CHAPTERWISE QUESTIONS

Class XII **BIOLOGY** **Time : 1½ hrs.**

Marks : 35

9. BIOTECHNOLOGY PRINCIPLES AND PROCESS

SET A

SECTION - A (7 Marks)

Question 1 to 7 are objective type questions. Carry one mark each.

1. Restriction enzymes belong to which class of enzymes?

   a) Ligases b) Exonucleases c) Nucleases d) Proteases

2. While isolating DNA from bacteria, which of the following enzymes is not used?

   a) lysozyme b) Ribonuclease

   c) Deoxyribonuclease d) Protease

3. Significance of heat shock method in bacterial transformation is to facilitate.

   a) Bonding of DNA to the cell wall

   b) Uptake of DNA through membrane transport proteins

   c) Uptake of DNA through transient pores in the bacterial cell wall

   d) Expression of antibiotic resistance gene

4. A bacterial cell was transformed with a recombinant DNA molecule that was generated using a human gene. However, the transformed cells did not produce the desired protein. Reasons could be:

   a) Human gene may have intron which bacteria cannot process

   b) Amino acid codons for humans and bacteria are different

   c) Human protein is formed but degraded by bacteria d) All of the above

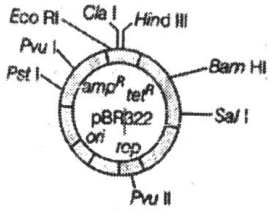
5. The given figure is the diagrammatic representation of the E. coli vector pBR 322. Which one of the given options correctly identified its certain component(s)?

   a) Ori-original restriction enzyme

   b) Rop-reduced osmotic pressure

   c) Hindi III, Eco RI-selectable markers

   d) ampR, tetR-antibiotic resistance genes



6. Which of the following enzymes catalyse the removal of nucleotides from the ends of DNA?

   a) Endonuclease b) Exonuclease c) DNA ligase d) Hind - II

7. Given below is a sample of portion of DNA strand giving the base sequence on the opposite strands? What is so, special shown in it?

   5'-GAATTC-3'

   3'CTTAAG-5'

   a) Replication completed
   b) Deletion mutation
   c) Start codon at the 5' end
   d) Palindromic sequence of base pairs

Question 8 to 9 are Assertion Reason type questions.

In each of the following questions, a statement of Assertion (A) is given followed by corresponding statement of Reason (R).

a) If both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

b) If both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

c) If Assertion (A) is true but Reason (R) is false.

d) If Assertion (A) is false but Reason (R) is true.

8. Assertion (A) : In recombinant DNA technology human genes are often transferred into bacteria (prokaryotes) or yeast (eukaryotes).

   Reason (R) : Both bacteria and yeast multiply very fast to form huge populations which express the desired gene.

9. Assertion (A) : Origin of replication is an essential part of a vector.

   Reason (R) : Ori is responsible for initiating replication.

OR

Assertion (A) : In gel electrophoresis, DNA fragments are separated.

Reason (R) : DNA is negatively charged, so it moves towards anode under electric field.

SECTION B

Q. No. 10 - 13. Answer any two **2 × 2 = 4**

10. What is meant by gene cloning?

11. What would happen when one grows a recombinant bacterium in the bioreactor but forget to add antibiotic to the medium in which the recombinant is growing?

OR

List the key tools used in recombinant DNA technology.

12. How does a restriction nuclease function. Explain.

13. a) Mention the number of primers required in each cycle of polymerase chain reaction (PCR). Write the role of primers and DNA polymerase in PCR.

    b) Give the characteristic feature and source organism of the DNA of the DNA polymerase used in PCR.

SECTION C

Q. No. 14 - 17. Answer any three **3 × 3 = 9**

14. List the key tools and steps used in recombinant DNA technology.

15. The development of bioreactors is required to produce large quantities of products.

    a) Give optimum growth conditions used in bioreactors.

    b) Draw a well labelled diagram of simple stirred-tank bioreactor.

    c) How does a simple stirred tank bioreactor differ from sparged stirred tank bioreactor?

OR

What modification is done on the Ti plasmid of Agrobacterium tumefaciens to convert it into a cloning vector?

16. a) Name the technique used for separation of DNA fragments.

    b) Write the type of matrix used in this technique.

    c) How is the separated DNA visualized and extracted for use in recombinant technology?

17. i) Describe the characteristics a cloning vector must possess.

    ii) Why DNA cannot pass through the cell membrane? Explain. How is a bacterial cell made 'competent' to take up recombinant DNA from the medium?

SECTION D

Case Study

18. **Read the following passage and answer questions.** **4 × 1 = 4**

Selectable marker is a gene, which helps in selecting transformed host cells and eliminating non-transformants. The process of the selection of recombinants from non-recombinants occurs as the transformants containing tetracycline resistant gene are plated on an ampicillin containing medium. The mixture is then transferred on a medium containing antibiotic tetracycline. The recombinants will form colonies in ampicillin medium but will not form colonies in tetracycline medium. The non-recombinants will grow on both the mediums thus separating out recombinants from non-recombinants. An alternative method used for the selection of transformed cell is known as insertional inactivation.

i) When an alien DNA is ligated in tetracycline resistant gene. What could be the recombinant?

ii) What is insertional inactivation?

iii) What basis of the Recombinant colonies in insertional inactivation are differentiated?

iv) Which are the function(s) of a selectable marker?

