Ravi Maths Tuition

9 Biotechnology Principles and Processes

12th Standard

Biology

Multiple Choice Question 88 x 1 = 88

1) Human genome project was discovered by

(a) Francis Collins and Roderick (b) Watson and Crick (c) Beadle and Tatum

(d) Paul Berg and Wollman

2) Transgenic plants are developed by

(a) clone and genetically modified genes (b) introduction of foreign genes (c) genetic engineering

(d) purified genes

3) Restriction endonucleases are most widely used in recombinant DNA technology. They are obtained from

(a) Bacteriophages (b) Bacterial cells (c) Plasmids (d) All prokaryotic cells

4) Which is used in molecular genetic engineering?

(a) Tomato (b) Tobacco (c) Carrot (d) Arabidopsis

5) Viral genome incorporated into host DNA is called

(a) Prophase (b) Prophage (c) Bacteriophage (d) None of these

6) Two microbes found to be very useful in genetic engineering are

(a) Crown gall bacterium and Coenorhabdities elegans

(b) Escherichia coli and Agrobacterium tumefaciens (c) Vibria cholerae and a tailed bacteriophage

(d) Diplococcus sp. and Pseudomonas sp.

7) 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

8) The process of reverse transcription was brought to light by the work of

(a) George Beadle and Edward Tatum (b) Garrod (c) H.W. Temin and D. Baltimore

(d) R.W. Holley and Grover (e) Marshall and W. Nirenberg

9) Genetic engineering is possible because

(a) the phenomenon of transduction in bacteria is well understood

(b) we can see DNA by electron microscope

(c) we can cut DNA at specific sites by endonucleases like DNAase 1

(d) restriction endonucleases purified from bacteria can be used in vitro

10) Find out the wrong statement

(a) Mobile genetic elements, transposons were visualized by Barbara Mc. Clintock

(b) Udder cell, a somatic cell is used to produce the cloned sheep by nuclear transplantation method.

(c) In pedigree analysis, a person immediately affected by an action is called propositus.

(d) Dr. Ian Wilmut produced a cloned sheep called Dolly.

(e) DNA ligases are used to cleave a DNA molecule.

11) Who discovered recombinant DNA (rDNA) technology?

(a) Har Gobind Khorana (b) James D. Watson (c) Stanley Cohen and Herbert Boyer
(d) Walter Sutton and Avery (e) Williams Bateson and Hugo de Vries

12) Plasmids are

(a) cDNA (b) mitochondrial DNA (c) Circular extrachromosomal DNA in bacteria (d) Viral RNA

13) Which conserved motifs are found in E. coli genes?

(a) TATA box (b) CAAT box (c) Pribnow box (d) All of these

14) A technique which involves deliberate manipulation of genes within or between species is called

(a) Gene therapy (b) Hybridoma technology (c) Tissue culture (d) Genetic engineering

15) One of the key factors, which makes the plasmid the vector in genetic engineering is that

(a) It is resistant to antibiotics. (b) It is resistant to restriction enzymes.
(c) Its ability to carry a foreign gene. (d) Its ability to cause infection in the host.

16) Which of the following is used as a best genetic vector in plants?

(a) Bacillus thuriengenesis (b) Agrobacterium tumifaciens (c) Pseudomonas putida (d) All of these

17) Which one among the following is just a cloning plasmid not an expression plasmid?

(a) $_{P}$BAD-18-Cam (b) $_{P}$B CSK (c) $_{P}$UC 18 (d) $_{P}$ET

18) The technique of genetic engineering includes

(a) creation of recombinant DNA (b) use of gene cloning (c) gene transfer (d) All of these.

