CHAPTER 11

Biotechnology : Principles and Processes

11.1 Principles of Biotechnology

1. The DNA molecule to which the gene of interest is integrated for cloning is called
(a) template (b) carrier
(c) transformer (d) vector. *(2015)*

2. The cutting of DNA at specific locations became possible with the discovery of
(a) selectable markers (b) ligases
(c) restriction enzymes (d) probes. *(2015)*

3. Which one of the following is a case of wrong matching?
(a) Somatic hybridization – Fusion of two diverse cells
(b) Vector DNA – Site for *t*RNA synthesis
(c) Micropropagation – *In vitro* production of plants in large numbers
(d) Callus – Unorganised mass of cells produced in tissue culture *(2012)*

4. Which one of the following techniques made it possible to genetically engineer living organisms?
(a) Recombinant DNA techniques
(b) X-ray diffraction
(c) Heavier isotope labelling
(d) Hybridization *(Mains 2011)*

5. Which of the following are used in gene cloning?
(a) Nucleoids (b) Lomasomes
(c) Mesosomes (d) Plasmids *(2010)*

6. Manipulation of DNA in genetic engineering became possible due to the discovery of
(a) restriction endonuclease
(b) DNA ligase
(c) transcriptase
(d) primase. *(2002)*

7. The bacteria generally used for genetic engineering is
(a) *Agrobacterium* (b) *Bacillus*
(c) *Pseudomonas* (d) *Clostridium*. *(2000)*

8. Which of the following is related to genetic engineering?
(a) Heterosis (b) Mutation
(c) Plastid (d) Plasmid *(1999)*

9. Genetic engineering is possible, because
(a) we can cut DNA at specific sites by endonucleases like DNase I
(b) restriction endonucleases purified from bacteria can be used *in vitro*
(c) the phenomenon of transduction in bacteria is well understood
(d) we can see DNA by electron microscope. *(1998)*

10. When scientists make an animal superior by view of genotype, introducing some foreign genes in it, is called
(a) immunization (b) genetic engineering
(c) tissue culture (d) biotechnology. *(1996)*

11. Which of the following organelles is related with genetic engineering?
(a) Mitochondria (b) Plasmids
(c) Golgi bodies (d) Lysosomes *(1994)*

11.2 Tools of Recombinant DNA Technology

12. Identify the wrong statement with regard to restriction enzymes.
(a) Each restriction enzyme functions by inspecting the length of a DNA sequence.
(b) They cut the strand of DNA at palindromic sites.
(c) They are useful in genetic engineering.
(d) Sticky ends can be joined by using DNA ligases. *(NEET 2020)*

13. Choose the correct pair from the following.
(a) Ligases - Join the two DNA molecules
(b) Polymerases - Break the DNA into fragments
(c) Nucleases - Separate the two strands of DNA
(d) Exonucleases - Make cuts at specific positions within DNA *(NEET 2020)*

14. The specific palindromic sequence which is recognised by *Eco*RI is
(a) 5′ - GAATTC - 3′ (b) 5′ - GGAACC - 3′
3′ - CTTAAG - 5′ 3′ - CCTTGG - 5′
(c) 5′ - CTTAAG - 3′ (d) 5′ - GGATCC - 3′
3′ - GAATTC - 5′ 3′ - CCTAGG - 5′.
(NEET 2020)

15. The sequence that controls the copy number of the linked DNA in the vector, is termed
(a) selectable marker (b) Ori site
(c) palindromic sequence (d) recognition site.
(NEET 2020)

16. In gel electrophoresis, separated DNA fragments can be visualized with the help of
(a) acetocarmine in bright blue light
(b) ethidium bromide in UV radiation
(c) acetocarmine in UV radiation
(d) ethidium bromide in infrared radiation.
(NEET 2020)

