**KENDRIYA VIDYALAYA SANGATHAN MUMBAI REGION.**
**PRE BOARD II EXAMINATION 2025**

**SUBJ: BIOTECHNOLOGY (045)** **CLASS: XII**
**Max. Marks 70** **Time allowed: 3 hours**

***General Instructions:***

***i) All questions are compulsory.***

***ii) The question paper has five sections. All questions are compulsory.***

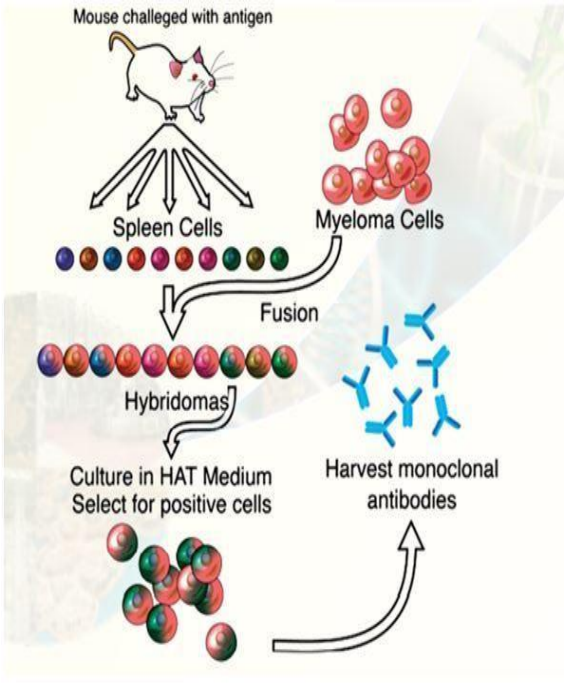
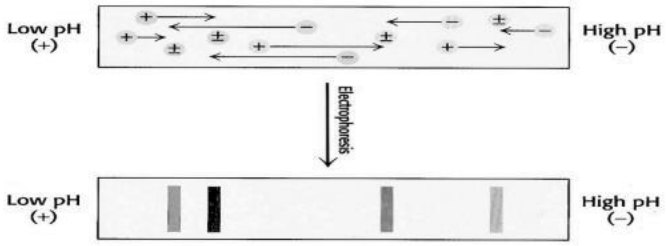
***iii) Section–A contains 12 Multiple choice questions and 4 Assertion-Reasoning based questions of 1 mark each; Section–B has 5 short answer questions of 2 marks each; Section –C has 7 short answer questions of 3 marks each; Section-D has two case based question of 4 marks; Section-E has three long 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.***

| Q. No. | Section A | Marks |
|---|---|---|
| **1.** | Which of the following is not true about protein fingerprinting?<br>a) Purified proteins are cleaved with trypsin to create fragments.<br>b) The first technique to separate the peptides at pH 2 is paper electrophoresis.<br>c) The first technique to separate the peptides at pH 2 is paper chromatography.<br>d) The second technique to separate the peptides is paper chromatography based on partition coefficient. | **1** |
| **2.** | A farmer wants to grow thousands of disease-free banana plants in a short time. A biotechnologist suggests using micropropagation through shoot tip culture. Which principle makes this technique possible?<br>(a) Genetic recombination<br>(b) Totipotency of plant cells<br>(c) Mutation<br>(d) Hybridization | **1** |
| **3.** | An approach that utilizes analysis of genome present in different environment to screen presence of variety of molecules.<br>A. Metagenomics<br>B. Proteomics<br>C. Strain preservation<br>D. Mutant selection | **1** |