19) In plant biotechnology, root tumours are induced in plant using the bacterium

(a) Agrobacterium rhizogenes (b) Agrobacterium basilis (c) Rhizobium (d) None of these

20) The polymerase chain reaction is a technique that

(a) Is used for in vivo replication of DNA (b) Is used for in vivo synthesis of mRNA
(c) Is used for in vitro synthesis of mRNA
(d) Is used for in vitro replication of specific DNA sequence using thermostable DNA polymerase

21) The construction of the first recombinant DNA was done by using the native plasmid of

(a) E. coli (b) Salmonella typhimurium (c) B. thuringiensis (d) Yeast

22) The linking of antibiotic resistance gene with the plasmid vector became possible with

(a) DNA polymerase (b) Exonuclease (c) DNA ligase (d) Enonucleases

23) 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

24) Cry 1 endotoxins obtained from Bacillus thuringiensis are effective against

(a) Nematodes (b) Boll worms (c) Mosquitoes (d) Flies

25) Molecular scissors which cut DNA at specific site is

(a) Pectinase (b) Polymerase (c) Restriction endonuclease (d) Ligase

26) Polyethylene glycol method is used for

(a) Biodiesel production (b) Seedless fruit production (c) Energy production from sewage
(d) Gene transfer without a vector

27) An antibiotic resistance gene in a vector usually helps in the selection of:

(a) Competent cells (b) Transformed cells (c) Recombinant cells (d) None of these

28) Significance of 'heat-shock' method in bacterial transformations is to facilitate:

(a) Binding 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

29) The role of DNA ligase in the construction of a recombinant DNS molecule is:

(a) Formation of phosphodiester bond between two DNA fragments

(b) Formation of hydrogen bonds between sticky ends of DNA fragments

(c) Ligation of all purine and pyrimidine bases (d) None of the above

30) Which of the following bacteria is not a source of restriction endonuclease?

(a) Haemophilus influenzae (b) Escherichia coli (c) Agrobacterium tumefaciens

(d) Bacillus amyloli

31) Which of the following steps are catalysed by Taq polymerase in a PCR reaction?

(a) Denaturation of template DNA (b) Annealing of primers to template DNA

(c) Extension of primer end on the template DNA (d) All of the above

32) A bacterial cell was transformed with a recombinant DNA 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 can not 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

33) Which of the following should be chosen for best yield if one were to produce a recombinant protein in large amounts?

(a) Laboratory flask of largest capacity (b) A stirred-tank bioreactor without in-lets and out-lets

(c) A continuous culture system (d) Any of the above

34) Who among the following was awarded the Nobel Prize for the development of PCR technique?

(a) Herbert Boyer (b) Hargovind Khurana (c) Kary Mullis (d) Arthur Kornberg

35) Which of the following statements does not hold true for restriction enzyme?

(a) It recognises a palindromic nucleotide sequence (b) It is an endonuclease

(c) It is isolated from viruses (d) It produces the same kind of sticky ends in different DNA molecules

36) Restriction endomuclease are enzyme which

(a) remove nucleotides from the ends of DNA molecule.

(b) make cuts at specific positions within the DNA molecule.

(c) recognise a specific nucleotide sequence for binding of DNA ligase.

(d) restrict the action of enzyme DNA polymerase.

37) Which one of the following pallindromic base sequences in DNA can be easily cut at about the middle by some particular restriction enzyme.

(a) 5' CACGTA 3' ; 3' CTCAGT 5' (b) 5' CGTTCG 3' ; 3' ATGGTA 5' (c) 5' GATATC 3' ; 3' CTACTA 5'

(d) 5' GAATTC 3' ; 3' CTTAAG 5'

38) DNA gyrase, the enzyme that participates in the process of DNA replication, is a type of

(a) DNA ligase (b) DNA polymerase (c) DNA topiosomerase (d) Reverse transcriptase

39) During transcription in eukaryotic cell the RNA splicing and RNA capping takes place inside the

(a) Nucleus (b) Ribosomes (c) Dictyosomes (d) ER

40) Which of the following are used in gene cloning?

