



ASSIGNMENT NO. 4

SUBJECT: BIOLOGY

CLASS-XII

OCT,2025

Chapter :9 Biotechnology:Principles and processes

MULTIPLE CHOICE QUESTIONS

1. Given below are two columns. In Column I is the list of four enzymes and in Column II is the list of functions of the given enzymes.

Which one of the following options shows the enzymes matched with their respective functions correctly?

Column I (Enzyme)	Column II (Function)
P. DNA Ligase	i. Removes nucleotides from ends of DNA
Q. Restriction exonuclease	ii. Extends primer on a DNA template
R. Taq polymerase	iii. Joins the DNA fragments
S. Restriction endonuclease	iv. Cuts DNA at a specific position

- (a) P-i, Q-ii, R-iv, S-iii
- (b) P-iv, Q-iii, R-ii, S-i
- (c) P-i, Q-iv, R-iii, S-ii
- (d) P-iii, Q-i, R-ii, S-iv

2. The organism used in construction of the first artificial recombinant DNA by Cohen and Boyer in 1972 was :

- (a) E. coli
- (b) Salmonella typhimurium
- (c) Agrobacterium tumefaciens
- (d) Bacillus thuringiensis

3. Given below are the steps carried out to construct a recombinant DNA. Which one of the following gives the correct sequence of these steps ?

- (i) Isolation of genetic material
- (ii) Insertion of recombinant DNA in the host cell / organism
- (iii) Obtaining the foreign gene product
- (iv) Amplification of gene of interest
- (v) Downstream processing

- (a) (i) (iii) (iv) (ii) (v)
- (b) (i) (iv) (ii) (iii) (v)
- (c) (ii) (i) (iii) (iv) (v)
- (d) (ii) (iv) (v) (iii) (i)

4. After the completion of biosynthetic stage in a bioreactor, the product undergoes a series of processes before it is ready for marketing. List of the processes is given below. Identify the option that gives the correct sequence of the processes carried out :

- (i) Purification of product
- (ii) Formulation with suitable preservative
- (iii) Separation of product
- (iv) Clinical trial of product

- (a) (ii) (iii) (i) (iv)
- (b) (iii) (ii) (i) (iv)
- (c) (iii) (i) (ii) (iv)
- (d) (i) (iii) (iv) (ii)

5. Restriction enzymes cut the strand of DNA –

I - a little away from the centre of palindrome sites

II- closer to the centre of palindrome sites

III- between the same two bases on the opposite strands

IV - between the different bases on the same strands V- leave single stranded portions at the ends

VI- do not leave the single stranded portions at the ends.

- a) I, III and VI
- b) I, III and V
- c) I, IV and VI
- d) II, IV and V

6. Which restriction site is not present in pBR322 plasmid?

- a) EcoRI
- b) Hind III
- c) Hind II d) Sal I

Assertion-Reason Questions

7. **Assertion (A):** In order to cut the DNA with a restriction enzyme, it needs to be released from the membrane which encloses it.

Reason (R): A plant cell was treated with chitinase to achieve this.

8. **Assertion (A):** PCR is a powerful technique to identify genetic disorders.

Reason (R): PCR can detect mutations in low amounts of DNA.

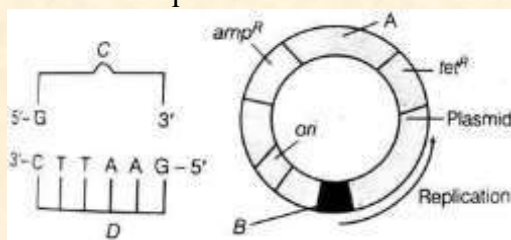
9. **Assertion (A):** Plasmids and bacteriophages are used as cloning vectors in rDNA technology.

Reason (R): They have low copy number of their genome within the bacterial cell.

10. **Assertion (A):** The matrix used in gel electrophoresis should have controllable pore size.
Reason(R): Agarose concentration can be changed to change pore sizes.

