KENDRIYA VIDYALAYA SANGATHAN – REGIONAL OFFICE LUCKNOW

PREBOARD EXAMINATION

BIOTECHNOLOGY (045)

Class XII (2025-26)

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 labelled 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. Which of the following vectors has both bacterial and yeast origins of replication?

(A) pBR322 (B) M13

(C) YEp (D) Ti plasmid

2. Which of the following techniques uses fluorescent probes to locate genes on chromosomes?

(A) FISH (B) SDS-PAGE

(C) ELISA (D) PCR

3. Which component provides carbon source in Murashige and Skoog (MS) medium?

(A) Sucrose (B) Glycine

(C) EDTA (D) Inositol

4. The full form of NCBI is:

(A) National Center for Biological Information

(B) National Center for Biotechnology Information

(C) Natural Centre for Bioinformatics India

(D) National Council of Bio Informatics

5. What is the primary risk associated with subculturing cells too frequently or at too low a density?

A) Increased risk of contamination

B) Cell differentiation

C) Loss of cell line

D) Accelerated cell senescence

6. The method used for measuring the cell growth

(i) measurement of wet weight of the cell

(ii) Turbidity measurement

(iii) ATP measurement and viable plate count

(iv) Coulter counter

a) Only i) & ii) b) Only iii) & iv) c) Only i) ii) and iii) d) i) ii) iii) & iv)

7. Artificial seeds are produced by encapsulating the somatic embryos at the stage in a protective coating.

(A) Torpedo

(B) Globular

(C) Cotyledon

(D) Triangular

8. Match the following and choose the correct option:

PROTEIN	THERAPEUTIC USE
i) Factor VIII	A. Cancer therapy
ii) FSH	B. Stroke
iii) tPA	C. Infertility
iv) IL2	D. Haemophilia A

A. i -> B, ii -> A, iii -> D, iv -> C

B. i -> D, ii -> C, iii -> B, iv -> A

C. i -> C, ii -> D, iii -> A, iv -> B

D. i -> A, ii -> B, iii -> C, iv -> D

9. 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?

a) AP is used to remove 3'-OH group to stop self-ligation of vector

b) AP is used to remove 5'-OH group to stop self-ligation of vector

c) AP is used to remove 5'-phosphate group to stop self-ligation of vector

d) AP is used to remove 3'-phosphate group to stop self-ligation of vector

10. Biological Value refers to

a) The amount of protein nitrogen that is retained by the body from a given amount of protein nitrogen that has been consumed.

b) Growth expressed in terms of weight gain of an adult by consuming 1 gm of food protein.

c) The total amount of protein nitrogen that has been consumed.

d) Growth expressed in terms of weight gain of an adult by consuming 1 Kg of food protein.

11. If a culture starts with 50 cells how many cells will be present after five generation with no cell death.

A. 200

B. 400

C. 1600

D. 3200

12. If you are treating a bacterial host cell with calcium chloride for facilitating introduction of rDNA which of these Methode you are using?

a) Transformation
b) Electroporation
c) Microinjection
d) biolistic

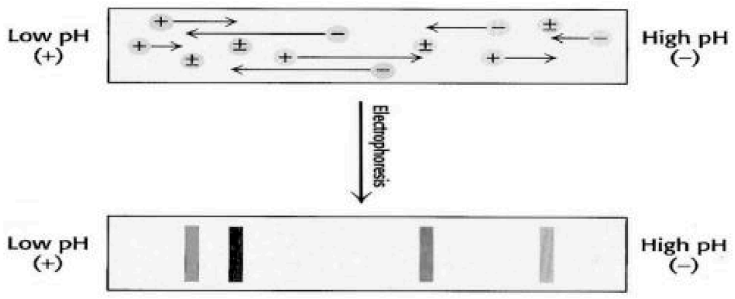
Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