17. Following statements describe the characteristics of the enzyme restriction endonuclease. Identify the incorrect statement.
(a) The enzyme recognises a specific palindromic nucleotide sequence in the DNA.
(b) The enzyme cuts DNA molecule at identified position within the DNA.
(c) The enzyme binds DNA at specific sites and cuts only one of the two strands.
(d) The enzyme cuts the sugar-phosphate backbone at specific sites on each strand. *(NEET 2019)*

18. A selectable marker is used to
(a) help in eliminating the non-transformants, so that the transformants can be regenerated
(b) identify the gene for a desired trait in an alien organism
(c) select a suitable vector for transformation in a specific crop
(d) mark a gene on a chromosome for isolation using restriction enzyme. *(Odisha NEET 2019)*

19. Given below are four statements pertaining to separation of DNA fragments using gel electrophoresis. Identify the incorrect statements.
(i) DNA is negatively charged molecule and so it is loaded on gel towards the anode terminal.
(ii) DNA fragments travel along the surface of the gel whose concentration does not affect movement of DNA.
(iii) Smaller the size of DNA fragment larger is the distance it travels through it.
(iv) Pure DNA can be visualized directly by exposing UV radiation.
Choose correct answer from the options given below.
(a) (i), (iii) and (iv) (b) (i), (ii) and (iii)
(c) (ii), (iii) and (iv) (d) (i), (ii) and (iv)
(Odisha NEET 2019)

20. Which of the following is commonly used as a vector for introducing a DNA fragment in human lymphocytes?
(a) Retrovirus (b) Ti plasmid
(c) λ phage (d) pBR322 *(NEET 2018)*

21. The DNA fragments separated on an agarose gel can be visualised after staining with
(a) acetocarmine (b) aniline blue
(c) ethidium bromide (d) bromophenol blue.
(NEET 2017)

22. DNA fragments are
(a) negatively charged (b) neutral
(c) either positively or negatively charged depending on their size
(d) positively charged. *(NEET 2017)*

23. A gene whose expression helps to identify transformed cell is known as
(a) vector (b) plasmid
(c) structural gene (d) selectable marker.
(NEET 2017)

24. What is the criterion for DNA fragments movement on agarose gel during gel electrophoresis ?
(a) The smaller the fragment size, the farther it moves.
(b) Positively charged fragments move to farther end.
(c) Negatively charged fragments do not move.
(d) The larger the fragment size, the farther it moves. *(NEET 2017)*

25. A foreign DNA and plasmid cut by the same restriction endonuclease can be joined to form a recombinant plasmid using
(a) EcoRI (b) Taq polymerase
(c) polymerase III (d) ligase. *(NEET-II 2016)*

26. Which of the following restriction enzymes produces blunt ends?
(a) *Sal*I (b) *Eco*RV (c) *Xho*I (d) *Hin*dIII
(NEET-II 2016)

27. Which of the following is not a feature of the plasmids?
(a) Transferable (b) Single-stranded
(c) Independent replication
(d) Circular structure *(NEET-I 2016)*

28. Which of the following is a restriction endonuclease?
(a) DNase I (b) RNase
(c) *Hind* II (d) Protease
(NEET-I 2016)

29. The introduction of T-DNA into plants involves
(a) exposing the plants to cold for a brief period
(b) allowing the plant roots to stand in water
(c) infection of the plant by *Agrobacterium tumefaciens*
(d) altering the pH of the soil, then heat-shocking the plants. *(2015)*

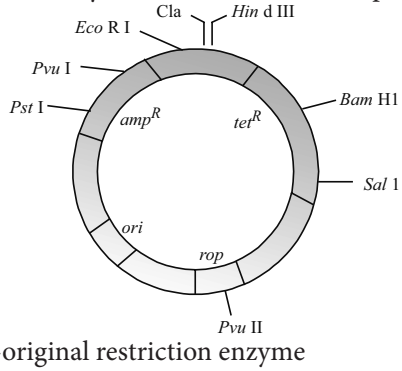
30. Which vector can clone only a small fragment of DNA?
(a) Bacterial artificial chromosome
(b) Yeast artificial chromosome
(c) Plasmid (d) Cosmid *(2014)*

