

Chapter 7

Biotechnology - Principles
and Processes**Solutions**

SECTION - A

Objective Type Questions

(Tools of Recombinant DNA Technologies)

1. A chimaeric DNA is formed by
 - (1) Deleting selectable markers
 - (2) Joining alien DNA with plasmid
 - (3) EcoR I
 - (4) Enzyme β -galactosidase

Sol. Answer (2)

Chimaeric DNA is recombinant DNA.

2. Although the Ti plasmid has revolutionised plant genetic engineering one limitation of its use is that it
 - (1) Cannot infect broad leaf plants
 - (2) Cannot be used on fruit-bearing plants
 - (3) Cannot transmit prokaryotic genes
 - (4) Does not infect cereal plants such as corn and rice in its native form

Sol. Answer (4)

Native form of Ti plasmid of *A. tumefaciens* does not infect cereals such as rice, corns, wheat, barley maize etc. Broad leaf plants and fruit bearing plants are mostly dicotyledonous and can be infected by Ti plasmid. It can transmit prokaryotic genes.

3. A plasmid
 - (1) Shows dependent assortment
 - (2) Has ability to replicate within bacterial cells independent of the control of chromosomal DNA
 - (3) Cannot replicate
 - (4) Contains genes for vital activities

Sol. Answer (2)

Plasmid can replicate.

4. Each restriction endonuclease functions by inspecting the length of a DNA sequence. It cleaves _____
- (1) Only the master strand to produce sticky end
 - (2) Sense strand of DNA to produce sticky ends
 - (3) Each of the two strands of the double helix at specific points in their sugar phosphate backbones
 - (4) Messenger RNA to remove exons

Sol. Answer (3)

5. Which enzyme is required to prevent unwanted self-ligation of vector DNA molecules in recombinant DNA technology?

- (1) DNA polymerase
- (2) DNA ligase
- (3) Alkaline phosphatase
- (4) Reverse transcriptase

Sol. Answer (3)

Alkaline phosphatase removes phosphate groups from the 5' end of DNA molecules.

6. A set of bacterial clones, each containing a plasmid or phage, is called

- (1) Gene library
- (2) Gene pool
- (3) Genophore
- (4) Genome

Sol. Answer (1)

Gene pool is the stock of different genes in interbreeding populations.

Genophore is the chromosomal DNA of a prokaryote.

Genome haploid set of chromosomes in a gamete.

7. Which of these are most widely used in genetic engineering?

- (1) Plastid
- (2) Plasmid
- (3) Mitochondria
- (4) Ribosome

Sol. Answer (2)

Plasmids are used much more because they can replicate independent of the chromosomal DNA.

Plastid is a major double-membrane organelle found in the cells of plants and algae.

Mitochondria and ribosome are organelles found in the cells.

8. A tumor inducing plasmid widely used in the production of transgenic plants is that of

- (1) *Escherichia coli*
- (2) *Bacillus thuringiensis*
- (3) *Staphylococcus aureus*
- (4) *Agrobacterium tumefaciens*

Sol. Answer (4)

Agrobacterium tumefaciens: It can cause tumor by transferring a defined segment of DNA (T-DNA) from its tumor inducing plasmid into the nuclear genome of plant cells.

9. Which of the following is **not** a basis of difference between chromosomal DNA and plasmid?

- a. Presence of histones
 - b. Presence of nucleotides
 - c. Nature of nucleotides
 - d. Linear form of genetic material
- (1) b & c only
 - (2) a & d only
 - (3) a, b & d only
 - (4) a, b, c & d

Sol. Answer (1)

Histones are absent in prokaryotes.

10. An antibiotic resistance gene in a vector helps in selection of
(1) Competent cells (2) Transformed cells (3) Recombinant cells (4) Both (2) & (3)

Sol. Answer (4)

11. Select the option that **excludes** characteristics applicable to plasmids
- a. Circular DNA b. Linear DNA
c. Present in all bacteria d. Contain essential genes
e. Extra chromosomal and self-replicating
- (1) b & d only (2) b, c & d only (3) d, b, e & c only (4) a only

Sol. Answer (2)

Plasmids are naturally occurring circular, extrachromosomal, autonomously replicating DNA, present in many prokaryotic and few eukaryotic organisms.

12. Term 'Disarmed' in disarmed vector represents
- (1) Removal of T-DNA from Ti plasmid (2) Insertional inactivation of β -galactosidase gene
(3) Insertional inactivation of antibiotic gene (4) Both (2) & (3)

Sol. Answer (1)

Disarmed means without pathogenic property.

13. Telomeric sequence, centromere, autonomously replicating sequence from yeast are characteristic features of
- (1) YAC (2) BAC (3) Retrovirus (4) All of these

Sol. Answer (1)

YAC = Yeast artificial chromosome.