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. **Assertion:** Yeast cells having YEp plasmid can grow on a medium lacking leucine and hence can be selected.
Reason: - LEU2 gene codes for an enzyme required for the synthesis of amino acid leucine.
14. **Assertion-** Gene prediction of bacterial genes can be done by GENSCAN**.**
Reason- Gene prediction of eukaryotic genes can be done by Gene Mark
15. **Assertion (A) -** Foaming is a problem in most microbiological cultures.
Reason (R) - It is caused due to the presence of fatty acids and silicones in the culture medium.
16. **Assertion:** It is very difficult to produce hybrids in inter-generic crosses
Reason: The abnormal development of endosperm leads to death of hybrid embryo.

Section - B

17. Observe the figure given below and answer the following questions



i)Identify the technique shown in the figure.
ii)Why do the proteins stop moving in the electric field as shown in the second figure?

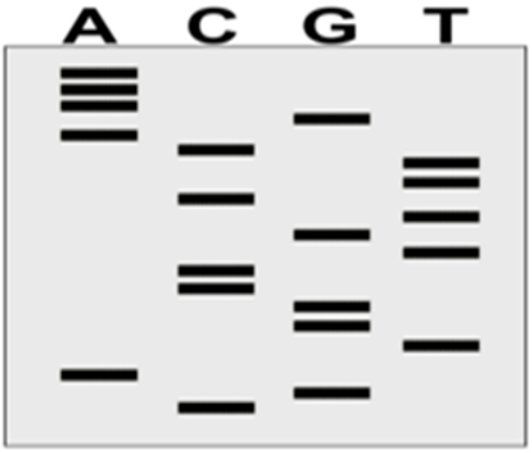
18.a) Explain one reason why high genome coverage is essential in shotgun sequencing.
b) How is FISH used to determine the efficacy of a drug in case of CML?
19. Mr. Arvindo sequenced genome of unknown organism. He wants to know the ancestry of unknown organism and the homologous sequence. Give the name of database used by them and write its principle.

20. A student tried to isolate insulin from recombinant *E. coli* cell. He collects the filtrate & performed chromatography. However, protein was not obtained. What may be possible reason.

21. i) Give the sequence of two primer (5 nucleotide long) required to amplify the following DNA sequence by PCR
5’ ATGCCTAGGATCATGC3’
ii) Diagrammatically show RFLP technique.
OR
Why embryonic stem cell present in undifferentiated state. Diagrammatically show production of chimeric mice.

Section - C

22**.** An autoradiogram of DNA sequencing is given below. Observe it and answer the following questions-
a) How many products of ddATP are observed?
b) Which tube has the shortest product and which tube has the longest product?
c) Write the sequence that can be arrived at reading the autoradiogram in 5’to 3’ direction



23. a) What is EPO? What is it used for?
b) Why is it advantageous over transfusion?

OR

Give one use of each of the following components used in animal tissue culture:
a) Na2CO3 in animal cell culture
b) Serum
c) Phenol red
d) Glucose

24. What are the functions of microbial culture collection? Write the name and location of any one Culture Collection Centre of India?

25. Transgenic crops are facing challenges globally. What are the major concerns about these GM crops?

26. Mention any three non-catalytic functions of whey used in food industry and the food products produced?

27. i) Write the benefits of Biodegradable plastic that are produced from GM crops
ii) How do the transgenic plant used as factories to produce Biodegradable plastics.

28. A biotech company is growing bacteria in a chemostat for continuous production of insulin. Fresh nutrient medium is added continuously, and an equal volume of culture is removed to keep the volume constant. After some time, the growth rate and cell density become constant.
i) Name the type of culture system used.
ii) What is meant by steady state?
iii) Mention **one industrial advantage** of this system.