31. Commonly used vectors for human genome sequencing are
(a) T - DNA (b) BAC and YAC
(c) expression vectors (d) T/A cloning vectors. *(2014)*

32. The colonies of recombinant bacteria appear white in contrast to blue colonies of non-recombinant bacteria because of
(a) insertional inactivation of alpha galactosidase in recombinant bacteria
(b) inactivation of glycosidase enzyme in recombinant bacteria
(c) non-recombinant bacteria containing beta galactosidase
(d) insertional inactivation of alpha galactosidase in non-recombinant bacteria. *(NEET 2013)*

33. DNA fragments generated by the restriction endonucleases in a chemical reaction can be separated by
(a) electrophoresis (b) restriction mapping
(c) centrifugation
(d) polymerase chain reaction. *(NEET 2013)*

34. The given figure is the diagrammatic representation of the *E. coli* vector pBR322. Which one of the given options correctly identifies its certain component(s)?



(a) *ori*-original restriction enzyme
(b) *rop*-reduced osmotic pressure
(c) *Hin*dIII, *Eco*RI - selectable markers
(d) amp^R, tet^R–antibiotic resistance genes *(2012)*

35. A single strand of nucleic acid tagged with a radioactive molecule is called
(a) vector (b) selectable marker
(c) plasmid (d) probe. *(2012)*

36. For transformation, micro-particles coated with DNA to be bombarded with gene gun are made up of
(a) silver or platinum (b) platinum or zinc
(c) silicon or platinum (d) gold or tungsten. *(2012)*

37. Biolistics (gene-gun) is suitable for
(a) disarming pathogen vectors
(b) transformation of plant cells
(c) constructing recombinant DNA by joining with vectors
(d) DNA fingerprinting. *(Mains 2012)*

38. In genetic engineering, the antibiotics are used
(a) as selectable markers
(b) to select healthy vectors
(c) as sequences from where replication starts
(d) to keep the cultures free of infection. *(Mains 2012)*

39. Which one of the following represents a palindromic sequence in DNA?
(a) 5′ - GAATTC - 3′ (b) 5′ - CCAATG - 3′
3′ - CTTAAG - 5′ 3′ - GAATCC - 5′
(c) 5′ - CATTAG - 3′ (d) 5′ - GATACC - 3′
3′ - GATAAC - 5′ 3′ - CCTAAG - 5′ *(Mains 2012)*

40. 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?
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 *(2011)*

41. There is a restriction endonuclease called *Eco*RI. What does "co" part in it stand for?
(a) colon (b) coelom
(c) coenzyme (d) coli *(2011)*

42. Agarose extracted from sea weeds is used in
(a) spectrophotometry (b) tissue culture
(c) PCR (d) gel electrophoresis. *(2011)*

43. Which one of the following palindromic base sequences in DNA can be easily cut at about the middle by some particular restriction enzyme?
(a) 5′ —— CGTTCG —— 3′
3′ —— ATGGTA —— 5′
(b) 5′ —— GATATG —— 3′
3′ —— CTACTA —— 5′
(c) 5′ —— GAATTC —— 3′
3′ —— CTTAAG —— 5′
(d) 5′ —— CACGTA —— 3′
3′ —— CTCAGT —— 5′ *(2010)*

44. Which one of the following is used as vector for cloning genes into higher organisms?
(a) Baculovirus
(b) *Salmonella typhimurium*
(c) *Rhizopus nigricans* (d) Retrovirus *(2010)*

45. DNA or RNA segment tagged with a radioactive molecule is called
(a) vector (b) probe
(c) clone (d) plasmid. *(2010)*

46. Restriction endonucleases are enzymes which
(a) make cuts at specific positions within the DNA molecule
(b) recognize a specific nucleotide sequence for binding of DNA ligase
(c) restrict the action of the enzyme DNA polymerase
(d) remove nucleotides from the ends of the DNA molecule. *(2010)*