2-mark questions:

1. Explain the process by which a bacterial cell can be made „competent“ to take up foreign DNA from its surroundings, using divalent cations and temperature treatment.
2. Vectors are DNA molecules that can carry a foreign DNA segment into the host cell.
(i) Write the significance of ori in this vector
(ii) Give one example each of vectors used for cloning genes in plants and animals.
3. What do you mean by “selectable markers”? Why are they necessary for genetic engineering?
4. Insertional inactivation“ is a method to detect recombinant DNA technology. Explain.
5. *Agrobacterium tumefaciens* is referred to as a natural plant genetic engineer by biotechnologists. Give arguments in favour of the claim.
6. How are DNA fragments visualized during gel electrophoresis? What is elution?
7. Study the figure and answer the questions that follow.



- (i) Identify the part B in the given illustration and give its function.
 - (ii) What is the term given to C and D sequence on a DNA and explain why?
8. Restriction enzyme Y was used to extract gene of interest from a plant. This gene needs to be inserted in the given DNA segment which has been treated with restriction enzyme X. Will there be a successful recombination? Explain with a reason.
 9. a. Why are restriction enzymes called molecular scissors?
b. Write one point of difference between exonuclease and endonuclease.
 10. How can retroviruses be used efficiently in biotechnology experiments inspite of them being disease causing?

3 Mark questions:

1. With the help of a schematic diagram only, show in three steps, the formation of recombinant DNA by the action of restriction endonuclease EcoRI and DNA ligase.
2. (a) Simple stirred-tank bioreactors are used to produce large quantities of recombinant proteins, stirring the contents and mixing it with oxygen. Write any four other advantages of using stirred tank.

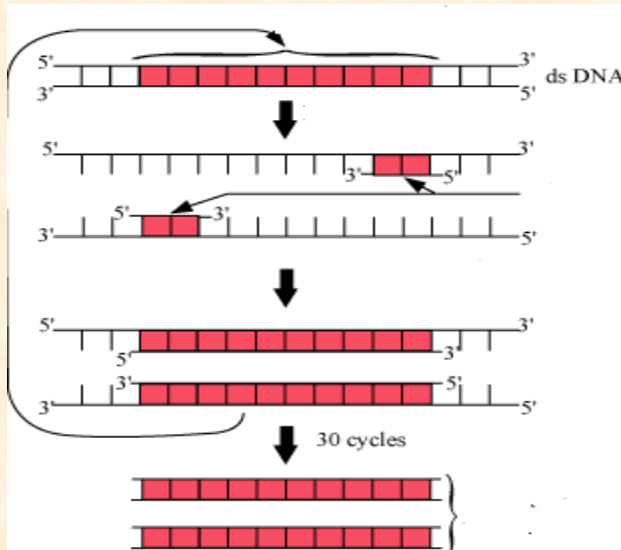
(b) After downstream processing, the product of the biosynthetic stage cannot be marketed directly. Why? Give two reasons.

3. A researcher wants to amplify a desired fragment of DNA to be ligated with a vector for further cloning. Name the technique she would use. Explain the steps of the technique diagrammatically only.
4. Mention three vector-free techniques that can be utilised to transfer recombinant DNA into a ready host cell.
5. Expand “BAC” and “YAC”. What are they, and why do they serve the purposes that they do?

5 mark questions:

1. Draw a simple stirred-tank bioreactor.
Highlight any one difference between a bacterial culture flask in a laboratory and a bioreactor that allows cells to grow in a continuous culture system.
Explain the significance of downstream processing in obtaining the final gene product.

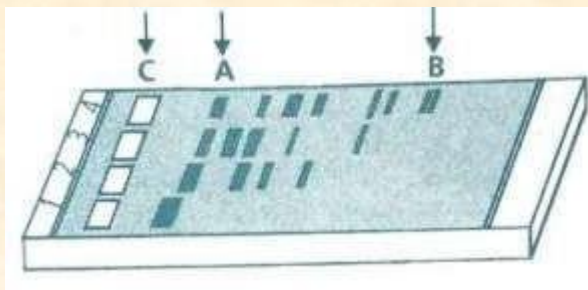
2.