(Processes of Recombinant DNA Technologies)

14. Which of the following is **not** a method of introducing alien DNA into host cells?
- (1) Microinjection (2) Heat shock method
(3) Being placed along with the cell into a gene gun (4) Gel electrophoresis

Sol. Answer (4)

Gel electrophoresis: Method for separation and analysis of macromolecules and their fragments based on their size using gel medium.

15. During the process of isolation of DNA, chilled ethanol is added to
- (1) Remove proteins such as histones (2) Precipitate DNA
(3) Break open the cell to release DNA (4) Facilitate action of restriction enzymes

Sol. Answer (2)

Proteases are used to digest proteins in solution.

16. Agarose extracted from sea weeds finds use in
- (1) Gel electrophoresis (2) Spectrophotometry (3) Tissue culture (4) PCR

Sol. Answer (1)

Agarose gels have very large pore size and are used primarily to separate very large molecules with a molecular mass greater than 200 K Da.

Spectrophotometry is a method to measure how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through sample solution.

Tissue culture involves the growth in an artificial medium of cells derived from living tissue.

PCR is a technique used to make multiple copies of a segment of DNA.

17. PCR is used for
- (1) Reverse transcribing RNA into DNA (2) Digesting DNA
(3) Amplifying DNA (4) Amplifying proteins and separating DNA

Sol. Answer (3)

PCR is polymerase chain reaction (*in vitro* replication of DNA)

18. Method in which recombinant DNA is directly injected into the nucleus of animal cell by using microneedles is called as

- (1) Gene gun method (2) Biolistic method (3) Microinjection method (4) Indirect method

Sol. Answer (3)

Gene gun method is a method in which cells are bombarded with high velocity microparticles of gold or tungsten coated with DNA.

19. Which of the following represents an advantage of growing cells in continuous culture as compared to a shake flask?

- (1) Cells can be maintained at a constant physiological state
(2) Most downstream and upstream processes are continuous in nature
(3) Continuous reactors do not need to be shut down and cleaned regularly
(4) All of these

Sol. Answer (4)

20. Which of the following methods gave birth to idea of gene immunization?

- (1) Microinjection (2) Direct DNA injection (3) Biolistic (4) Both (1) & (3)

Sol. Answer (2)

SECTION - B

Previous Years Questions

1. A selectable marker is used to [NEET-2019 (Odisha)]
- (1) Mark a gene on a chromosome for isolation using restriction enzyme
(2) Help in eliminating the non-transformants, so that the transformants can be regenerated
(3) Identify the gene for a desired trait in an alien organism
(4) Select a suitable vector for transformation in a specific crop

Sol. Answer (2)

Selectable markers help in identification and elimination of non-transformants whilst permitting selective growth of transformants.

2. Given below are four statements pertaining to separation of DNA fragments using Gel electrophoresis. Identify the incorrect statements.
- (a) DNA is negatively charged molecule and so it is loaded on gel towards the Anode terminal.
(b) DNA fragments travel along the surface of the gel whose concentration does not affect movement of DNA.
(c) Smaller the size of DNA fragment, larger is the distance it travels through it.
(d) Pure DNA can be visualized directly by exposing to UV radiation.

Choose correct answer from the options given below :

[NEET-2019 (Odisha)]

- (1) (a), (b) and (d) (2) (a), (c) and (d) (3) (a), (b) and (c) (4) (b), (c) and (d)

Sol. Answer (1)

- DNA fragments are negatively charged molecules. Separated by forcing them to move towards positive electrode *i.e.* anode.
- Increasing the concentration of a gel reduces the migration speed of DNA.
- Smaller the fragment size, farther it moves from the point of loading *i.e.* the well.
- DNA fragment can only be visualised under UV light after staining with ethidium bromide and not directly.

3. An enzyme catalysing the removal of nucleotides from ends of DNA is **[NEET-2019 (Odisha)]**

- (1) Protease (2) DNA ligase (3) Endonuclease (4) Exonuclease

Sol. Answer (4)

Restriction enzymes belong to a larger class of enzymes called Nucleases.