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| **4.** | In an RDT experiment, the vector is digested with a restriction endonuclease and then it is treated with alkaline phosphatase (AP). Why is this done?<br>a) AP is used to remove 3'-OH group to stop self-ligation of vector<br>b) AP is used to remove 5'-OH group to stop self-ligation of vector<br>c) AP is used to remove 5'-phosphate group to stop self-ligation of vector<br>d) AP is used to remove 3'-phosphate group to stop self-ligation of vector | **1** |
| **5** | YEp, contains a gene coding for:<br>(a) X-Gal<br>(b) B-galactosidase<br>(c) Leucine<br>(d) GFP | **1** |
| **6** | Biological Value refers to<br>a) The amount of protein nitrogen that is retained by the body from a given amount of protein nitrogen that has been consumed.<br>b) Growth expressed in terms of weight gain of an adult by consuming 1 gm of food protein.<br>c) The total amount of protein nitrogen that has been consumed.<br>d) Growth expressed in terms of weight gain of an adult by consuming 1 Kg of food protein. | **1** |
| **7** | Male sterility is widely used in crops such as maize, sunflower for hybrid production. Male sterile plants are created by introducing a gene encoding-<br>(a) Barnase protein<br>(b) TA29<br>(c) Barstar protein<br>(d) Coat protein | **1** |
| **8** | Choose the right combination of components required to set up PCR reaction<br>a) Template DNA, two primers, dNTPs and DNA ligase<br>b) Template DNA, two primers, NTPs and DNA ligase<br>c) Template RNA, two primers, NTPs and DNA polymerase<br>d) Template DNA, two primers, dNTPs and DNA polymerase | **1** |
| **9** | Doctor suggested a patient to take curd after a course of antibiotics. Why?<br>a) Curd is a good source of calcium<br>b) Curd is a probiotic<br>c) Curd is a source of proteins<br>d) Curd is good for taste | **1** |
| **10** | Mr Sohan is working on a sensational case, for which he collected DNA samples from the site. Suggest a technique to amplify the DNA<br>A. RFLP<br>B. Site Directed Mutagenesis<br>C. SNPs<br>D. PCR | **1** |

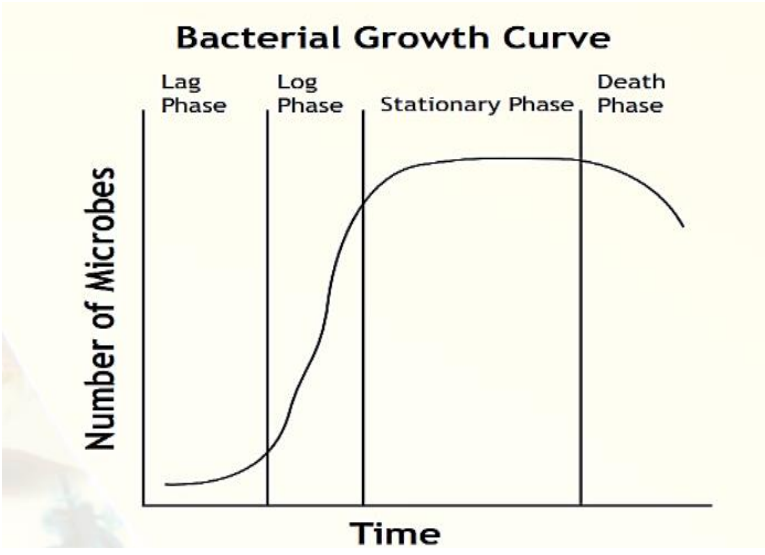
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| **11** | Gargee wants to start a business on Amylase production using culture microbes. On a large scale for production of useful metabolites she should not use:<br><br>a. Nutrients that are available throughout the year<br>b. Nutrients which are economical available readily<br>c. Nutrients that yield minimum products or biomass per gram of the substrate used.<br>d. Raw material that needs minimal pre-treatment | **1** |
| **12** | Which of the following is not true about protein fingerprinting?<br>a) Purified proteins are cleaved with trypsin to create fragments.<br>b) The first technique to separate the peptides at pH 2 is paper electrophoresis.<br>c) The first technique to separate the peptides at pH 2 is paper chromatography.<br>d) The second technique to separate the peptides is paper chromatography based on partition coefficient. | **1** |
| | Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R).<br>Answer these questions selecting the appropriate option given below:<br>a) Both Assertion and Reason are true and the reason is the correct explanation of the assertion<br>b) Both Assertion and Reason are true but the reason is not the correct explanation of the assertion<br>c) Assertion is true but Reason is false.<br>d) Both Assertion and Reason are false | |
| **13** | **Assertion:** It is very difficult to produce hybrids in inter-generic crosses<br>**Reason:** The abnormal development of endosperm leads to death of hybrid embryo**.** | **1** |
| **14** | **Assertion:** The regulation of pH is essential for survival of mammalian cells.<br>**Reason:** Animal cell cultures mostly make use of Bicarbonate carbon dioxide buffering System to maintain pH. | **1** |
| **15** | **Assertion-** Protein efficiency ratio can be used to measure the growth in terms of weight gain after consuming 1 gram of protein<br>**Reason-** Biological value and PER of wheat is the highest when compared to other proteins. | **1** |
| **16** | **Assertion:** Locus Link is a type of database retrieval tool developed by NCBI, USA<br>**Reason:** Locus Link carries information on the official gene names and other descriptive information about genes. | **1** |