47. In genetic engineering, a DNA segment (gene) of interest, is transferred to the host cell through a vector. Consider the following four agents (i-iv) in this regard and select the correct option about which one or more of these can be used as a vector/vectors.
(i) Bacterium (ii) Plasmid
(iii) Plasmodium (iv) Bacteriophage
(a) (i), (ii) and (iv) (b) (i) only
(c) (i) and (iii) (d) (ii) and (iv)
(Mains 2010)

48. Polyethylene glycol method is used for
(a) biodiesel production
(b) seedless fruit production
(c) energy production from sewage
(d) gene transfer without a vector. *(2009)*

49. Which one of the following is commonly used in transfer of foreign DNA into crop plants?
(a) *Meloidogyne incognita*
(b) *Agrobacterium tumefaciens*
(c) *Penicillium expansum*
(d) *Trichoderma harzianum* *(2009)*

50. Gel electrophoresis is used for
(a) construction of recombinant DNA by joining with cloning vectors
(b) isolation of DNA molecules
(c) cutting of DNA into fragments
(d) separation of DNA fragments according to their size. *(2008)*

51. The linking of antibiotic resistance gene with the plasmid vector became possible with
(a) DNA polymerase (b) exonucleases
(c) DNA ligase (d) endonucleases. *(2008)*

52. Restriction endonuclease
(a) synthesizes DNA
(b) cuts the DNA molecule randomly
(c) cuts the DNA molecule at specific sites
(d) restricts the synthesis of DNA inside the nucleus. *(2006)*

53. Two microbes found to be very useful in genetic engineering are
(a) crown gall bacterium and *Caenorhabditis elegans*
(b) *Escherichia coli* and *Agrobacterium tumefaciens*
(c) *Vibrio cholerae* and a tailed bacteriophage
(d) *Diplococcus sp*. and *Pseudomonas sp*. *(2006)*

54. Restriction endonucleases
(a) are present in mammalian cells for degradation of DNA when the cell dies
(b) are used in genetic engineering for ligating two DNA molecules
(c) are used for *in vitro* DNA synthesis
(d) are synthesized by bacteria as part of their defense mechanism. *(2004)*

55. The *Ti* plasmid, is often used for making transgenic plants. The plasmid is found in
(a) *Azotobacter*
(b) *Rhizobium* of the roots of leguminous plants
(c) *Agrobacterium*
(d) Yeast as a 2 mm plasmid. *(2004)*

56. The most thoroughly studied of the known bacteria-plant interactions is the
(a) cyanobacterial symbiosis with some aquatic ferns
(b) gall formation on certain angiosperms by *Agrobacterium*
(c) nodulation of *Sesbania* stems by nitrogen fixing bacteria
(d) plant growth stimulation by phosphate-solubilising bacteria. *(2004)*

57. Which one of the following bacteria has found extensive use in genetic engineering work in plants?
(a) *Clostridium septicum*
(b) *Xanthomonas citri*
(c) *Bacillus coagulens*
(d) *Agrobacterium tumefaciens* *(2003)*

58. Which of the following enzymes are used to join bits of DNA?
(a) Ligase (b) Primase
(c) DNA polymerase (d) Endonuclease
(2002)

59. A mutant strain of T_4 - Bacteriophage, R-II, fails to lyse the *E. coli* but when two strains R-IIX and R-IIY are mixed then they lyse the *E. coli*. What may be the possible reason?
(a) Bacteriophage transforms in wild.
(b) It is not mutated.
(c) Both strains have similar cistrons.
(d) Both strains have different cistrons.
(2001)

60. Which of the following cut the DNA from specific places?
(a) *E.*coli restriction endonuclease I
(b) Ligase
(c) Exonuclease
(d) Alkaline phosphate *(2001)*