Nucleases are of two different kinds :

- (1) Exonucleases which remove nucleotides from the end of a DNA molecule
- (2) Endonucleases, which break internal phosphodiester bonds at palindromic sites that are highly specific
- (3) DNA ligase helps in ligating/joining DNA fragments

4. Match the following enzymes with their functions **[NEET-2019 (Odisha)]**

- | | |
|-----------------------------|---|
| a. Restriction endonuclease | (i) Joins the DNA fragments |
| b. Restriction exonuclease | (ii) Extends primers on genomic DNA template |
| c. DNA ligase | (iii) Cuts DNA at specific position |
| d. Taq polymerase | (iv) Removes nucleotides from the ends of DNA |

Select the correct option from the following:

- (1) a(ii), b(iv), c(i), d(iii) (2) a(iii), b(i), c(iv), d(ii) (3) a(iii), b(iv), c(i), d(ii) (4) a(iv), b(iii), c(i), d(ii)

Sol. Answer (3)

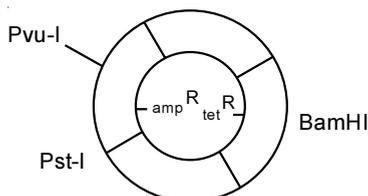
- | | | |
|-----------------------------|---|--|
| a. Restriction endonuclease | : | Cuts DNA at specific position |
| b. Restriction exonuclease | : | Removes nucleotides from the ends of DNA |
| c. DNA ligase | : | Joins the DNA fragments |
| d. Taq polymerase | : | Extends primers on genomic DNA template |

5. The two antibiotic resistance genes on vector pBR322 are for **[NEET-2019 (Odisha)]**

- (1) Tetracycline and Kanamycin (2) Ampicillin and Tetracycline
(3) Ampicillin and Chloramphenicol (4) Chloramphenicol and Tetracycline

Sol. Answer (2)

E. Coli cloning vector pBR322 contains antibiotic resistance genes for Ampicillin and Tetracycline.



6. Which one of the following equipments is essentially required for growing microbes on a large scale, for industrial production of enzymes? **[NEET-2019]**

- (1) BOD incubator (2) Sludge digester (3) Industrial oven (4) Bioreactor

Sol. Answer (4)

To produce enzymes in large quantity equipment required are bioreactors. Large scale production involves use of bioreactors.

7. DNA precipitation out of a mixture of biomolecules can be achieved by treatment with [NEET-2019]
(1) Isopropanol (2) Chilled ethanol
(3) Methanol at room temperature (4) Chilled chloroform

Sol. Answer (2)

During the isolation of desired gene, chilled ethanol is used for the precipitation of DNA.

8. Following statements describe the characteristics of the enzyme Restriction Endonuclease. Identify the **incorrect** statement. [NEET-2019]
(1) The enzyme cuts DNA molecule at identified position within the DNA.
(2) The enzyme binds DNA at specific sites and cuts only one of the two strands.
(3) The enzyme cuts the sugar-phosphate backbone at specific sites on each strand.
(4) The enzyme recognizes a specific palindromic nucleotide sequence in the DNA.

Sol. Answer (2)

Restriction enzymes cut DNA molecules at a particular point by recognising a specific sequence. Each restriction endonuclease functions by inspecting the length of a DNA sequence. Once it finds its specific recognition sequence, it will bind to the DNA and cut each of the two strands of the double helix at specific points in their sugar-phosphate backbone.

9. The correct order of steps in Polymerase Chain Reaction (PCR) is [NEET-2018]
(1) Extension, Denaturation, Annealing (2) Annealing, Extension, Denaturation
(3) Denaturation, Annealing, Extension (4) Denaturation, Extension, Annealing

Sol. Answer (3)

This technique is used for making multiple copies of gene (or DNA) of interest in vitro.

Each cycle has three steps

- (1) Denaturation
- (2) Primer annealing
- (3) Extension of primer

10. A gene whose expression helps to identify transformed cell is known as [NEET-2017]
(1) Selectable marker (2) Vector (3) Plasmid (4) Structural gene

Sol. Answer (1)

In recombinant DNA technology, selectable markers helps in identifying and eliminating non-transformants and selectively permitting the growth of the transformants.

11. DNA fragments are [NEET-2017]
(1) Positively charged
(2) Negatively charged
(3) Neutral
(4) Either positively or negatively charged depending on their size

Sol. Answer (2)

DNA fragments are negatively charged because of phosphate group.

12. The DNA fragments separated on an agarose gel can be visualised after staining with [NEET-2017]
(1) Bromophenol blue (2) Acetocarmine (3) Aniline blue (4) Ethidium bromide

Sol. Answer (4)

Ethidium bromide is used to stain the DNA fragments and will appear as orange coloured bands under UV light.

13. What is the criterion for DNA fragments movement on agarose gel during gel electrophoresis? [NEET-2017]
 (1) The larger the fragment size, the farther it moves (2) The smaller the fragment size, the farther it moves
 (3) Positively charged fragments move to farther end (4) Negatively charged fragments do not move

Sol. Answer (2)

During gel electrophoresis, DNA fragments separate (resolve) according to their size through sieving effect provided by agarose gel.