(a) Nucleoids (b) Lomasomes (c) Mesosomes (d) Plasmids

41) Restriction anzymes

(a) restrict elongation of DNA (b) cut DNA at specific locations (c) link tagether two pieces of DNA

(d) restrict DNA replication

42) A mixture DNA fragments A, B, C and D, with molecular weights of A + B = C > B and D > C was subjected to agarose get electrophoresis. The position of these fragments from cathode to anode sides of the gel would be

(a) B, A, C, D (b) A, B, C, D (c) C, B, A, D (d) B, A, D, C

43) What will be the correct gene expression pathway?

(a) gene - > mRNA - > transcription - translation - protein

(b) transcription - gene - translation - mRNA - protein

(c) gene - transcription - mRNA - translation - protein

(d) gene - translation -mRNA - transcription -protein

44) Enzyme that cleaves nucleic acids within the polynucleotide chain is known as

(a) endonuclease (b) exonuclease (c) arysulfatase (d) phosphotriesterase

45) Agarose extracted from sea weeds is used in

(a) spectrophotometry (b) tissue culture (c) PCR (d) gel electrophoresis

46) Which one of the following technique made it possible to genetically engineer living organisms?

(a) recombinant DNA technique (b) X-ray diffraction (c) heavier isotope labelling (d) hybridization

47) Read the following four statements (A-D) about certain mistakes in two of them:
(A) The first transgenic buffalo, Rosie produced milk which was human alpha-lactalbumin enriched
(B) Restriction enzymes are used in isolation of DNA from other macromolecules
(C) Downstream processing is one of the steps of rDNA technology
(D) Disarmed pathogen vectors are also used in transfer of rDNA into the host
Which of the two statements have mistakes?

(a) B and C (b) C and D (c) A and C (d) A and B

48) Given below is a sample of a portion of DNA strand giving the base sequence on the opposite strands. What is to special shown in it?
5'.....GAATTC.....3'
3'.....CTTAAG.....5'

(a) replication completed (b) deletion mutation (c) start codon at the 5' end

(d) pallindromic sequence of base pairs

49) There is a restriction endonuclease called EcoRI. What does 'co' part in it stand for?

(a) colon (b) coelom (c) coenzyme (d) coli

50) Which one is a 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

51) Which one of the following is a case of wrong matching?

(a) Somantic 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 cell produced in tissue culture

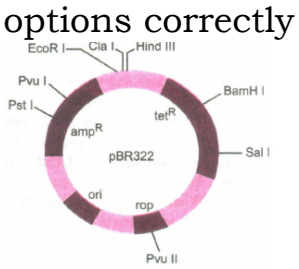
52) A single strand of nucleic acid tagged with a radioactive molecule is called:

(a) Vector (b) Selectable marker (c) Plasmid (d) Probe

53) 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

54) The figure below is the diagrammatic representation of the E.Coli vector $_{P}$BR 322. Which one of the given options correctly identifies its certain component (s)?



(a) ori-original restriction enzyme (b) rop-reduced osmotic pressure

(c) Hind III, EcoRI-selectable markers (d) amp^R, tet^R-antbiotic resistance genes

55) Biolistics (gene-gun) is suitable for

(a) disarming pathogen vectors (b) transformations of plant cells

(c) constructing recombinant DNA by joining with vectors (d) DNA fingerprinting

56) 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

57) Restriction enzyme Eco RI cuts the DNA between bases G and A only when sequence in DNA is

(a) GATATC (b) GAATTC (c) GATTCC (d) GAACTT

58) Cohen and Boyer isolated an antibiotic resistance gene, by cutting out a piece of DNA from a plasmid which was responsible for conferring antibiotic resistance, in the year

(a) 1962 (b) 1965 (c) 1972 (d) 1982

59) The restriction enzyme(s) used in recombinant DNA technology that make staggered cuts in DNA leaving sticky ends is/are

(a) Eco R I (b) Hind III (c) Bam H I (d) all of these

60) Match the items in Column I with those in Column II.

