CBSE Question Paper 2018

Class 12 Biotechnology

Time allowed : 3 hours

Maximum Marks : 70

General Instructions:

1. All questions are compulsory.
2. There is no overall choice. However, an internal choice has been provided in one question of 3 marks and one question of 5 marks. You have to attempt only one of the choices in such questions.
3. Questions No. 1 to 6 are very short answer questions, carrying 1 mark each.
4. Questions No. 7 to 14 are short answer questions, carrying 2 marks each.
5. Questions No. 15 to 25 are also short answer questions, carrying 3 marks each.
6. Questions No. 26 to 28 are long answer questions, carrying 5 marks each.
7. Use of calculators is not permitted. However, you may use log tables, if necessary

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1. **Cancer cells lose 'contact inhibition', an important feature of normal cells. What is 'Contact Inhibition'?**
   Ans. Cell growth inhibited when in contact with other cells/wall of the container.
2. **Van der Waals forces are weak attractions, but are important in proteins. Why?**
   Ans. Van der Waals forces are important in macromolecules such as proteins because the large surface areas involved can result in reasonably large total forces/Several Van der Waals forces together give rise to stronger force.
3. **Write the principle used in measuring bacterial cell growth by spectrophotometer.**
   Ans. Bacterial cells scatter light in proportion to their concentration giving rise to high turbidity/absorbance/optical density.
4. **To construct a c-DNA library, reverse transcriptase enzyme is needed. Why?**
   Ans. Reverse transcriptase is required to convert unstable m RNA to stable c DNA.
5. **For short-term storage of germplasm using explant culture, abscisic acid is added to the medium. What is the purpose of doing so?**
   Ans. Growth retardant

6. **Name a technique that can help researchers to observe interactions among thousands of genes simultaneously.**
   Ans. Microarray using DNA chip.
7. **A biotechnologist wants to develop a variety of rice, which can survive in high salinity. How can he do so?**
   Ans.
   - Create transgenic plants by introducing genes which over express stress related osmolytes/osmoprotectants
   - Examples such as sugars (trehalose), sugar alcohol(mannitol), amino acids (proline), betaines (glycine betaine),etc.
8. **Both PCR and M-13 bacteriophage can amplify DNA with respect to the DNA fragment obtained. What is the basic difference between the two?**
   Ans. PCR produces double stranded DNA and M-13 produces single stranded DNA.
9. **Differentiate between finite and continuous cell lines.**
   Ans. Finite cell line - Limited life span, slow growth rate, show contact inhibition, monolayer form etc.. (Any two)
   Continuous cell line - No contact inhibition, no anchorage dependence, monolayer or suspension form, rapid growth rate etc.
10. **Analysis of m-RNA in a given cell doesn't provide a direct reflection of its protein content. Give two reasons to support the statement.**
    Ans. Several proteins can be obtained from a single m-RNA; processes such as polyadenylation; alternative splicing ; m-RNA editing can cause this/post translational modifications.(Any two)
11. **Downstream processing becomes difficult and costly, if eukaryotic proteins are produced in prokaryotes. Give two reasons.**
    Ans. Several additional steps are required which may use enzymes and hence add on to the cost. Difficulty arises due to various post-transcriptional and posttranslational modifications. (Any two)
12. **How is the blue-white selection method used to screen transformed host cells?**
    Ans. Insertional inactivation of Lac Z gene present in vector. Transformed host cells appear white and non- transformed host cells appear blue on X-Gal substrate
13. **Differentiate between primary and secondary metabolites in plants.**
    Ans. Primary metabolites are required for basic metabolic processes e.g. amino acids,

nucleic acids.

Secondary metabolites are additional products which may be required e.g. in defense mechanisms. Any example from page 119 -120

14. **Suggest two challenges faced in the area of animal cell culture.**

    Ans. Animal cell culture requires periodic replenishment of media / only limited generations are possible /scale up is challenging.

15. a. **What are Epitopes?**
    b. **Differentiate between monoclonal and polyclonal antibodies.**

    Ans.

    a. Specific domains of macromolecules(antigens) / specific sequences of amino acids that invoke immune response.
    b.