14. Stirred-tank bioreactors have been designed for [NEET(Phase-2)-2016]
 (1) Purification of product (2) Addition of preservatives to the product
 (3) Availability of oxygen throughout the process (4) Ensuring anaerobic conditions in the culture vessel

Sol. Answer (3)

Stirred-tank bioreactor is provided with stirrer for availability of oxygen throughout the process.

15. A foreign DNA and plasmid cut by the same restriction endonuclease can be joined to form a recombinant plasmid using [NEET(Phase-2)-2016]
 (1) *Eco RI* (2) *Taq* polymerase (3) Polymerase III (4) Ligase

Sol. Answer (4)

In DNA recombinant technology, linking of foreign DNA and plasmid is made possible by DNA ligase which is also called "molecular glue".

16. Which of the following is **not** a component of downstream processing? [NEET(Phase-2)-2016]
 (1) Separation (2) Purification (3) Preservation (4) Expression

Sol. Answer (4)

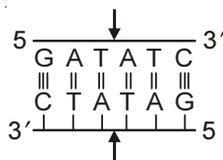
After the completion of biosynthetic pathway, downstream processing includes all the steps involved in isolation, purification and preservation of products. All the steps before the completion of pathway are included in upstreaming processing *i.e.*, expression of genetic material.

17. Which of the following restriction enzymes produces blunt ends? [NEET(Phase-2)-2016]
 (1) *Sal I* (2) *Eco RV* (3) *Xho I* (4) *Hind III*

Sol. Answer (2)

Eco RV cuts the DNA in the centre of restriction sites forming blunt ends.

The pallindromic sequence for *Eco RV* is



18. Which of the following is **not** a feature of the plasmids? [NEET-2016]
 (1) Single-stranded (2) Independent replication (3) Circular structure (4) Transferable

Sol. Answer (1)

Plasmid is extrachromosomal, double stranded circular DNA.

19. The *taq* polymerase enzyme is obtained from [NEET-2016]
 (1) *Pseudomonas putida* (2) *Thermus aquaticus*
 (3) *Thiobacillus ferrooxidans* (4) *Bacillus subtilis*

Sol. Answer (2)

Taq polymerase is thermostable DNA polymerase obtained from *Thermus aquaticus*.

- (1) RNase (2) Hind II (3) Protease (4) DNase I

Sol. Answer (2)

Hind II is a restriction endonuclease.

21. The DNA molecule to which the gene of interest is integrated for cloning is called **[ReAIPMT-2015]**

- (1) Carrier (2) Transformer (3) Vector (4) Template

Sol. Answer (3)

The DNA molecule to which the gene of interest is integrated for cloning is called vector.

22. The cutting of DNA at specific locations became possible with the discovery of **[ReAIPMT-2015]**

- (1) Ligases (2) Restriction enzymes (3) Probes (4) Selectable markers

Sol. Answer (2)

The cutting of DNA at specific locations became possible with the discovery of restriction enzymes is called molecular scissors or knife.

23. Which vector can clone only a small fragment of DNA? **[AIPMT-2014]**

- (1) Bacterial artificial chromosome (2) Yeast artificial chromosome
(3) Plasmid (4) Cosmid

Sol. Answer (3)

Plasmid can clone only a small fragment of DNA about 10 kbp size

Cosmid – 45 kbp

YAC – 1 Mbp/1000 kbp – 2,500 kbp

BAC – 300 to 350 kbp

24. DNA fragments generated by the restriction endonucleases in a chemical reaction can be separated by

[NEET-2013]

- (1) Polymerase chain reaction (2) Electrophoresis
(3) Restriction mapping (4) Centrifugation

Sol. Answer (2)

25. Which of the following is **not** correctly matched for the organism and its cell wall degrading enzyme?

[NEET-2013]

- (1) Plant cells - Cellulase (2) Algae - Methylase (3) Fungi - Chitinase (4) Bacteria - Lysozyme

Sol. Answer (2)

26. The colonies of recombinant bacteria appear white in contrast to blue colonies of non-recombinant bacteria because of **[NEET-2013]**

- (1) Insertional inactivation of alpha-galactosidase in non-recombinant bacteria
(2) Insertional inactivation of alpha-galactosidase in recombinant bacteria
(3) Inactivation of glycosidase enzyme in recombinant bacteria
(4) Non-recombinant bacteria containing beta-galactosidase

Sol. Answer (2)

27. Which one is a **true** statement regarding DNA polymerase used in PCR? **[AIPMT (Prelims)-2012]**

- (1) It is isolated from a virus (2) It remains active at high temperature
(3) It is used to ligate introduced DNA in recipient cells (4) It serves as a selectable marker