Column I	Column II
A. Sea weeds	1. Gel electrophoresis
B. Staining of DNA	2. Source of Agarose
C. Separation of DNA fragments	3. Isolation of DNA fragments from the gel
D. Elution	4. Ethidium bromide

(a) A - 2, B - 4, C - 1, D - 3 (b) A - 4, B - 2, C - 1, D - 3 (c) A - 2, B - 4, C - 3, D - 1

(d) A - 3, B - 4, C - 1, D - 2

61) Match the Column I with the Column II.

Column I	**Column II**
A. Competent host	1. Separation and purification
B. Cloning vector	2. Culturing of cells in large volumes
C. Downstream	3. Taq polymerase
D. PCR	4. Divalent cation (Ca^{2+})
E. Bioreactor	5. pBR 322
	6. Gel electrophoresis

(a) A - 4, B - 5, C - 1, D - 3, E - 2 (b) A - 5, B - 4, C - 1, D - 3, E - 2

(c) A - 4, B - 5, C - 2, D - 3, E - 1 (d) A - 4, B - 3, C - 1, D - 5, E - 2

62) Biolistics (gene gun) is suitable for

(a) introducing rDNA into plant cells (b) introducing rDNA into animal cells

(c) disarming the pathogen vectors (d) DNA fingerprinting.

63) In genetic engineering experiments, restriction enzymes are used for

(a) viral DNA (b) bacterial DNA (c) eukaryotic DNA (d) any type of DNA.

64) The DNA fragments produced by the use of restriction endonucleases can be separated by

(a) polymerase chain reaction (b) gel electrophoresis (c) density gradient centrifugation

(d) any of the above.

65) Plasmids in bacterial cells are

(a) extra-chromosomal DNA, which cannot replicate

(b) extra-chromosomal DNA, which can self - replicate (c) extra DNA -associated with the genome

(d) extra DNA, associated with the genome, but cannot replicate.

66) The DNA polymerase enzyme used in PCR is obtained from

(a) Thermus aquaticus (b) Escherichia coli (c) Agrobacterium tumefaciens

(d) Salmonella typhimurium

67) While isolating DNA from bacteria, which of the following enzymes is not used?

(a) Lysozyme (b) Ribonuclease (c) Deoxyribonuclease (d) Protease

68) Significance of 'heat shock' method in bacterial transformation is to facilitate

(a) binding 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

69) Which of the given statement is correct in the context of observing DNA separated by agarose gel electrophoresis?

(a) DNA can be seen in visible light (b) DNA can be seen without staining in visible light

(c) Ethidium bromide stained DNA can be seen in visible light

(d) Ethidium bromide stained DNA can be seen under exposure to UV light

70) '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 ofthe multiplication of bacteriophage in bacteria (d) all of the above

71) In an experiment, recombinant DNA bearing ampicillin-resistance gene is transferred into E.coli cells. The host cells are then cultured on a medium containing ampicillin. The result will be

(a) both transformants and non-transform ants cannot survive.

(b) both transformants and non-transformants can survive.

(c) transformants only and not the nontransformants can survive.

(d) transformants cannot survive, but nontransformants can not.

72) Restriction endonucleases are enzymes, which

(a) make cuts at specific positions within the DNA molecule

(b) recognise a specific nucleotide sequence for binding and then cleave both the strands of DNA

(c) restrict the action of the enzyme DNA polymerase

(d) remove nucleotides from the ends of the DNA molecule

73) GAATTC is recognition site of which restriction endonucleases?

(a) Hae III (b) EcoRI (c) BamHI (d) Hind III

74) EcoRI cleaves the DNA strands to produce

(a) satellite ends (b) blunt end (c) ori replication end (d) sticky ends

75) The restriction enzyme acts on recognition site which is palindromic and has specified base pairs. This means that the recognition site has

(a) base sequences identical to one another (b) base sequences that consist of only four bases

(c) the base sequence in one DNA strand reading from one end the same as the sequence in the complementary strand reading from the opposite end.