- a) Identify the process given in the diagram given above. What is the significance of this process in Biotechnology.
- b) Name the enzyme used in this process. What is its special feature?
- c) Explain the steps involved in the process.

CASE STUDY BASED QUESTION

3. When cut by the same restriction enzyme, the resultant DNA fragments have the same kind of „sticky-ends“ and these can be joined together (end-to-end) using DNA ligases. The cutting of DNA by restriction endonucleases results in the fragments of DNA. These fragments can be separated by a technique depicted in the picture.



1. Name the material used as matrix in gel electrophoresis and mention its role. 1
2. Why do DNA fragments move towards the anode during gel electrophoresis? 1
3. How are the DNA fragments separated by gel electrophoresis visualised and separated for use in constructing recombinant DNA?

OR

Write any two ways the products obtained through this technique can be utilized.

II. Bioreactors are considered as vessels in which raw materials are biologically converted into specific products by microbes, plants and animal cells or their enzymes. They are used for large scale production as they provide optimum growth conditions such as temperature, pH, substrate, vitamins, oxygen and salts for obtaining desired product. Most commonly used bioreactors are of stirring type which include simple stirred tank bioreactor and sparged stirred tank bioreactor.

1. How does a simply stirred tank bioreactor to differ from sparged stirred – tank“ bioreactor?

OR

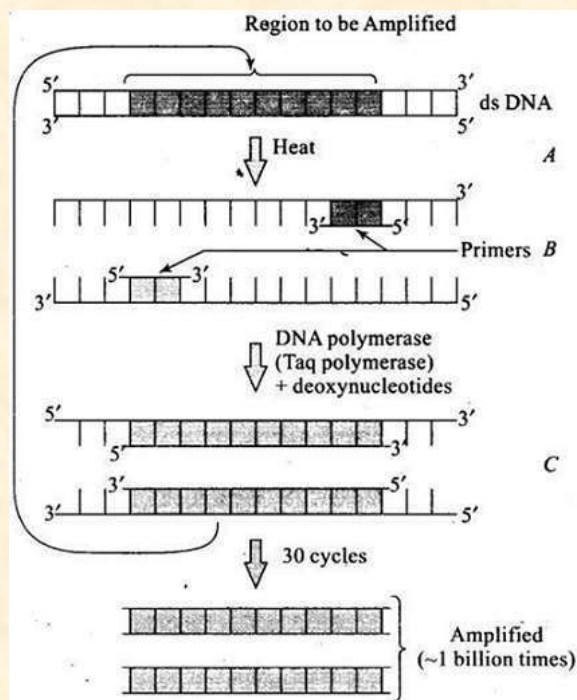
List four growth conditions that a bioreactor provides for obtaining the desired product.

2. State the function of sampling ports.
3. The stirred-tank reactor is usually cylindrical or a curved base. Why?

III-. pBR322 is a plasmid and was one of the first widely used E. coli cloning vectors. Created in 1977 in the laboratory of Herbert Boyer at the University of California, San Francisco, it was named after Francisco Bolivar Zapata, the postdoctoral researcher and Raymond L. Rodriguez. The p stands for "plasmid," and BR for "Bolivar" and "Rodriguez."

1. State the significance of 'ampR' and 'tetR'.
2. Write the role of 'Ori' and 'restriction' site in a cloning vector pBR322. OR
Name four recognition sites in pBR322.
4. What happens when an alien gene is ligated at Sal I site of pBR322 plasmid? 1

IV- Polymerase chain reaction (abbreviated PCR) is a laboratory technique for rapidly producing (amplifying) millions to billions of copies of a specific segment of DNA, which can then be studied in greater detail. PCR involves using short synthetic DNA fragments called primers to select a segment of the genome to be amplified, and then multiple rounds of DNA synthesis to amplify that segment.