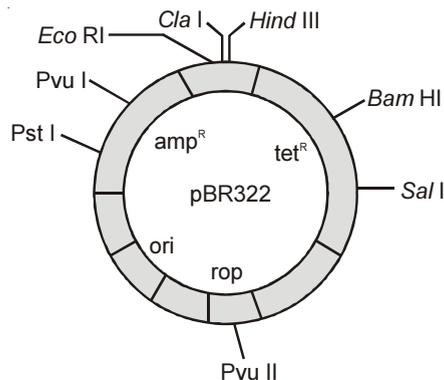
Sol. Answer (2)

28. For transformation, micro-particles coated with DNA to be bombarded with gene gun are made up of [AIPMT (Prelims)-2012]

- (1) Silicon or Platinum (2) Gold or Tungsten (3) Silver or Platinum (4) Platinum or Zinc

Sol. Answer (2)

29. The figure below is the diagrammatic representation of the *E.coli* vector pBR 322. Which one of the given options correctly identifies its certain component(s)? [AIPMT (Prelims)-2012]



- (1) amp^R, tet^R- antibiotic resistance genes
 (2) ori-original restriction enzyme
 (3) rop-reduced osmotic pressure
 (4) Hind III, EcoRI-selectable markers

Sol. Answer (1)

The corrected options

- (2) ori- origin of replication
 (3) rop- codes for the proteins involved in the replication of the plasmid.
 (4) Hind III, EcoRI- Restriction sites

30. Biolistics (gene-gun) is suitable for [AIPMT (Mains)-2012]

- (1) DNA fingerprinting
 (2) Disarming pathogen vectors
 (3) Transformation of plant cells
 (4) Constructing recombinant DNA by joining with vectors

Sol. Answer (3)

As gene gun inserts recombinant DNA into host cells which leads to transformation of plant cells.

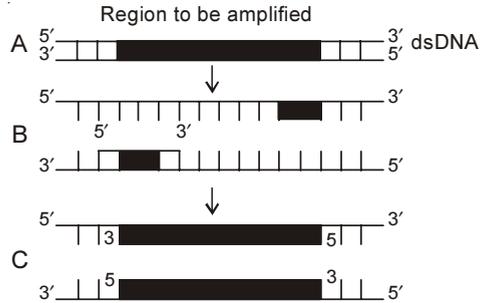
31. In genetic engineering, the antibiotics are used [AIPMT (Mains)-2012]

- (1) To keep the cultures free of infection (2) As selectable markers
 (3) To select healthy vectors (4) As sequences from where replication starts

Sol. Answer (1)

The host cells must naturally be sensitive to the antibiotic in question so that any vector molecule which transforms a host cell can confer antibiotic resistance. By plating transformed cells on a medium containing the antibiotic, only those cells that have been transformed by vector molecules survive.

32. The figure below shows three steps (A, B, C) of Polymerase Chain Reaction (PCR). Select the option giving correct identification together with what it represents ? **[AIPMT (Mains)-2012]**



- (1) A – Annealing with two sets of primers
 (2) B – Denaturation at a temperature of about 98°C separating the two DNA strands
 (3) A – Denaturation at a temperature of about 50°C
 (4) C – Extension in the presence of heat stable DNA polymerase

Sol. Answer (4)

33. Which one of the following represents a palindromic sequence in DNA? **[AIPMT (Mains)-2012]**

- (1) 5' – GAATTC – 3' (2) 5' – CCAATG – 3' (3) 5' – CATTAG – 3' (4) 5' – GATACC – 3'
 3' – CTTAAG – 5' 3' – CAATCC – 5' 3' – GATAAC – 5' 3' – CCTAAG – 5'

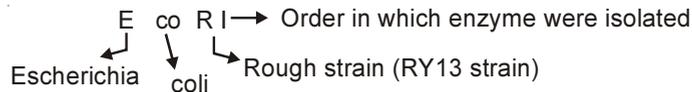
Sol. Answer (1)

Palindromic sequence is a sequence of base pairs that read same on the two strands when orientation of reading is kept same.

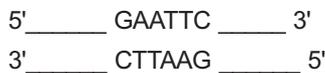
34. There is a restriction endonuclease called EcoRI. What does "co" part in it stand for? **[AIPMT (Prelims)-2011]**

- (1) coli (2) colon (3) coelom (4) coenzyme

Sol. Answer (1)



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



[AIPMT (Prelims)-2011]

- (1) Palindromic sequence of base pairs (2) Replication completed
 (3) Deletion mutation (4) Start codon at the 5' end

Sol. Answer (1)

36. Which one of the following techniques made it possible to genetically engineer living organisms?

[AIPMT (Mains)-2011]

- (1) Heavier isotope labelling (2) Hybridization
 (3) Recombinant DNA techniques (4) X-ray diffraction

Sol. Answer (3)

37. Continuous addition of sugars in 'fed batch' fermentation is done to **[AIPMT (Prelims)-2011]**

- (1) Degrade sewage (2) Produce methane (3) Obtain antibiotics (4) Purify enzymes

Sol. Answer (3)

Conditions in which continuous addition of sugars in fed batch fermentation is done to obtain antibiotics.

