Biotechnology Principles Processes Important Questions With Answers

NEET Biology 2023

1. What is the criterion for DNA fragments movement on agarose gel during gel electrophoresis?
   a) The larger the fragment size, the farther it moves **b) The smaller the fragment size, the farther it moves**
   c) Positively charged fragments move to farther end d) Negatively charged fragments do not move

   Solution : -
   During electrophoresis, DNA fragments separate according to their size through sieving effect provided by agarose gel.

2. A gene whose expression helps to identify transformed cell is known as :
   a) Selectable marker b) Vector c) Plasmid d) Structural gene

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

3. Which of the following restriction enzymes produces blunt ends?
   a) Sal I **b) Eeo RV** c) Xho I d) Hind III

   Solution : -
   Blunt ends have no overlap. Eco RV is a type II restriction endonuclease isolated from strains of E. coli.

4. A foreign DNA and plasmid cut by the same restriction endonuclease can be joined to form a recombinant plasmid using:
   a) Eeo RI b) Taq polymerase c) Polymerase III **d) Ligase**

   Solution : -
   When cut by the same restriction enzyme, the resultant DNA fragments have the same kind of 'sticky-ends' which are joined together using DNA ligases

5. Which of the following is not a feature of the plasmid?
   a) Single stranded b) Independent replication c) Circular structure d) Small, circular double-stranded

   Solution : -
   A plasmid is a small, circular doublestranded DNA molecule that is separate from the main chromosome. It is found in bacteria and some yeast.

6. Given below is a sample of a portion of DNA strand giving the base sequence on the opposite strands?
   5'_____GAATTC_____3'
   3'_____CTTAAG_____5'
   What is so special shown in it?
   a) Replication completed b) Deletion mutation c) Start codon at the 5' end
   d) Palindromic sequence of base pairs

   Solution : -
   Each restriction endonuclease recognises a specific palindromic nucleotide sequences in the DNA. The sequences read the same on the two strands in 5' - 3' direction. This is also true if read in the 3' - 5' direction.

7. The correct order of steps in Polymerase Chain Reaction (PCR) is :
   a) Denaturation, Extension, Annealing b) Annealing, Extension, Denaturation
   c) Extension, Denaturation, Annealing **d) Denaturation, Annealing, Extension**

   Solution : -
   Each cycle of PCR has three steps : (1) Denaturation, (2) Primer annealing, (3) Extension of primers.

8. Which of the following is not a component of downstream processing?
   a) Separation b) Purification c) Preservation **d) Expression**

   Solution : -
   It is a series of processes such as separation and purification of products after the biosynthetic stage

9. Stirred-tank bioreactors have been designed for:
   a) Purification of product b) Addition of preservatives to the product
   c) Availability of oxygen throughout the process d) Ensuring anaerobic conditions in the culture vessel

   Solution : -
   The stirrer facilitates even mixing and oxygen availability throughout the bioreactor.

10. The Taq polymerase enzyme is obtained from:
    a) Thiobacillus ferroxidans b) Bacillus subtilis c) Pseudomonas putida **d) Thermus aquaticus**

    Solution : -
    A thermostable DNA polymerase (isolated from a bacterium, Thermus quaticus), which remain active during the high temperature induced denaturation of double stranded DNA.

11. Which of the following is a restriction endonuclease?
    a) Protease b) DNase I c) RNase **d) Hind II**

    Solution : -
    The first restriction endonuclease-Hind II, whose functioning depended on a specific DNA nucleotide sequence was isolated and characterised five years later.