1. Identify „A“ and „C“

1

2. Name the source of the DNA polymerase used in PCR technique. Mention why it is used?

2

2. How many copies of DNA samples are produced in the PCR technique after 6-cycles?

CHAPTER 10 : BIOTECHNOLOGY AND ITS APPLICATIONS

MULTIPLE CHOICE QUESTIONS

1. The illegal and unlawful development of biomaterials without payment to the inhabitants of their origin is called

- a. Biopatent b. biopiracy c. biowar d. biotechnology

2. In ELISA, infection by the pathogen can be detected by the presence of

- a. antigen b. antibody c. Both antigen and antibody d. DNA and RNA

3. Arrange in correct sequence the steps in synthesis of insulin by Eli Lilly company –

- I. Extraction of chain A and B
- II. Isolation of DNA sequences corresponding to chain A and B
- III. Combining chain A and B by creating disulphide bonds.
- IV. Introduction of the DNA sequence in plasmids of E coli.
- V. Production of chain A and chain B in bioreactors separately.

a. I, II, III, IV, V b. II, IV, V, I, III c. I, IV, V, II, III d. V, III, I, II, IV

4. C- peptide of human insulin is-

- a. a part of the mature insulin molecule
- b. responsible for biological activity
- c. removed during maturation of proinsulin to insulin
- d. responsible for biological activity

5. Identify the vector used to transfer functional ADA cDNA to the lymphocytes

a. Micro injection b. Gene gun c. retrovirus d. bacteria

6. The organization which is involved in making decisions regarding validity of GM research and the safety of introducing GM crops for public services is-

- a. Genetic Engineering Approval Committee
- b. Genetic Engineering Assessment Committee
- c. Genetic Engineering Assessment Council
- d. Genetic Engineering Approval Council

Assertion-Reason Questions

- 1. Assertion- Cellular defense mechanism in eukaryotes is RNAi.
Reason – RNAi is silencing of specific m- RNA.
- 2. Assertion – Bt produces cry protein which is toxic to insect larvae.
Reason – Bt is species specific.
- 3. Assertion – Patents are granted by the government to an inventor.
Reason – Patents prevent others from commercial use of an invention.
- 4. Assertion- Conventional Insulin caused allergies.
Reason – Earlier insulin was extracted from the pancreas of slaughtered cattle.

2-Mark questions

1. How does the insulin synthesized in the human body differ from the insulin produced by Eli Lilly Company?
2. Genetically modified plants are useful to us in many ways. Mention any 4 uses.
3. RNA i involves silencing of a specific mRNA due to a complementary dsRNA. What is the source of this complementary RNA?
4. Give reason - The Bt toxin does not kill the bacillus but kills the insect larvae.
5. Name some techniques of early diagnosis of diseases.

3 Mark questions

6. What is the cause of ADA deficiency? Explain briefly how it is treated?
7. Bt toxins are insect group specific. Explain by giving examples.
8. List down the steps in development of pest resistant tobacco plants.

CASE STUDY BASED QUESTION

1. The gene therapy clinical trials underway in the U.S. are closely monitored by the Food and Drug Administration and the National Institutes of Health to ensure that patient safety issues are a top priority during research.

Currently, the only way for you to receive gene therapy is to participate in a clinical trial. Clinical trials are research studies that help doctors determine whether a gene therapy approach is safe for people. They also help doctors understand the effects of gene therapy on the body. Your specific procedure will depend on the disease you have and the type of gene therapy being used.

The possibilities of gene therapy hold much promise. Clinical trials of gene therapy in people have shown some success in treating certain diseases. But several significant barriers stand in the way of gene therapy becoming a reliable form of treatment.

- a. What is gene therapy?
- b. What is ADA.?
- c. Gene therapy was successful in the treatment of ADA deficiency. Explain the steps in the treatment of ADA deficiency.