Monoclonal antibodies	**Polyclonal antibodies**
Binds to a specific epitope on an antigen	Binds to multiple epitopes on an antigen
It is produced by single clone of B-cells	It is produced by multiple clones of B-cells (Any one)

16. **What is Molecular Pharming? Give four advantages of producing recombinant proteins in milk.**

    Ans. Transgenic animals are created by direct microinjection of DNA into Ova/ stem cells to produce proteins.

    Advantages:

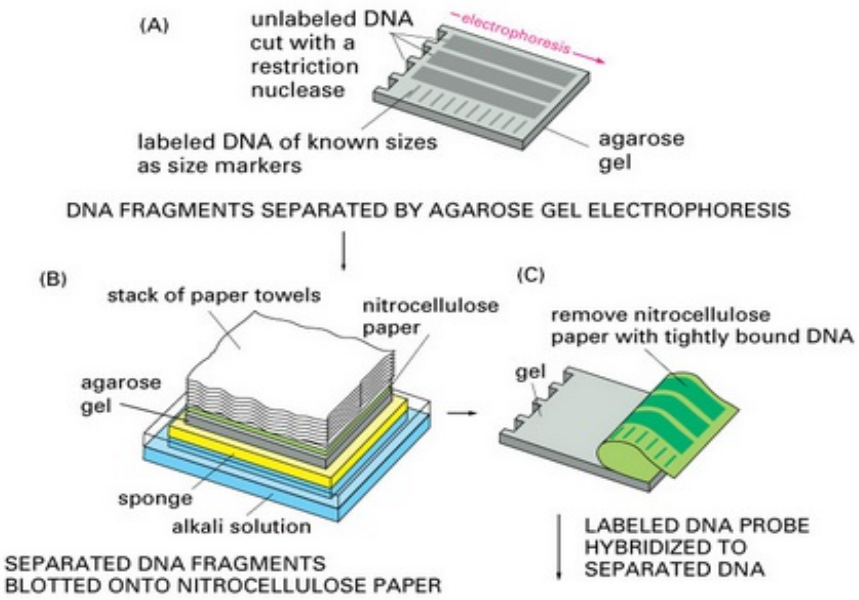
    a. High production capacity.
    b. Ease of source material collection
    c. Moderate capital instrument requirements
    d. Low operational cost
    e. Ease of production including purification and scale-up.

17. **Explain how fluorescent DNA probes can be created using 'Nick Translation'.**

    Ans. Nick translation (or head translation), developed in 1977 by Rigby and Paul Berg, is a tagging technique in molecular biology in which DNA Polymerase I is used to replace

some of the nucleotides of a DNA sequence with their labeled analogues, creating a tagged DNA sequence which can be used as a probe in fluorescent in situ hybridization (FISH) or blotting techniques. It can also be used for radiolabeling.

18. **What are the main areas of consideration for safety aspects specific to Microbial Culture ? (Any three)**
    Ans. Any three on page no 106
19. **Using an example, describe a technique commonly used to compare similar proteins from different sources.**
    Ans. Peptide mass fingerprinting (PMF) (also known as protein fingerprinting) is an analytical technique for protein identification in which the unknown protein of interest is first cleaved into smaller peptides, whose absolute masses can be accurately measured with a mass spectrometer such as MALDI-TOF or ESI-TOF.
    Mass spectrometry (MS) is an analytical technique that ionizes chemical species and sorts the ions based on their mass-to-charge ratio. In simpler terms, a mass spectrum measures the masses within a sample. Mass spectrometry is used in many different fields and is applied to pure samples as well as complex mixtures.
    Example Normal Hb and Sc Hb
20. **In a large scale experiment, it was found that CHO cell lines expressed a protein as 100 mg/500 ml of culture medium. A Biotech company has to produce 1000 gm of this protein. They have two 100 L fermenters each, which can operate only once in a week. How much time is required to produce the desired amount of protein?**
    Ans. 106 mg to be produced
    100 mg is produced in 0.5 l
    106 mg will be produced in 5000l
    Hence total volume of culture medium required is 5000 l
    Total capacity of 2 fermentors / week = 2 x100 l
    Number of weeks = 5000l/2x100
    Time required = 25 weeks
21. **Depict the technique of Southern Hybridisation with a labelled diagram. Suggest one application of the same.**
    Ans.