(d) base sequence with attached probe

76) Match the following Column I with Column II and choose the correct option from the codes given below

Column I (Vectors)	**Column II (Derivative microorganisms)**
(A) EcoRI	1. E coli R 245
(B) HindlII	2. Bacillus amyloliquefaciens
(C) BamHI	3. Haemophilus influenzae
(D) EcoRII	4. Escherichia coli RY13

(a) (b) (c) (d)

A	**B**	**C**	**D**
1	2	3	4

A	**B**	**C**	**D**
3	2	1	4

A	**B**	**C**	**D**
4	3	2	1

A	**B**	**C**	**D**
4	2	3	1

77) The function of DNA ligase in recombinant DNA technology is

(a) fragmentation of DNA (b) transfer DNAinto host cell (c) link newly formed DNA fragments

(d) separate DNA fragmentsby their charge and size

78) Plasmids are vectors for the gene cloning because they

(a) replicate freely outside bacterial cell (b) can self replicate in bacterial cells

(c) can be multiplied in laboratories using enzymes (d) can be multiplied in culture

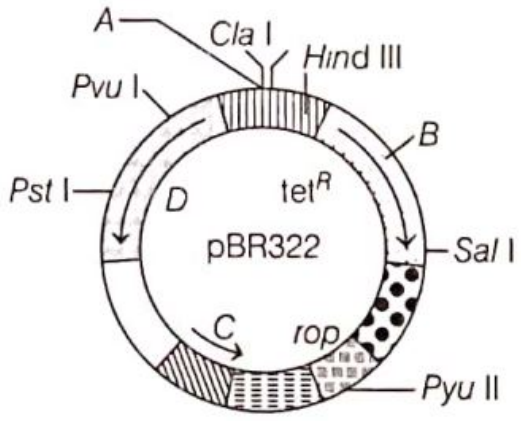
79) In recombinant DNA technique, the term vector refers to a

(a) donor DNA,it is identified and picked up through electrophoresis

(b) plasmid, transfers DNA into living cell (c) collection of entire genome in the form of plasmid

(d) enzyme that cuts the DNA at specific sites

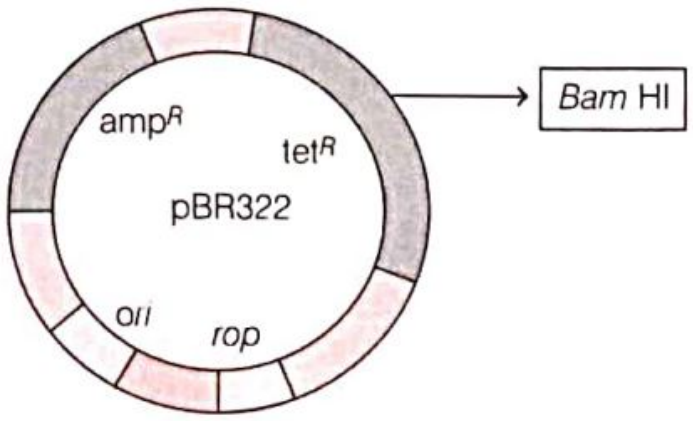
80) Identify A, B, C and D in the given diagram of E.coli cloning vector pBR322.



(a) A-EcoRI, B-BamHl, C-ori, D-amp^R (b) A-amp^R, B-ori, C-BamHI, D-EcoRI

(c) A-ori, B-BamHI, C-EcoRI, D-amp^R (d) A-BamHI, B-EcoRI, C-amp^R, D-ori

81) The figure shows the structure of a plasmid



A foreign DNA was ligated at Bam HI. The transformants were then grown in a medium containing antibiotics tetracycline and ampicillin. Choose the correct observation for the growth of transformed bacterial colonies from the given table.