12. Which one is true statement regarding DNA polymerase used in PCR?
    a) It is used to ligate introduced DNA in recipient cell b) It serves as a selectable marker
    c) It is isolated from a virus **d) It remains active at high temperature**

    Solution : -
    The enzyme extends the primers using the nucleotides provided in the reaction and the genomic DNA as template. If the process of replication of DNA is repeated many times, the segment of DNA can be amplified to approximately billion times, i.e., 1 billion copies are made. Such repeated amplification is achieved by the use of a thermostable DNA polymerase (isolated from a bacterium, Thermus quaticus), which remain active during the high temperature induced denaturation of double stranded DNA

13. Which one of the following is a case of wrong matching?
    a) Somatic hybridization - Fusion of two diverse cells **b) Vector DNA - Site for tRNA synthesis**
    c) Micro propagation - In vitro production of plants in large numbers d) Callus - Unorganized mass of cells

    Solution : -
    RNA polymerase III activity is in nucleus for tRNA synthesis

14. The use of bio - resources by multinational companies & other organisations without proper authorisation from the countries & people concerned, is known as-
    a) Biopatent **b) Biopiracy** c) Biower d) Biodiversity

15. Who is the father of genetic engineering?
    a) Steward Linn b) Stanley Cohen **c) Paul Berg** d) Kary Mullis

    Solution : -

In 1972, genetic engineering was started by Paul Berg. He was able to introduce a gene of SV-40 virus into a bacterium with the help of lambda phage. Berg is often considered as "Father of genetic engineering". He was awarded Nobel Prize in 1980.

16. Which of the following processes/techniques can be included under biotechnology?
(i) In vitro fertilisation
(ii) Synthesis of a gene
(iii) Correcting a defective gene
(iv) Developing a DNA vaccine
a) (i) and (ii) b) (ii) and (iii) c) (iii) and (iv) **d) (i), (ii), (iii) and (iv)**

17. Plasmid used to construct the first recombinant DNA was isolated from which bacterium species?
a) Escherichia coli **b) Salmonella typhimurium** c) Agrobacterium tumefaciens d) Thermus aquaticus

Solution : -
The first recombinant DNA was constructed by Stanley Cohen and Herbert Boyer in 1972. They cut the piece of DNA from a plasmid carrying antibiotic resistance gene in the bacterium Salmonella typhimurium and linked it to the plasmid of Escherichia coli.

18. The term 'molecular scissors' refers to
a) recombinant DNA **b) restriction enzymes** c) Taq polymerase d) palindromic nucleotide sequences.

Solution : -
The restriction endonuclease enzyme inspects the length of a DNA sequence. Once it recognises specific sequence, it binds to the DNA and cuts each of the two strands of the double helix at specific points in their sugar phosphate back bone. Special sequence in the DNA recognised by restriction endonuclease is called palindromic nucleotide sequence. Restriction endonuclease enzymes are also known as molecular scissors or biological scissors or chemical knives or chemical scalpels.

19. The term 'chemical knife' refers to
a) endonucleases b) cellulases c) polymerases **d) endonucleases**

20. In recombinant DNA technology, the term vector refers to:
a) the enzyme that cuts DNA into restriction fragments b) the sticky end of a DNA fragment
c) a plasmid used to transfer DNA into a living cell d) a DNA fragment which carries only ori gene

Solution : -
The DNA used as a carrier for transferring a fragment of foreign DNA into a suitable host is called vehicle DNA or cloning vector or gene carrier. When desired gene is introduced into a vector, recombinant DNA is formed. Vectors may be plasmids, bacteriophages, cosmids, phagemids, Yeast Artificial Chromosomes (YACs), Bacterial Artificial Chromosomes (BACs), transposons, viruses, etc.

21. One of the key factors, which makes the plasmid the vector in genetic engineering is
a) its resistance to antibiotics b) its resistance to restriction enzymes **c) its ability to carry a foreign gene**
d) its ability to cause infection in the host.

Solution : -
Plasmids are extra-chromosomal, self replicating, usually circular, double stranded DNA molecules found naturally in many bacteria and also in some yeasts. Plasmids are usually not essential for normal cell growth and division, they often confer some traits to the host organism e.g., resistance to certain antibiotics. The plasmid that is used as carrier for transferring a fragment of foreign DNA into a suitable host is called vehicle DNA or cloning vector or gene carrier.

