. B. What is the RFLP pattern expected in case of identical twins.	3
27	 Look at the diagram and answer the following questions A. Derive at the original DNA sequence by reading above given autoradiogram. B. Why are ddNTPs used along with dNTPs in the enzymatic method of DNA sequencing? C. How is a dNTP chemically different from a ddNTP? - - - - - - - - - - - - - - - - - - - *For Visually impaired students* The sequence of the strand of DNA complementary to the sequenced strand is 5' ACGCCCGAGTAGCCCAGA 3' A. Write the sequence of the original strand. B. Which method is commonly used to sequence DNA? C. Why is automated DNA sequencing considered safer?	3

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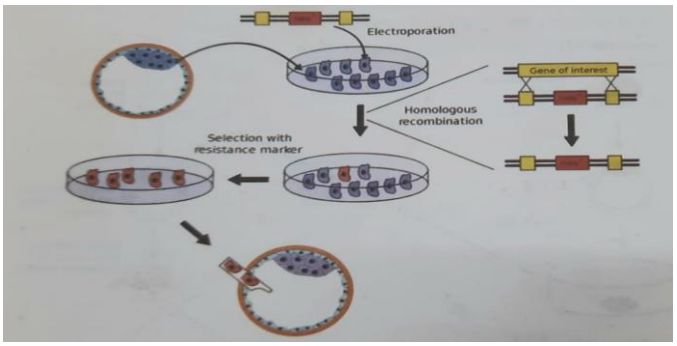
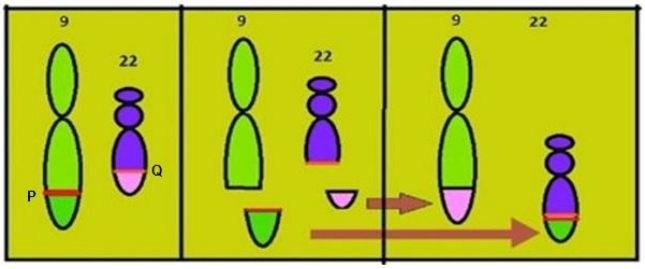
28	 A. Based on the visual cues, Identify the technique which is depicted here? B. Expand ICM. From which developmental stage is it obtained, and why is this stage ideal for pluripotency research? - - - - - - - - - - - - - - - - - - - *For Visually impaired students* A. Differentiate between finite and continuous cell lines based on their lifespan in culture. B. Herceptin is a monoclonal antibody used to treat HER2 - positive breast cancer. Based on the information provided, what is the role of the HER2 receptor in cancer cell growth, and how does Herceptin interfere with this process to inhibit cancer progression?	3
	SECTION D	
29	Chronic Myelogenous Leukemia is caused due to Reciprocal translocation mutation between chromosome 9 and 22 that forms an extra-long chromosome 9 and extra small chromosome 22 containing the fused gene regions. Refer to the schematic view representing metaphase chromosome and answer the question that follow:  A. Identify the gene region P and Q in the given diagram. B. What is the extra small resultant chromosome 22 called? *Attempt either subpart C or D.* C. Apart from Karyotyping, which other technique can be used to detect CML in patients? State the principle of the technique. **OR** D. Why is Karyotyping not, a preferred method to find out the severity of CML disease? - - - - - - - - - - - - - - - - - - -	4

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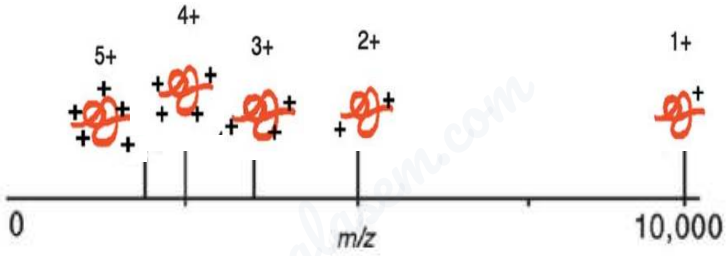
	For Visually impaired students Chronic Myelogenius Leukemia is caused due to reciprocal translocation between chromosome 9 and 22 that forms an extra-long chromosome 9 and an extra small chromosome 22 containing the fused gene regions. Both the chromosomes are metaphase arrested and visible during Karyotyping. Answer the questions that follow: A. What are the names given to both the gene regions of chromosome 9 and 22 that fuse? B. What is the extra small chromosome 22 known as? *Attempt either subpart C or D.* C. Apart from Karyotyping, which other technique can be used to detect CML in patients? What is its principle? **OR** D. Why is Karyotyping not, a preferred method to find out the severity of CML disease?	
30	Mass spectrometry  (MS) has emerged as an important tool for characterisation. A protein with a molecular weight of 10,000 dalton generates five different peaks with the ions containing 5, 4, 3, 2, and 1 charges, respectively, as shown below. A. What happens if there is a loss of charge from a biomolecule? B. Mass spectrometry is an analytical tool. Justify the statement. *Attempt either subpart C or D.* C. Calculate the m/z ratio each for protein ions containing 4 and 2 charges. OR D. A protein has a molecular weight of 20,000 daltons and it forms two protein ions containing 6 and 7 charges, what will be its mass/charge ratio? - - - - - - - - - - - - - - - - - - - *For Visually impaired students* Mass spectrometry (MS) has emerged as an important tool in biotechnology. It is extremely useful in obtaining protein structural information such as peptide mass or amino acid sequences. The	4

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	molecular ions are generated either by a loss or gain of a charge (e.g. electron ejection, protonation or deprotonation). After the ions are formed, they can be separated according to their m/z ratio and finally detected. A. What happens if there is a loss of charge from a biomolecule? Give two reasons. B. Mass spectrometry is an analytical tool. Justify the statement. *Attempt either subpart C or D.* C. Name the major components of a mass spectrometer. **OR** D. How is MALDI used to volatilize and protonate proteins?	
	SECTION E	
31	***Attempt either option A or B.*** A. Few restriction enzymes break the phosphodiester bond in such a manner that single stranded overhang ends are generated in the DNA strand. *EcoRI* is one such a restriction enzyme. I. Write the sequence for restriction site for enzyme EcoRI. Give a name to the kind of ends generated here. II. If the following DNA strand is digested by EcoRI, how many DNA fragments will be generated. Write the sequence of these double stranded DNA fragments with their respective polarity. 5' GTATTAGCTGAATTCTATAAAACG 3' 3' CATAATCGACTTAAGATATTTTGC 5' III. Why is *EcoRI* named so? **OR** B. A gene X was introduced into cloning vector pUC19 at LacZ gene site. What will be the impact on the recombinant plasmids? Also suggest a possible way by which we can differentiate recombinants from non-recombinant plasmids.	5
32	***Attempt either option A or B.*** A. I. A company plans to release a new insect-resistant GM crop. Evaluate three potential bioethical concerns in plant genetic engineering. II. What was the need to develop "Flavr Savr"? **OR** B. I. How can the transgenic plants be used as factories to produce biodegradable plastics? II. What are artificial seeds and mention any one application? Explain diagrammatically.	5

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33	***Attempt either option A or B.*** A. I. Describe the technique developed by O'farrell to study proteomics. II. Name any two properties that can be manipulated using protein Engineering. **OR** B. I. Why is sickle cell anaemia called a molecular disease? II. Who developed peptide mapping? Describe the technique.	5

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