Section - D

Read the following passage and answer the given questions

29. Stem cells are characterized by their ability to renew themselves through mitotic cell division and differentiate into a diverse range of specialized cell types. Stem cells are found in all multi cellular organisms. Stem cells are like good shares in the stock market which can either be multiplied (self-renewal) by getting bonus shares or sold to buy goods (differentiate). Tissues like skin, blood and intestinal epithelium are subject to continuous renewal throughout life and must maintain an adequate number of cells (stem cells) that retain the potential to proliferate to make good such losses. The most well studied process has been the formation of blood cells (haematopoiesis). It was known in case of mouse that haematopoiesis occurs in the spleen and bone marrow. In human being about 100,000 haematopoietic stem cells produce one billion RBC, one billion platelets, one million T cells, one million B cells per Kg body weight per day. The field of stem cell research was established in 1960s by Ernest McCulloch and James Till at the University of Toronto.

1. What is depicted in the above given image?
2. Name two diseases which can be treated with stem cell therapy.
3.Write two sources of stem cells in an adult human being
4.Differentiate between pluripotent stem cell and a multi potent stem cell with one example.

30. Subtilisin (27 kD) is a protease produced by bacteria that can digest a broad range of proteins that commonly soil clothing. The enzymatic activity of subtilisin is contributed by a catalytic triad, i.e., Ser221, His64 and Asp32 similar to Improving laundry detergent Subtilisin. Replacement of all three residues with alanine either singly or in combination results in significant loss of activity. Subtilisin represents the largest industrial market for any enzyme. To improve the efficiency of laundry detergents, detergent manufacturers supplement subtilisin in their products with various catchy slogans on the detergent box such as "stain cutter" or "biologically active enzymes".

i) . Subtilisin is best described as which type of enzyme?
A. Cysteine proteases
B. Aspartic proteases
C. Serine proteases
D. Metalloproteases

ii). What happens when the catalytic triad residues of subtilisin are replaced with alanine?
A. Activity increases
B. No effect on activity
C. Activity becomes pH-independent
D. Activity is significantly lost?

iii). Subtilisin is stable in detergents because it is:
A. Highly glycosylated
B. Naturally resistant to high pH
C. Insoluble in water
D. A metal-dependent enzyme

iv). Subtilisin is often engineered through protein engineering to:
A. Reduce its activity
B. Improve stability in detergents
C. Lower its molecular weight
D. Change it to an amylase

Section - E

31. Attempt either option A or B.

A. Explain how proteins are volatilized as well as analysed by a mass spectrometer. Draw a well labelled Diagram of mass spectrometer. Why ESI is better than MALDI.

OR

B. i) Write two genetic engineering approaches which have been used to improve the seed protein quality.

ii) Write detailed notes on any four important plant-derived secondary metabolites (e.g., quinine, vinblastine, Taxol, Diosgenin, Shikonin, Azadirachtin, Digoxin reserpine). Mention their source plant, chemical nature, and uses.

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32. Attempt either option A or B.

A

What are SNPs? Explain with an example of SNP related diseases. How many SNP sites are present in the human genome? How do SNP mapping of patients help physicians in determining the effectiveness of a prescribed drug?

OR

B. i) You are asked to design a Bioreactor, what are the main features that you have to keep in mind while designing it.

ii) The specific growth rate of a few bacteria is given below. From the data given find out which microorganism has the least doubling time.

Microorganism	Specific growth rate
Benechea natriegens	*4.24*
M . methyolytica	*0.53*
A.nidulans	*0.36*
P.chryosogenum	*0.12*

iii) Give the significance of specific growth rate constant.

33. Attempt either option A or B.

A. i) You want to design a plasmid in your laboratory. Which features will you add to the plasmid to make it as ideal vector?

ii) Briefly explain the 'Host Restriction Modification' defence mechanism in a bacterium.

iii) Why only type II restriction enzymes are used in rDNA technology?

OR

B.

i) Why all the tissue/cell culture manipulations must be performed under LAF?

ii) Draw a schematic representation to show the method of production of tPA through mammalian cell culture.

iii) How does an Oncologist determine whether tumours are cancerous or not under *In Vivo* and *In vitro* condition.