OR

β-galactosidase enzyme is considered a better selectable marker. Justify the statement.

19. **Read the following passage and answer questions.** **4 × 1 = 4**

In recombinant DNA technology, the fragments of DNA generated after cutting the DNA by restriction enzymes are separated according to their size or length by gel electrophoresis. Gel electrophoresis is performed in a gel matrix so that molecules of similar electric charges can be separated on the basis of size. Most commonly used matrix in gel electrophoresis is agarose. The fragments are separated under the influence of electric field. The separated DNA fragments can be seen only after staining the DNA with compound known as ethidium bromide (EtBr) followed by exposure to UV radiation as bright orange band.

i) How is gel electrophoresis used to separate restriction fragments?

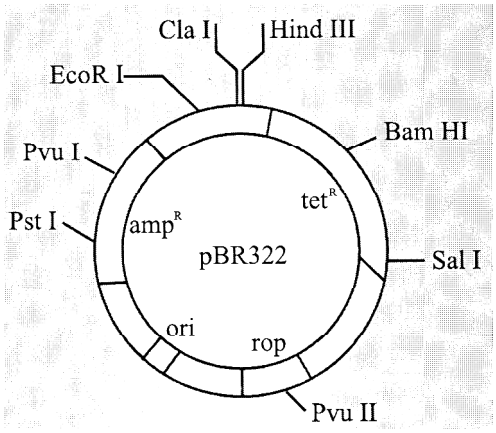
ii) What is the function of the gel used in gel electrophoresis?

iii) How do restriction enzymes work in gel electrophoresis?

SECTION E

Q. No. 20. Long Answer any one. **1 × 5 = 5**

20. Study the figure of vector pBR322 given below in which foreign DNA is ligated at the Bam HI site of tetracyline resistance gene.



Answer the following questions :

a) Mention the function of rop.

b) What will be the selectable marker for this recombinant plasmid and why?

c) Explain transformation.

OR

Illustrate the design of a bioreactor. Highlight the difference between a flask in your laboratory and a bioreactor which allows cells to grow in a continuous culture system.

CHAPTERWISE QUESTIONS

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9. BIOTECHNOLOGY PRINCIPLES AND PROCESS

SET B

SECTION - A (7 Marks)

Question 1 to 7 are objective type questions. Carry one mark each.

1. Which of the following statements does not hold true for restriction enzymes?
   a) It recognise a palindromic nucleotide sequence
   b) It is an endonuclease c) It is isolated from viruses
   d) It can produce the same kind of sticky ends in different DNA molecules
2. The role of DNA ligase in the construction of a recombinant DNA molecule is
   a) Formation of phosphodiester bond between two DNA fragment
   b) Formation of hydrogen bonds between sticky ends of DNA fragments
   c) Ligation of all purine and pyrimidine bases.
   d) None of the above
3. The most important feature in a plasmid to be used as a vector is
   a) Origin of replication b) Presence of a selectable marker
   c) Presence of sites for restriction endonucleases d) Its size
4. Which of the following is not required in the preparation of a recombinant DNA molecules?
   a) Restriction endonucleases b) DNA ligase
   c) DNA fragments d) E.Coli
5. The transfer of genetic material from one bacterium to another through the medication of a vector like virus is termed us
   a) transduction b) conjugation c) transformation d) translation
6. An antibiotic resistance gene in a vector usually helps in the selection of
   a) Competent bacterial cells b) Transformed bacterial cells
   c) Recombinant bacterial cells d) None of the above
7. 'Restriction' in Restriction enzyme refers to
   a) Cleaving of phosphodiester bond in DNA by the enzyme
   b) Cutting of DNA at specific position only
   c) Prevention of the multiplication of bacteriophage by the host bacteria
   d) All of the above

Question 8 to 9 are Assertion Reason type questions.

In each of the following questions, a statement of Assertion (A) is given followed by corresponding statement of Reason (R).

a) If both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

b) If both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

c) If Assertion (A) is true but Reason (R) is false.

d) If Assertion (A) is false but Reason (R) is true.

8. Assertion (A) : DNA finger printing involves indentifying differences in specific regions of DNA sequence.

   Reason (R) : DNA finger printing is the basis of paternity testing.

9. Assertion (A) : Vector DNA and foreign DNA are cut by same restriction endonuclease.

   Reason (R) : Digestion of vector DNA and foreign and foreign DNA with same enzyme produces complimentary sticky ends.

OR

Assertion (A) : Bacteriophage vectors are more advantageous than plasmid vectors.

Reason (R) : Bacteriophage vectors can be easily detected at the time of cloning experiments.