(a)

Medium with tetracycline	**Medium with ampicillin**
Growth	No growth

(b)

Medium with tetracycline	**Medium with ampicillin**
No growth	Growth

(c)

Medium with tetracycline	**Medium with ampicillin**
No growth	No growth

(d)

Medium with tetracycline	**Medium with ampicillin**
Growth	Growth

82) Microparticles for coating with DNA to be bombarded with gene gun is made up of

(a) platinum or zinc (b) silicon or platinum (c) silver or platinum (d) gold or tungsten

83) The example of a natural genetic engineer is

(a) Bacillus subtilis (b) Salmonella typhimurium (c) Agrobacterium tumefaciens

(d) Bacillus amyloliquefaciens

84) The process of recombinant DNA technology has following steps

I. Amplification of gene.

II. Insertion of recombinant DNA into the host cell.

III. Cutting of DNA at specific location using restriction enzyme.

IV. Isolation of genetic material (DNA).

Pick out the option for the correct sequence of step for the process of recombinant DNA technology.

(a) II, III, IV and I (b) IV, II, III and I (c) I, II, III and IV (d) IV, III, I and II

85) Which of the following is not correctly matched for organism and its cell wall degrading enzyme?

(a) Algal-methylase (b) Bacteria-lysosyme (c) Fungi-chitinase (d) Plant cells-cellulase

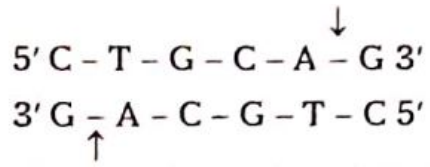
86) What is the criterion for DNA fragments movement on agarose gel during gel electrophoresis?

(a) The smaller the fragment size, the farther it moves (b) Negatively charged fragments do not move

(c) Positively charged fragments move to the farther end

(d) The larger the fragment size, the farther it moves

87) Given below is the restriction site of a restriction endonuclease Pst I and the cleavage sites on a DNA molecule.



Choose the option that gives the correct resultant fragments by the action of the enzyme Pst I.

(a)
5'C - T - G C - A - G 3'
3' G - A - C - G - T C 5'

(b)
5' C - T G - C - A - G 3'
3' G - A - G - C T - C 5'

(c)
5' C - T - G - C A - G 3'
3' G - A - C - G T - C 5'

(d)
5' C - T - G - C - A G 3'
3' G A - C - G - T - C 5'

88) Which one of the following enzymes, a fungal cell should be treated with to get the DNA along with other macromolecules released from it?

(a) Isozymes (b) Cellulose (c) Ribonuclease (d) Chitinase

Fill up / 1 Marks 10 x 1 = 10

89) The _____ in a vector helps in identifying the transformants and eliminating the nontransformants.

90) When the enzyme _____ is inactivated in E.coli, the transformants do not produce any colour in the presence of a chromogenic substrate.

91) _____ is the method of bombarding high velocity microparticles of gold or tungsten coated with DNA, into plant cells.

92) To isolate DNA from fungal cells for biotechnology experiments, enzyme _____ is necessary.

93) _____ is used as cloning vector for transformation in plant cells.

94) Downstream processing involves separation and _____.

95) _____ is the process of extraction of DNA from the separated bands of DNA in agarose gel.

96) _____ gene in the E.coli vector, pBR 322 codes for enzymes/proteins involved in the replication of the plasmid.

97) _____ are the E.coli enzymes that remove the nucleotides from the ends of DNA strands.

98) _____ is an autonomously replicating, circular, extra-chromosomal DNA in bacterial cells.

True or False 5 x 1 = 5

99) Since DNA fragments are positively charged they move towards the anode.

(a) True (b) False

100) Agarose, the most commonly used matrix in gel electrophoresis is obtained from fungi.

(a) True (b) False

101) The DNA fragments separate according to their size through agarose gel during electrophoresis.

(a) True (b) False

102) The cloning vector pBR 322 has three antibioticresistance genes.

(a) True (b) False

103) The vector DNA and foreign DNA are cut by the same restriction endonuclease.

(a) True (b) False

1 Marks 130 x 1 = 130

104) What would be the molar concentration of human DNA in a human cell? Consult your teacher.

105) Why is the enzyme cellulase needed for isolating genetic material from plant cells and not from animal cells?

106) How does an alien DNA gain entry into a plant cell by 'biolistic' method?