22. The term 'recombinant DNA' refers to

a) DNA of the host cell **b) DNA with a piece of foreign DNA** c) DNA with selectable marker

d) DNA with more than one recognition sites

Solution : -

After cutting the source DNA and the vector DNA with a specific restriction enzyme, the cut out 'gene of interest' from the source DNA and the cut vector with space are mixed and ligase enzyme is added. This results in the formation of rDNA or hybrid DNA or chimeric DNA.

23. The term 'chimeric DNA' refers to:
a) DNA with overhanging stretches b) DNA with palindromic sequence **c) a recombinant DNA**

d) molecular scissors

24. Which of the following contains the key tools for recombinant DNA technology?
(i) Restriction endonucleases, ligases, vectors
(ii) Ligases, host organism, polymerase enzymes
(iii) Vectors, Taq polymerase, primers
(iv) Restriction exonucleases, ligases, primers, bioreactors
a) (i), (ii) and (iii) **b) (i) and (ii)** c) (i), (iii) and (iv) d) (iii) and (iv)

25. Which of the following is not a tool of genetic engineering?
a) Cloning vector b) Restriction enzyme c) Foreign DNA **d) GMO**

Solution : -

Genetically modified organisms (GMOs) are plants, bacteria, fungi and animals whose genes have been changed by manipulations. They are not a tool of genetic engineering but a product of it.

26. The first restriction endonuclease isolated was:
a) EcoRI b) BamHI c) san **d) HindII**

27. The letter 'R' in EcoRI is derived from
a) the name of genus **b) the name of strain** c) the name of species d) the term 'restriction'.

Solution : -

In EcoRI, capital letter E comes from the genus Escherichia. The letters co are from the species coli. The letter R is from RY13 (strain). The Roman number I indicates that it was the first enzyme isolated from the bacterium E.coli RY 13.

28. The source of the restriction enzyme HindIII is
a) Escherichia coli RY 13 **b) Escherichia coli RY 13** c) Bacillus amy/oliquefaciens H

d) Streptomyces albus.

29. A restriction endonuclease breaks bonds between the
a) base pairs of a DNA molecule b) base pairs of a DNA-RNA hybrid molecule

c) sugar and phosphate components of a nucleic acid molecule

d) exons and introns of a DNA molecule.

30. Readthe given statements and select the correct option.
Statement 1 : Restriction endonuclease enzymes recognise a specific palindromic nucleotide sequence in the DNA.
Statement 2 : Restriction endonuclease enzymes are called as molecular scissors or biological scissors.
a) Both statements 1 and 2 are correct. b) Statement 1 is correct but statement 2 is incorrect.

c) Statement 1 is incorrect but statement 2 is correct. d) Both statements 1 and 2 are incorrect.

31. The sticky ends of a fragmented DNA molecule are made of

a) calcium salts b) endonuclease enzyme **c) unpaired bases** d) methyl groups

Solution : -

The single-stranded free ends that project from each fragment of DNA duplex are unpaired bases and are known as "sticky ends". Sticky ends can join with similar complementary ends of DNA fragment from some other sources.

32. Identify the palindromic sequence in the following.

a) $\frac{GAATTC}{CTTUUG}$ **b)** $\frac{GGATCC}{CCTAGG}$ c) $\frac{CCTGG}{GGACC}$ d) $\frac{CGATA}{GCTAA}$

Solution : -

The palindromes in DNA are base pair sequences that are the same when read forward (left to right) or backward (right to left) from a central axis of symmetry.

Thus, $\frac{GGATCC}{CCTAGG}$ is a palindromic sequence.

33. If a plasmid vector is digested with EcoRI at a single site then

a) one sticky end will be produced **b) two sticky ends will be produced**

c) four sticky ends will be produced d) six sticky ends will be produced.

Solution : -

Plasmid is a circular DNA, if it is digested at a single site, one fragment will be produced with two sticky ends.

34. How many fragments will be generated on the digestion of a closed circular DNA molecule with a restriction enzyme having six recognition sites on the DNA?

a) 5 b) 7 **c) 6** d) 9

Solution : -

When a closed circular DNA molecule is digested with a restriction enzyme having six recognition sites, it will produce 6 DNA fragments.