38. Agarose extracted from sea weeds finds use in [AIPMT (Prelims)-2011]
(1) Gel electrophoresis (2) Spectrophotometry (3) Tissue Culture (4) PCR

Sol. Answer (1)

39. Which one of the following is used as vector for cloning genes into higher organisms? [AIPMT (Prelims)-2010]
(1) Retrovirus (2) Baculovirus
(3) *Salmonella typhimurium* (4) *Rhizopus nigricans*

Sol. Answer (1)

Retroviruses are most commonly used as they have a relatively high insert capacity.

40. Which one of the following palindromic base sequences in DNA can be easily cut by *EcoRI*? [AIPMT (Prelims)-2010]
(1) 5'.....CACGTA.....3'
 3'.....CTCAGT.....5'
(2) 5'.....CGTTCG.....3'
 3'.....ATGGTA.....5'
(3) 5'.....GATATG.....3'
 3'.....CTACTA.....5'
(4) 5'.....GAATTC.....3'
 3'.....CTTAAG.....5'

Sol. Answer (4)

41. Restriction endonucleases are enzymes which [AIPMT (Prelims)-2010]
(1) Remove nucleotides from the ends of the DNA molecule
(2) Make cuts at specific positions within the DNA molecule
(3) Recognize a specific nucleotide sequence for binding of DNA ligase
(4) Restrict the action of the enzyme DNA polymerase

Sol. Answer (2)

Restriction endonucleases make cuts at specific positions within the DNA molecule.

42. Stirred-tank bioreactors have been designed for [AIPMT(Prelims)-2010]
(1) Availability of oxygen throughout the process (2) Addition of preservatives to the product
(3) Purification of the product (4) Ensuring anaerobic conditions in the culture vessel

Sol. Answer (1)

43. Which of the following are used in gene cloning? [AIPMT (Mains)-2010]
(1) Nucleoids (2) Lomasomes (3) Mesosomes (4) Plasmids

Sol. Answer (4)

44. In genetic engineering, a DNA segment (gene) of interest, is transferred to the host cell through a vector. Consider the following four agents (A-D) in this regard and select the **correct** option about which one or more of these can be used as a vector/ vectors [AIPMT (Mains)-2010]

Statements

- (A) A bacterium (B) Plasmid (C) Plasmodium (D) Bacteriophage
(1) (A), (B) & (D) only (2) (A) only (3) (A) & (C) only (4) (B) & (D) only

Sol. Answer (4)

45. Gel electrophoresis is used for [AIPMT (Prelims)-2008]
(1) Isolation of DNA molecule
(2) Cutting of DNA into fragments
(3) Separation of DNA fragments according to their size
(4) Construction of recombinant DNA by joining with cloning vectors
Sol. Answer (3)
46. The linking of antibiotic resistance gene with the plasmid vector became possible with [AIPMT (Prelims)-2008]
(1) Exonucleases (2) DNA ligase (3) Endonucleases (4) DNA polymerase
Sol. Answer (2)
47. Restriction endonuclease [AIPMT (Prelims)-2006]
(1) Cuts the DNA molecule randomly (2) Cuts the DNA molecule at specific sites
(3) Restricts the synthesis of DNA inside the nucleus (4) Synthesizes DNA
Sol. Answer (2)
48. Microbes found to be very useful in genetic engineering are [AIPMT (Prelims)-2006]
(1) *Escherichia coli* and *Agrobacterium tumefaciens* (2) *Vibrio cholerae* and a tailed bacteriophage
(3) *Diplococcus* sp. and *Pseudomonas* sp. (4) Crown gall bacterium and *Caenorhabditis elegans*
Sol. Answer (1)
49. Production of a human protein in bacteria by genetic engineering is possible because [AIPMT (Prelims)-2005]
(1) Bacterial cell can carry out the RNA splicing reactions
(2) The human chromosome can replicate in bacterial cell
(3) The mechanism of gene regulation is identical in humans and bacteria
(4) The genetic code is universal
Sol. Answer (4)
50. Which one of the following hydrolyses internal phosphodiester bonds in a polynucleotide chain? [AIPMT (Prelims)-2005]
(1) Lipase (2) Exonuclease (3) Endonuclease (4) Protease
Sol. Answer (3)
51. All the following statements about Stanley Cohen and Herbert Boyer are correct but one is wrong. Which one is **wrong**?
(1) They discovered recombinant DNA (r-DNA) technology which marked the birth of modern biotechnology.
(2) They first produced, healthy sheep clone, a Finn Dorset lamb, Dolly, from the differentiated adult mammary cells.
(3) They invented genetic engineering by combining a piece of foreign DNA containing a gene from a bacterium with a bacterial (*E. coli*) plasmid using the enzyme restriction endonuclease.
(4) They isolated the antibiotic resistance gene by cutting out a piece of DNA from a plasmid which was responsible for conferring antibiotic resistance.
Sol. Answer (2)
Dolly was cloned by Ian Wilmut and Campbell.