107) Write the importance of the bacterium Thermus aquaticus in polymerase chain reaction.

108) How is Agrobacterium tumefaciens able to transform a normal plant cell into a tumor?

109) Biotechnologists refer to Agrobacterium tumefaciens as a natural genetic engineer of plants. Give reasons to support the statement.

110) How can retroviruses be used efficiently in biotechnology experiments in spite of them being disease causing?

111) State what happens when an alien gene is ligated at Pvu I site of pBR 322 plasmid.

112) Why is 'plasmid' an important tool in biotechnology experiments?

113) Mention the name of the specific sequence of DNA in a plasmid that the gene of interest ligates with to enable it to replicate.

114) Mention the source of thermostable DNA polymerase.

115) State the function of an exonuclease.

116) How can bacterial DNA be released from the bacterial cell for biotechnology experiments?

117) Mention the uses of cloning vector in biotechnology

118) Why is it essential to have a 'selectable marker' in a cloning vector?

119) In the year 1963 two enzymes responsible for restricting the growth of bacteriophage in E.Coli were isolated. How did the enzymes act to restrict the growth of the bacteriophage?

120) What is the host called that produces a foreign gene product?What is this product called?

121) Mention the role of 'molecular scissors' in recombinant DNA technology

122) What is the role of ethidium bromide during agarose-gel electrophoresis of DNA fragments?

123) Restiction enzymes should not have mora than one site of action in the cloning site of a vector? Comment

124) Would you choose an exonuclease for producing a recombinant DNA molecule?

125) What does 'competent' refer to, in competent cells used in transformation experiment?

126) What is the significance of adding proteases at the time of isolation of genetic material (DNA)?

127) Name a recombinant vaccine that is currently being used in vaccination pro-grammes

128) What is the role of $CaCl_2$ in the preparation of competent cells?

129) How was European Federation of Biotechnology (EFB) defined biotechnology?

130) Provide one word or one sentence information about 'plasmid' with respect to its (i)chemial nature and (ii)its duplication.

131) Name the first restriction endonuclease discovered.

132) To use the restriction enzyme to cut the DNA the DNA must be in a pure from i.e, free from proteins and RNAs associated with it. How is it achieved?

133) Name the substance used as a medium/matrix in gel electrophoresis.

134) Name two commonly used vectors for genetic engineering.

135) Name the commonly used vector for transformation in plant cells.

136) Name the enzyme used to digest cell wall of
(i) bacteria and
(ii) fungi,respectively for genetic engineering.

137) In plants how is the alien DNA introduced into the host cell?

138) What is the advantage of sparged stirredtank bioreactor?

139) What are sampling ports in a bioreactor?

140) What is bioconversion?

141) Restriction enzymes present in the cloning site of a vector should not have more than one recognition site. Comment.

142) Do molecules (DNA, protein) exhibit biological activity in anhydrous conditions?

143) What are BACs and YACs?

144) Name the soil bacterium which contain gene for production of endotoxins.

145) What is crown gall tumour?

146) Define T - DNA.

147) Name the compound used for staining DNA to be used in Recombinant Technology. What is the colour of such stained DNA?

148) How elution of DNA is done?

149) What is the role of 'Ori' in any plasmid?

150) Do normal E, coli cells have any gene resistant against antibiotics?

151) Name any two medically useful recombinant products.

152) Give the full form of PCR.Who developed it?

153) Name some other DNA polymerases that are found to be more efficient than Taq polymerase in PCR. Give their source.

154) Define "melting of target DNA".

155) How many PCR cycles are adequate for proper amplification of DNA segment?

156) Name two enzymes involved in PCR.

157) What are selectable markers?

158) What is clone of cell?

159) What is the system to multiply the cells harbouring cloned genes?

160) Why is it not possible for an alien DNA to becomes part of chromosome anywhere along its length and replicate normally?

161) Mention the type of host cells suitable for the gene guns to introduce an alien DNA.

162) Name the enzymes that are used for isolation of DNA from bacterial and fungal cells for recombinant DNA technology.