Detection of specific DNA sequences by fluorescence amplification: a color complementation assay…. It is based on the simultaneous amplification of two or more DNA segments with fluorescent oligonucleotide primers such that the generation of a color, or combination of colors, can be visualized and used for diagnosis DNA fingerprinting is the process of determining an individual's DNA characteristics, which are as unique as fingerprints. DNA analysis intended to identify a species, rather than an individual, is called DNA barcoding.

22. a. **Why do we need different kinds of cloning vectors?**
    b. **What will you observe if you use a YAC vector prepared without Autonomously Replicating Sequence (ARS) as a vector?**
    c. **In order to produce a foreign protein in the host, what is the suitable vector ? State one special feature of these type of vectors.**

Ans.

a. Different insert size / Different types of host cells.
b. YAC will not replicate 1
c. Expression vectors ; Special features like signals for transcription and translation are incorporated along with foreign genes.

23. **Name 2 databases commonly used in bioinformatics. What all information do they respectively store? Name any one database retrieval tool and give its application.**
Ans. Any two database along with information available from page no 80.
Any one database retrieval tool and its application from page no 78/79

24. **Differentiate between 'Fed-batch culture' and 'Continuous culture'.**

OR

Why is aeration important for microbial growth ? How can proper aeration be achieved in microbial culture grown under lab conditions?
Ans.

Fed –Batch culture	Continuous culture
Subsequently fed with fresh medium	Nutrients are added before it gets exhausted
Volume of culture increases	Volume remains constant
Graph as on Fig 6. page no 92/ Any point included in the graph.	Graph as on Fig 7. page no 92/ Any point included in the graph.

OR

a. Proper mixing of nutrients and providing O_2 for better microbial growth.
b. Use of Baffle flask and shakers to increase turbulence.

25. **Why do cereals and legumes have a limited nutritional quality? Write two genetic engineering approaches that have been used to improve the seed protein quality.**
Ans. Deficiency of essential amino acids/ vitamins
Two approaches:
a. Transgene for amino acids/ vitamins introduced in plants under control of seed specific promoter
b. Endogenous genes are modified to increase essential amino acids/ vitamins

26. a. **What is a "gene knockout" ?**
b. **Draw a diagram or flow chart to show basic principle of tissue engineering.**
c. **Enlist two applications of tissue engineering.**

OR

a. **Plants are cheap chemical factories. Why?**
b. **How are virus-free plants obtained from virus-infected plants?**
c. **What can be done to raise**

i. **hybrids of interspecific cross plants, and**
ii. **male sterile plants?**

Ans.

a. Gene Knock out is to selectively remove a gene in order to study its function in an organism
b. Fig. 13, Page no 155
c. Any two on page no 155

OR

a. Need only soil, water, minerals, CO2 and sunlight to produce thousands of sophisticated chemical molecules.
b. Meristem culture technique(Apical meristem), as these are generally free of viruses
c. i. Embryo rescue – Excise embryo at proper stage , grow on suitable nutrient medium/Somatic hybridization
   ii. Use of Barnase gene(with specific TA -29 promoter).

27. **Expand NCBI. Give two advantages for complete sequencing of a genome. What kind of analysis can be made using bioinformatics tools? (Any two)**
Ans. NCBI –National Centre for Biotechnology Information.
Any two advantages on page 60.
Any two analysis on page 80

28. a. **What is the isoelectric point of a protein?**
    b. **Write the principle of 2-D gel electrophoresis.**
    c. **Describe the aqueous two-phase partition process used for purification of proteins.**

Ans.

a. pH at which net charge on amino acids is zero.
b. Proteins are separated on the basis of Iso-electric point in one dimension and on the basis of mass /size in other dimension.
c. Crude homogenate is added to biphasic mixture of Dextran and PEG. Cellular debris partitions to dextran and soluble constituents partitions to PEG.