SECTION B

Q. No. 10 - 13. Answer any two **2 × 2 = 4**

10. What modification is done on the Ti plasmid of Agrobacterium tumefaciens to convert it into a cloning vector?

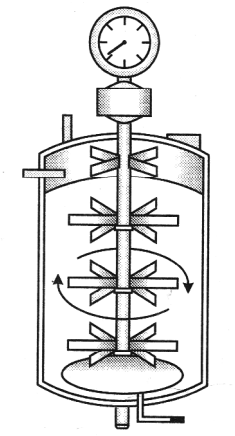
11. How does one visualise DNA on an agarose gel?

OR

Describe the role of $CaCl_2$ in the preparation of competent cells?

12. State the role of DNA ligase in biotechnology.

13. Name the type of bioreactor shown. Write the purpose for which it is used?



SECTION C

Q. No. 14 - 17. Answer any three **3 × 3 = 9**

14. Any recombinant DNA with a desired gene is required in billion copies for commercial use. How is the amplification done? Explain.

15. How are the following used in biotechnology?

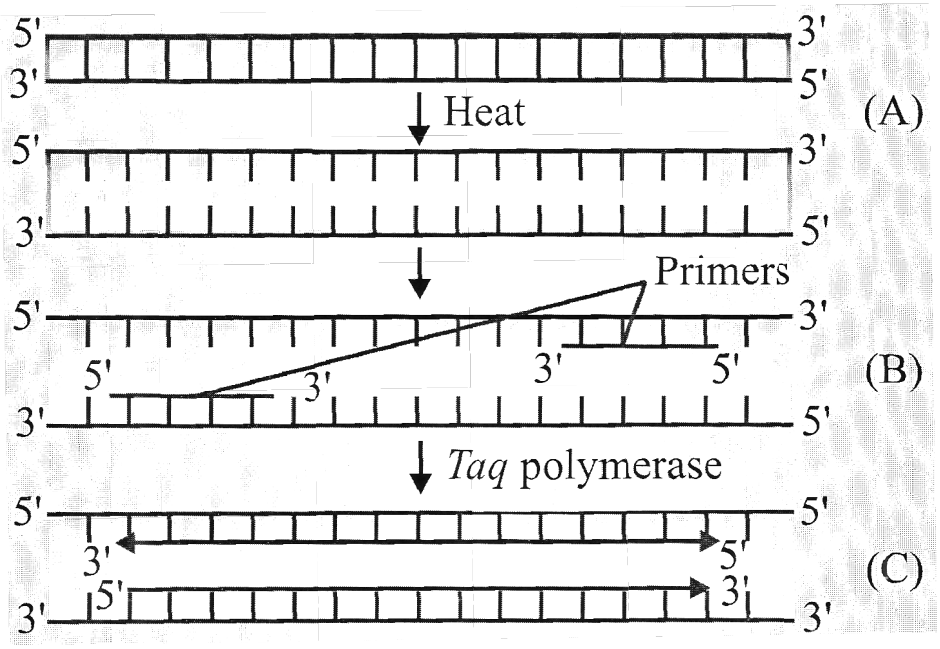
    a) Plasmid DNA b) Recognition sequence c) gel electrophoresis

OR

    a) Mention the importance of gel electrophoresis in biotechnology.

    b) Explain the process of this technique.

16. In the given figure, one cycle of polymerase chain reaction (PCR) is shown :



    a) Name the steps A, B and C.

    b) Give the purpose of each of these steps.

    c) State the contribution of *Thermus aquaticus in this process.*

17. How do biofertilizers enrich the fertility of the soil?

SECTION D

Case Study

18. **Read the following passage and answer questions.** **4 × 1 = 4**

Bioreactors are considered as vessels in which raw materials are biologically converted into specific products by microbes, plant and animal cells or their enzymes. They are used for large scale production as they provide optimum growth conditions such as temperature, *p*H, 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.

i) How is Bioreactor useful?

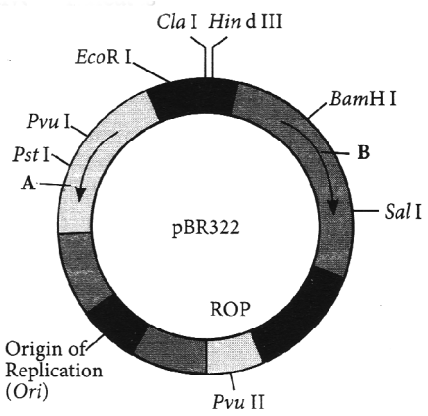
ii) Which is essential to obtain desired product in a bioreactor?

iii) Write the name of two bioreactors.

iv) Which could affect the quality of obtained product in a bioreactor?

19. **Read the following passage and answer questions.** **4 × 1 = 4**

Observe the diagram given below and answer the question that follows.



(b) *ROP* and *Sal I*

(d) tet^R and amp^R.

i) What is pBR 322?

ii) What is the function of *rop*?

iii) What significance do amp^R and tet^R hold?

iv) What is *ori*?

v) What do the letters 'pBR' of pBR322 indicate?

SECTION E

Q. No. 20. Long Answer any one. **1 × 5 = 5**

20. Describe the role of *Agrobacterium tumefaciens* in transforming a plant cell.

OR

For selection of recombinants, insertional inactivation of antibiotic marker has been supercoded by insertional inactivation of a marker gene coding for a chromogenic substrate. Give reasons.