35. In recombinant DNA technology, a plasmid vector is cleaved by:

a) modified DNA ligase b) a heated alkaline solution **c) the same enzyme that cleaves the donor DNA**

d) the different enzymethan that cleaves the donor DNA

Solution : -

Plasmid vector is cleaved by same restriction enzyme that cleaves donor DNA leading to creation of sticky ends.

36. Gel electrophoresis is a

a) technique of separation of charged molecules under the influence of magnetic field

b)

technique of incorporation of DNA molecules into the cell through transient pores made due to electrical impulses

c)

technique of separation of DNA fragments through the pores of agarosegel underthe influence of electric field

d) technique of separation and purification of gene products.

Solution : -

Electrophoresis is a technique of separation of molecules such as DNA, RNA or protein, under the influence of an electrical field, so that they migrate in the direction of electrode bearing the opposite charge, viz. positively charged molecules move towards cathode (-ve electrode) and negatively charged molecules travel towards anode (+ve electrode) through a medium/matrix. Since DNA fragments are negatively charged molecules, they can be separated by allowing them to move towards the anode (+ve electrode) under an electric field through a matrix of agarose gel.

37. Which of the following steps should be performed by a person in order to visualise the bands of DNA fragments obtained from gel electrophoresis?

a) Exposure of DNA fragments to UV radiations.

b) Staining with bromophenol blue followed by exposure to UV radiations.

c) Staining with ethidium bromide followed by exposure to UV radiations.

d) Person can see the bands without staining.

38. Having become an expert on gel electrophoresis, you are asked to examine a gel. Where would you find the smallest segments of DNA?

a) Near the positive electrode, farthest away from the wells

b) Near the negative electrode, close to the wells

c) Near the negative electrode, farthest away from the wells

d) Near the middle, they tend to slow down after the first few minutes.

Solution : -

Since DNA is itself negatively charged, it would move towards the positive electrode. In gel electrophoresis, DNA fragments are separated on the basis of charge and masses. Thus, smaller the DNA fragment farther it moves from the well.

39. Which of the following tools of recombinant DNA technology is incorrectly paired with its use?

a) EcoRI - Production of sticky ends b) DNA ligase - Multiplication of rDNA molecules

c) ori- copy number d) Selectable marker - Identification of transformants

Solution : -

DNA ligases are also called genetic gum. They join two individual fragments of double stranded DNA by forming phosphodiester bonds between them thus help in sealing of DNA fragments. Therefore acts as molecular glue. The enzyme used most often is T4 DNA ligase.

40. If you want to recover many copies of the target DNA, you will choose a vector:

a) which does not have origin of replication b) which has antibiotic resistance gene

c) whose origin supports high copy number d) which has only one restriction site

Solution : -

Vectors that have high number per cell will have high copy number of their genome within the bacterial cell. If we link an alien piece of DNA with vector, we can multiply its number equal to the copy number of the vector. Any piece of DNA when linked to the 'or! sequence, can be made to replicate within the host cells. This property of 'or! is used to make a number of copies of the linked DNA. If we want to obtain many copies of the target DNA. then it should be cloned in such a vector whose 'or! supports high copy number.

41. Which of the following statements are correct?

(i) Restriction enzymes cut the strand of DNA a little away from the centre of the palindrome site, but between the same two bases on the opposite strands.

(ii) Hind II always cuts DNA molecules at a particular point by recognising a specific sequence of six base pairs.

(iii) Separated DNA fragments cannot be visualised without staining on an agarose gel electrophoresis.

(iv) 'Ori' is the sequence responsible for controlling the copy number.

(v) DNA is a positively charged molecule.

a) (i), (iii) and (v) **b) (i), (ii), (iii) and (iv)** c) (iii), (iv) and (v) d) (i), (ii), (iii), (iv) and (v)

Solution : -

DNA is a negatively charged molecule.