61. Maximum number of bases in plasmids discovered so far
(a) 50 kilo base (b) 500 kilo base
(c) 5000 kilo base (d) 5 kilo base. *(2001)*

62. Plasmid has been used as vector because
(a) it is circular DNA which have capacity to join to eukaryotic DNA
(b) it can move between prokaryotic and eukaryotic cells
(c) both ends show replication
(d) it has antibiotic resistance gene. *(2000)*

63. The process of replication in plasmid DNA, other than initiation, is controlled by
(a) mitochondrial gene
(b) plasmid gene
(c) bacterial gene
(d) none of these. *(1999)*

64. Recombinant DNA is achieved by cleaving the pro-DNAs by
(a) ligase
(b) restriction endonuclease
(c) primase
(d) exonucleases. *(1998)*

65. Two bacteria found to be very useful in genetic engineering experiments are
(a) *Nitrobacter* and *Azotobacter*
(b) *Rhizobium* and *Diplococcus*
(c) *Nitrosomonas* and *Klebsiella*
(d) *Escherichia* and *Agrobacterium.* *(1998)*

66. Restriction endonucleases are
(a) used for *in vitro* DNA synthesis
(b) used in genetic engineering
(c) synthesized by bacteria
(d) present in mammalian cells for degradation of DNA. *(1998)*

67. The restriction enzymes are used in genetic engineering, because
(a) they can cut DNA at specific base sequence
(b) they are nucleases that cut DNA at variable sites
(c) they can degrade harmful proteins
(d) they can join different DNA fragments. *(1995)*

11.3 Processes of Recombinant DNA Technology

68. Match the organism with its use in biotechnology.

(A) *Bacillus thuringiensis*	(i) Cloning vector
(B) *Thermus aquaticus*	(ii) Construction of first *r*DNA molecule
(C) *Agrobacterium tumefaciens*	(iii) DNA polymerase
(D) *Salmonella typhimurium*	(iv) Cry proteins

Select the correct option from the following.

	(A)	**(B)**	**(C)**	**(D)**
(a)	(ii)	(iv)	(iii)	(i)
(b)	(iv)	(iii)	(i)	(ii)
(c)	(iii)	(ii)	(iv)	(i)
(d)	(iii)	(iv)	(i)	(ii)

(NEET 2020)

69. DNA precipitation out of a mixture of biomolecules can be achieved by treatment with
(a) chilled chloroform
(b) isopropanol
(c) chilled ethanol
(d) methanol at room temperature. *(NEET 2019)*

70. Which one of the following equipments is essentially required for growing microbes on a large scale, for industrial production of enzymes?
(a) Bioreactor (b) BOD incubator
(c) Sludge digester (d) Industrial oven
(NEET 2019)

71. The correct order of steps in Polymerase Chain Reaction (PCR) is
(a) extension, denaturation, annealing
(b) annealing, extension, denaturation
(c) denaturation, extension, annealing
(d) denaturation, annealing, extension.
(NEET 2018)

72. The process of separation and purification of expressed protein before marketing is called
(a) downstream processing
(b) bioprocessing
(c) postproduction processing
(d) upstream processing. *(NEET 2017)*

73. 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. *(NEET-II 2016)*

74. Which of the following is not a component of downstream processing?
(a) Separation (b) Purification
(c) Preservation (d) Expression
(NEET-II 2016)

75. The *Taq* polymerase enzyme is obtained from
(a) *Bacillus subtilis*
(b) *Pseudomonas putida*
(c) *Thermus aquaticus*
(d) *Thiobacillus ferroxidans*. *(NEET-I 2016)*

76. An analysis of chromosomal DNA using the Southern hybridization technique does not use
(a) electrophoresis (b) blotting
(c) autoradiography (d) PCR. *(2014)*