| | Section B | |
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| **17.** | A. Observe the image carefully.<br><br><br>a) Identify the technique shown above.<br>b) State any three applications of the technique. | ½<br>**X4** |
| **18.** | Observe the figure given below and answer the following questions<br><br><br>a) Identify the technique shown in the figure.<br>b) Why do the proteins stop moving in the electric field as shown in the second figure? | **1+1** |
| **19.** | Discuss about the edible vaccines and their usefulness. | **1+1** |
| **20.** | pBR322 is used to clone a fragment of DNA. How will you prepare a recombinant plasmid? Illustrate will the help of a diagram. | **2** |

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| **21.** | Cancer cell and normal cell were compared with microarray technology. Cancer cell cDNA was labelled red and normal cell cDNA was labelled green. On scanning the microarray chip, the following was observed-<br><table><tr><td>Gene A</td><td>Gene B</td><td>Gene C</td><td>Gene D</td><td>Gene E</td><td>Gene F</td><td>Gene G</td></tr><tr><td>Green</td><td>Red</td><td>Yellow</td><td>No colour</td><td>Red</td><td>Yellow</td><td>No colour</td></tr></table>a) Which genes are expressed only in cancer cell?<br>b) Which genes are expressed only in normal cell?<br>c) Which genes are expressed in both cells?<br>d) Which genes are not expressed in either of the cells? | **½ X4** |
| | **Section C** | |
| **22.** | Why subtilisin is used in detergents? Why do we need to improve this enzyme? How is subtilisin improved to be used in detergents? | **1+1+1** |
| **23.** | i) You are trying to preserve bacterial cells at very low temperature using liquid nitrogen. You are advised to add glycerol or dimethyl sulphoxide. What will happen if glycerol or DMSO is not added in this technique?<br>ii) Why is aeration important for microbial growth? How can proper aeration can be achieved in microbial culture growth under laboratory conditions? | **1+1+1** |
| **24.** | Bioinformatics databases provide resources for gene level sequences such as RefSeq, Homologene, Paralogs and UniGene and BLAST. Which of these would you use as most suitable starting point for:<br>a) Avoiding redundancy in EST data.<br>b) For inferring relations among organisms.<br>c) Information retrieved from this resource will be used in designing gene chips. | **1+1+1** |
| **25** | A. Proteolytic enzymes constitute a large part of the industrial enzymes. Name any three proteolytic enzymes and their industrial uses.<br>OR<br>B. Mention any three non-catalytic functions of whey used in food industry and the food products produced | **1+1+1**<br>**1+1+1** |
| **26** | Mention the use of the following products of animal cell culture-<br>a) r-HuEPO<br>b) Factor VIII<br>c) Factor IX<br>d) tPA<br>e) OKT3<br>f) Herceptin | **½ X 6** |
| **27** | An autoradiogram of DNA sequencing is given below. Observe it and answer the following questions-<br>a) How many products of ddATP are observed?<br>b) Which tube has the shortest product and which tube has the longest product?<br>c) Write the sequence that can be arrived at reading the autoradiogram in 5'to 3' direction. | **1+1+1** |




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| **28** | Write about different types of proteomics and the scientific knowledge that can be gained from them. | **3** |
| | **Section D** | |
| **29** | Clear understanding of microbial growth is necessary for proper utilization of biological processes for production of metabolites. In this section, the methods used for the measurement and quantitative evaluation of microbial growth will be discussed. There are four general patterns of microbial growth exemplified by bacteria, yeast, mold and viruses. All these microorganisms grow in different ways: bacteria grow by binary fission, yeast divide by budding, fungi divide by chain elongation and branching whereas viruses normally do not follow a regular growth pattern as they grow intracellularly in host cells. | |