52. There are three basic steps in genetically modifying an organism. Which of the following is **wrong** statement about the process?

- (1) Identification of the DNA with desirable genes
- (2) Cleaving DNA segments with 'ligase' and joining them with endonuclease
- (3) Introduction of the identified DNA into the host
- (4) Maintenance of introduced DNA in the host and transfer of DNA to its progeny

Sol. Answer (2)

Cleaving DNA segments with endonuclease and joining them with 'ligase'.

53. What is true for plasmid?

- (1) Plasmids are used widely in gene transfer
- (2) These are found in viruses
- (3) Plasmids contain genes for vital activities
- (4) These are main part of chromosome

Sol. Answer (1)

These are found in bacteria and some yeast cells.

Chromosomal DNA contains vital genes necessary for cell.

Plasmid is extra chromosomal DNA.

54. Extraction of bands of DNA from the agarose gel is termed as

- (1) Down stream processing
- (2) Upstream processing
- (3) Elution
- (4) Insertional inactivation

Sol. Answer (3)

Down stream processing the recovery and purification of biosynthetic products, particularly pharmaceuticals, from natural sources such as animal or plant tissue or fermentation both, including the recycling of salvageable components.

Upstreaming processing process from cell isolation and cultivation to cell banking and culture expansion of the cells until final harvest.

Insertional inactivation is the inactivation of a gene upon insertion of another gene in its place or within its coding sequence.

55. In plant biotechnology, PEG is used in

- (1) Protoplast isolation
- (2) Cell culture preparation
- (3) Protoplast fusion
- (4) Hardening

Sol. Answer (3)

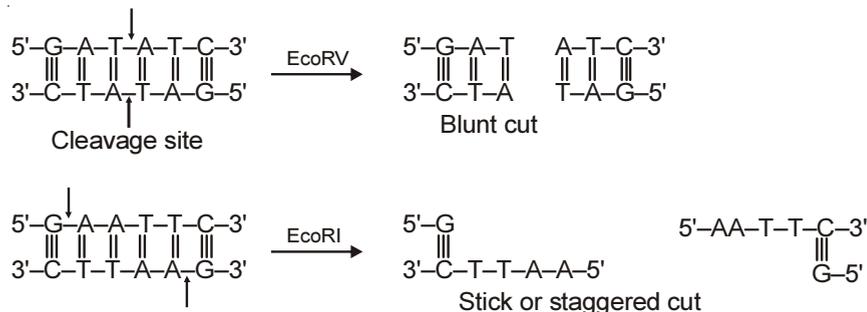
Certain chemicals, such as polyethylene glycol (PEG), act as **fusogen**, agents that cause cell membranes to fuse together. This can be exploited to transfect plant cells by mixing them with other cells containing large amounts of plasmid DNA.

56. Restriction enzymes cut the strand of DNA a little away from the centre of the palindromic site, but between the same two bases on the opposite single stranded strands, these overhanging stretches formed on each strand are called _____

- (1) Blunt ends (2) Sticky ends
 (3) Staggered end (4) Both (2) & (3)

Sol. Answer (4)

In Blunt ends the cleavage point occur exactly on the axis of symmetry.



57. Which of the following is considered as molecular glue?

- (1) Alkaline phosphatase
 (2) Restriction endonuclease
 (3) DNA ligase
 (4) DNA polymerase

Sol. Answer (3)

DNA ligase: Catalyzes the joining of DNA strands together.

Alkaline phosphatase: Removes phosphate groups from the 5' ends of DNA molecules, which prevents these molecules from being ligated to one another.

Restriction endonuclease: Enzyme that cuts DNA at or near specific recognition nucleotide sequence.

DNA polymerase: Enzymes that create DNA molecules by assembling nucleotides, the building blocks of DNA.

58. Genetic engineering is possible because

- (1) DNA can be cut at specific sites by endo nucleases like DNAase
 (2) Restriction endonucleases purified from bacteria can be used *in vitro*
 (3) The phenomenon of transduction in bacteria is well understood
 (4) DNA can be seen by electron microscope

Sol. Answer (2)

Restriction endonucleases purified from bacteria can be used *in vitro*.