42. Which one of the following characteristics is generally not preferred for a cloning vector?

a) An origin of replication b) An antibiotic resistance marker **c) Multiple restriction sites**

d) A high copy number

43. Read the following statements and select the correct ones.
(i) Same kind of sticky ends are produced when a DNA has been cut by different restriction enzymes.
(ii) Exonucleases make cuts at specific positions within the DNA.
(iii) Hind II was the first restriction endonuclease to be isolated.
(iv) A bacteriophage has the ability to replicate within bacterial cells by integrating its DNA with bacterial DNA.
(v) Presence of more than one recognition sites for a enzyme within the vector complicates the gene cloning.
a) (i), (iii) and (v) b) (i) and (iv) **c) (iii) and (iv)** d) (ii), (iii) and (iv)

Solution : -
When cut by the same restriction enzyme, the resultant DNA fragments have the same kind of 'stickyends' produced, which can be joined together (end-to-end) using DNA ligase. Restriction enzymes are of two kinds - exonucleases and endonucleases. Exonucleases remove nucleotides from the ends of the DNA whereas endonucleases make cuts at specific positions within the DNA. Presence of more than one recognition sites within the vector will generate several fragments, which will complicate the gene cloning. Therefore, in order to link the alien DNA (or foreign DNA), the vector needs to have very few, preferably single, recognition/ cloning sites for the commonly used restriction enzymes.

44. Which of the following is not a cloning vector?
a) Cosmid b) pBR322 **c) Sa/I** d) Phagemid

45. The gene 'rop' present in pBR322 cloning vector, codes for:
a) the proteins involved in the translation **b) the proteins involved in the replication of the plasmid**

c) the proteins involved in the synthesis of ampicillin only

d) the proteins involved in the synthesis of tetracycline only.

46. Read the given statements and select the correct option.
Statement 1 : The cloning vector is required to have very few, preferably single, recognition sites for the commonly used restriction enzymes.
Statement 2 : Presence of more than one recognition sites within a cloning vector will generate several fragments, which will complicate the process of gene cloning.
a) Both statements 1 and 2 are correct. b) Statement 1 is correct but statement 2 is incorrect.

c) Statement 1 is incorrect but statement 2 is correct. d) Both statements 1 and 2 are incorrect.

47. pBR322 was the first artificial cloning vector to be constructed. What does "BR" stands for?
a) Bacteriophage and Recombinant **b) Boliver and Rodriguez** c) Boyer and Replicative

d) None of these

48. Read the following statements and select the correct ones.
(i) Electrophoresis is a technique used for the separation of molecules based on their size and charge.
(ii) Plasm ids are extra-chromosomal, self-replicating, usually circular, double stranded DNA molecules found naturally in many bacteria and also in some yeast.
(iii) It is not advisable to use an exonuclease enzyme while producing a recombinant DNA molecule.
(iv) In EcoRI, the roman numeral I indicates that it was the first enzyme isolated from E.coli RY 13.
a) (i) and (ii) b) (iii) and (iv) c) (i), (ii) and (iv) **d) (i), (ii), (iii) and (iv)**

49. In pBR322, tetracycline resistance gene (tet^R) has recognition site for which of the following restriction endonuclease?
a) HindIII **b) BamHI** c) EcoRI d) PstI

Solution : -

In plasmid vector pBR322, two unique restriction sites PstI and PvuI are located within the amp^R gene and BamHI, San, etc., are located within the tet^R gene. The presence of restriction sites within the marker genes tet^R and amp^R permits an easy selection for cells transformed with the recombinant pBR322. When restriction enzyme BamHI or SalI is used, the DNA insert is placed within the gene tet^R making it nonfunctional.

50. Which of the following is not a characteristic of pBR322 vector?

a) It was the first artificial cloning vector constructed in 1977 by Boliver and Rodriguez.

b) It is the most widely used, versatile and easily manipulated vector.

c) It has two antibiotic resistance genes tet^R and amp^R. **d) It does not have restriction site for Sa/I**