(i) During batch fermentation, in which phase the microbes in the fermenter are adapting to the new environment? **1**

(a) Lag phase
(b) Log or exponential phase
(c) Stationary phase
(d) Death phase

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| | (ii) Which of the following is the best definition of generation time in a bacterium?<br>(a) the length of time it takes to reach the log phase<br>(b) the length of time it takes for a population of cells to double<br>(c) the time it takes to reach stationary phase<br>(d) the length of time of the exponential phase | **1** |
| | (iii) Which of the following is used to grow bacterial cultures continuously?<br>(a) Chemostat<br>(b) Coulter Counter<br>(c) Hemostat<br>(d) Petroff-Hausser chamber | **1** |
| | (iv) During the decline phase?<br>(a) Microorganisms try to settle in the new environment<br>(b) Shows exponential growth<br>(c) Death rate is equal to the rate of generation of new cell<br>(d) Number of live cells decreases | **1** |
| **30** | 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. It is also useful in identifying the type and location of amino acid modification within proteins. A mass spectrometer is an analytical device that determines the molecular weight of chemical compounds by separating molecular ions according to their mass/charge ratio (m/z) ratios. The process of ionisation, ion separation and detection in a mass spectrum can provide molecular weight or even structural information. A sample M with a molecular weight greater than 1200 D can give rise to multiple charged ions such as (M+nH)n+.<br><br>(i) The conversion of protein molecules into charged ions in mass spectrometry is called:<br>a) Detection<br>b) Fragmentation<br>c) Ionisation<br>d) Resolution<br><br>(ii) Which feature of mass spectrometry makes it suitable for detecting such small differences in protein mass**?**<br>a) High resolving power<br>b) Ability to use any solvent<br>c) Requirement of large sample quantity<br>d) Low sensitivity<br><br>(iii) Mass spectrometry separates ions based on:<br>a) Solubility<br>b) Polarity<br>c) Mass-to-charge ratio (m/z)<br>d) Absorbance<br><br>(iv) The purpose of the **vacuum system** in a mass spectrometer is to: | |

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| | a) Cool the sample<br>b) Prevent ions from colliding with air molecules<br>c) Increase ion charge<br>d) Accelerate ions | |
| | **Section E** | |
| **31** | A.<br>(i) What are restriction enzymes?<br>(ii) Briefly explain the 'Host Restriction Modification' defence mechanism in a bacteria.<br>(iii) Why only type II restriction enzymes are used in rDNA technology?<br>(iv) Explain why *E. coli* is widely used as a host?<br>(OR)<br>B. (i) How is BAC different from YAC? ( any 2 points)<br>(ii) You want to design a plasmid in your laboratory. Which features will you add to the plasmid to make it as ideal vector?<br>(iii) Give one feature/ characteristic of Shuttle vector? | **1**<br>**2**<br>**1**<br>**1**<br>**2**<br>**2**<br>**1** |
| **32** | A. (i) Explain the differences between batch, fed-batch, and continuous culture systems, also draw graphs to support your answer.<br>(ii) Describe the procedure of isolation and cultivation of pure microbial cultures.<br>(OR)<br>B. (i) Explain the two techniques used to improve the desirable characteristics of the strain.<br>(ii) List out the reason why when a eukaryotic gene is expressed in prokaryotic host, there are additional problems to be tackled. ( any 2 reasons).<br>(iii) Give the role of Expression vector in Genetic engineering. | **3**<br>**2**<br>**2**<br>**2**<br>**1** |
| **33** | A. (i) Although not required for cell growth, antibiotics are added to the growth medium, why? Name two such antibiotics.<br>(ii) Why all the tissue/cell culture manipulations must be performed under LAF?<br>(iii) Draw a schematic representation to show the method of production of tPA through mammalian cell culture.<br>(OR)<br>B. (i) Enlist any two advantages culturing animal cells.<br>(ii) Explain two important features of animal cell growth on culture.<br>(iii) Differentiate between Primary and secondary cell culture | **2**<br>**1**<br>**2**<br>**1**<br>**2**<br>**2** |