59. What would happen if a recombinant DNA is inserted within the coding sequence of an enzyme, β -galactosidase?

- (1) This will result in the inactivation of the enzyme
 (2) The presence of chromogenic substrate will give blue coloured colonies
 (3) The recombinant colonies do not produce any colour
 (4) Both (1) & (3) are correct

Sol. Answer (4)

Blue coloured colonies are produced when plasmid does not have an insert.

60. Plasmids are used in genetic engineering because they are
- (1) Easily available
 - (2) Able to integrate with host chromosome
 - (3) Able to replicate along with chromosomal DNA
 - (4) May contain DNA sequences coding for drug resistance

Sol. Answer (4)

Plasmids replicate independent of main genome.

Plasmid is extra chromosomal DNA and there is no integration with host chromosome.

61. The term 'B' and 'R' in the name pBR322 represents which of the following?

- (1) Name of the scientists
- (2) Name of the restriction endonuclease enzymes
- (3) Name of cities in U.S.A.
- (4) Name of the strain of bacterias used

Sol. Answer (1)

p-plasmid

BR– Boliver and Rodriguez

322– Distinguishes this plasmid from others developed in the same laboratory.

62. You suspect your patient to be suffering from a bacterial disease, however the number of bacteria in the patient's body is very less. Which method can help you detect these pathogens in the laboratory?

- (1) Hybridoma technology
- (2) PCR
- (3) Somatic hybridization
- (4) DNA fingerprinting

Sol. Answer (2)

It helps to detect very low concentration of bacteria or virus at the time when the symptoms of the disease are not visible by amplification of their nucleic acid.

63. Downstreaming process in biotechnology refers to

- (1) The process which includes separation and purification of the product, after the completion of the biosynthetic stage
- (2) Large scale production of a product, by using bioreactors
- (3) The cells harbouring cloned genes of interest, being grown on a small scale
- (4) The microbes which act upon the substrate are cultured and added into the fermenter

Sol. Answer (1)

Fact.

64. cDNA is

- (1) Formed by reverse transcriptase
- (2) Cloned DNA
- (3) Circular DNA
- (4) Recombinant DNA

Sol. Answer (1)

cDNA (complementary DNA) is a double stranded DNA synthesized from a messenger RNA template in a reaction catalysed by enzyme reverse transcriptase.

Cloned DNA– DNA created by copying of DNA fragement, cells, or organisms.

Circular DNA is a form of DNA that is found in viruses, bacteria.

Recombinant DNA– DNA that has been formed artificially by combining constituents from different organisms.

SECTION - C

Assertion-Reason Type Questions

- A : DNA ligase plays an important role in recombinant DNA technology.
R : The linking of antibiotic resistance gene with plasmid vector became possible by enzyme DNA ligase.

Sol. Answer (1)
- A : Restriction enzymes belong to a larger class of enzymes called nucleases.
R : Each restriction enzyme recognises a specific palindromic nucleotide sequence in the DNA.

Sol. Answer (2)
- A : During gel electrophoresis, the DNA fragments move towards the anode.
R : DNA fragments are negatively charged molecules.

Sol. Answer (1)
DNA is negatively charged due to phosphate.
- A : Selection of recombinants due to inactivation of antibiotics is cumbersome procedure.
R : It requires simultaneous plating on two plates having different antibiotics.

Sol. Answer (1)
- A : *Taq* Polymerase is involved in PCR technique.
R : This enzyme remain active during the high temperature including denaturation of double stranded DNA.

Sol. Answer (1)
- A : Myocardial infarction can now be treated more effectively due to genetic engineering.
R : Streptokinase produced by *Streptococcus* and modified by RDT is used as a clot buster for removing thrombus.

Sol. Answer (1)
- A : Disarmed Ti plasmid can be utilised as a shuttle vector.
R : It can survive in both prokaryotic and eukaryotic organisms.

Sol. Answer (1)
- A : *Pst* I generates single stranded over hanging stretches in DNA after digestion that facilitate ligation.
R : These short extensions can form phosphodiester bonds with their complementary counterparts.

Sol. Answer (3)
The short extensions form covalent bonds with their complementary counter parts.
- A : Ethidium bromide helps in visualizing DNA in UV light only.
R : This intercalating agent absorbs light in range 260 – 330 nm.

Sol. Answer (1)
- A : To extract RNA from tomato cells it must first be treated with cellulase, protease and then deoxyribonuclease.
R : Deoxyribonuclease will digest DNA while RNA will be intact.

Sol. Answer (2)