77. *In vitro* clonal propagation in plants is characterized by
(a) PCR and RAPD
(b) Northern blotting
(c) electrophoresis and HPLC
(d) microscopy. *(2014)*

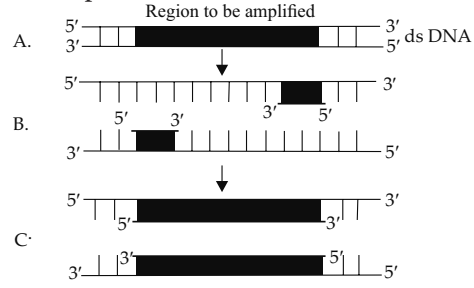
78. Which of the following is not correctly matched for the organism and its cell wall degrading enzyme?
(a) Algae – Methylase
(b) Fungi – Chitinase
(c) Bacteria – Lysozyme
(d) Plant cells – Cellulase *(NEET 2013)*

79. During the process of isolation of DNA, chilled ethanol is added to
(a) precipitate DNA
(b) break open the cell to release DNA
(c) facilitate action of restriction enzymes
(d) remove proteins such as histones.
(Karnataka NEET 2013)

80. PCR and restriction fragment length polymorphism are the methods for
(a) study of enzymes
(b) genetic transformation
(c) DNA sequencing
(d) genetic fingerprinting. *(2012)*

81. Which one is a true statement regarding DNA polymerase used in PCR?
(a) It is used to ligate introduced DNA in recipient cells.
(b) It serves as a selectable marker.
(c) It is isolated from a virus.
(d) It remains active at high temperature. *(2012)*

82. 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?



(a) B - denaturation at a temperature of about 98°C separating the two DNA strands
(b) A - denaturation at a temperature of about 50°C
(c) C - extension in the presence of heat stable DNA polymerase
(d) A - annealing with two sets of primers
(Mains 2012)

83. Stirred-tank bioreactors have been designed for
(a) addition of preservatives to the product
(b) purification of the product
(c) ensuring anaerobic conditions in the culture vessel
(d) availability of oxygen throughout the process.
(2010)

ANSWER KEY

1.	(d)	**2.**	(c)	**3.**	(b)	**4.**	(a)	**5.**	(d)	**6.**	(a)	**7.**	(a)	**8.**	(d)	**9.**	(b)	**10.**	(b)
11.	(b)	**12.**	(d)	**13.**	(a)	**14.**	(a)	**15.**	(b)	**16.**	(b)	**17.**	(c)	**18.**	(a)	**19.**	(d)	**20.**	(a)
21.	(c)	**22.**	(a)	**23.**	(d)	**24.**	(a)	**25.**	(d)	**26.**	(b)	**27.**	(b)	**28.**	(c)	**29.**	(c)	**30.**	(c)
31.	(b)	**32.**	(c)	**33.**	(a)	**34.**	(d)	**35.**	(d)	**36.**	(d)	**37.**	(b)	**38.**	(a)	**39.**	(a)	**40.**	(d)
41.	(d)	**42.**	(d)	**43.**	(c)	**44.**	(d)	**45.**	(b)	**46.**	(a)	**47.**	(d)	**48.**	(d)	**49.**	(b)	**50.**	(d)
51.	(c)	**52.**	(c)	**53.**	(b)	**54.**	(d)	**55.**	(c)	**56.**	(b)	**57.**	(d)	**58.**	(a)	**59.**	(d)	**60.**	(a)
61.	(b)	**62.**	(a)	**63.**	(c)	**64.**	(b)	**65.**	(d)	**66.**	(b)	**67.**	(a)	**68.**	(b)	**69.**	(c)	**70.**	(a)
71.	(d)	**72.**	(a)	**73.**	(c)	**74.**	(d)	**75.**	(c)	**76.**	(d)	**77.**	(a)	**78.**	(a)	**79.**	(a)	**80.**	(d)
81.	(d)	**82.**	(c)	**83.**	(d)														