163) Discuss with your teacher and find out how to distinguish between Plasmid DNA and chromosomal DNA

164) Discuss with your teacher and find out how to distinguish between RNA and DNA

165) Define biotechnology.

166) What is the popular terminology of recombinant DNA technology?

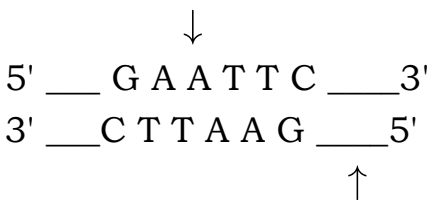
167) Name the three types of 'biological tools' used in the synthesis of recombinant DNA.

168) Name the enzyme commonly used to dissolve the bacterial cell wall.

169) What do you mean by Ori ?

170) Name a 'natural genetic engineer' of plants.

171) Name the enzyme responsible for cleavage in the following sequence:



172) What type of cut ends are formed both the strands of DNA molecule is cleaved at exactly the same nucleotide position?

173) What is microinjection ?

174) What is gene gun ?

175) What is the meaning of the term vehicle in genetic engineering ?

176) Expand GM.

177) What is the function of DNA-ligase ?

178) Why is enzyme cellulase used for isolating genetic material from plant cells but not animal cells.

179) Which enzyme is called molecular scissors?

180) What is downstream processing?

181) What are the uses of PCR?

182) What is a plasmid?

183) Give the name of techniques, that are used genetic engineering.

184) Give the name of bacterium other than E. coli, which is used in recombinant DNA technology.

185) Expand the terms rDNA and cDNA

186) Why are bacteriophages used as vectors in RDT?

187) State what happens when an alien gene is ligated at Sal I and Pvu I site of pBR 322 plasmid?

188) Retroviruses are disease-causing microorganisms, even then are efficiently used in biotechnology experiments. Explain how is it possible?

189) Write the significance of adding proteases at the time of isolation of genetic materials.

190) Why do DNA fragments move towards the anode during gel electrophoresis? If yes, explain.

191) Suggest a technique to a researcher who needs to separate fragments of DNA.

192) Name the technique that is used to alter the chemistry of genetic material (DNA, RNA) to obtain desired result.

193) Mention the use of gel electrophoresis in biotechnology experiments.

194) Why it is not possible for an alien DNA to become part of a chromosome anywhere along its length and replicate normally?

195) Name the host cells in which micro-injection technique is used to introduce an alien DNA.

196) Name the two components of the first artificial recombinant DNA molecule constructed by Cohen and Boyer.

197) How is the action of normal endonuclease enzymes different from that of restriction endonuclease?

198) Which main technique and instrument is used to isolate DNA from a plant cell?

199) Why EtBr is used in gel electrophoresis in spite of it being highly carcinogenic?

200) Why do DNA fragments move towards the anode during gel electrophoresis?

201) Mention two objectives of setting up GEAC by our Government.

202) PCR requires very high temperature conditions where most of the enzymes get denatured. How was this problem resolved in a PCR?

203) Indiscrimate diagnostic practices using X-rays etc. should be avoided. Give one reason.

204) Write the names of the enzymes that are used for isolation of DNA from bacterial and fungal cells respectively for Recombinant DNA Technology.

205) Any DNA flanked at its two borders by T-DNA can be integrated into the plant genome. Name the vector used for this plant gene transfer?

206) In making bacteria as a competent host for transformation with r-DNA, it is treated with a specific concentration of divalent cation like calcium. What is the role of calcium?

207) Mention the role of restriction enzymes in recombinant DNA technology.

208) Molecular scissors used in recombinant DNA technology are known as.

209) Define vector in terms of biotechnology?

210) What is the role of enzymes like chitinase and lysozyme in genetic engineering?

211) How can you remove DNA which is separated out from a cell suspension?

212) Name the enzyme needed for amplification of gene during PCR?

213) What is the purpose of using Mg^{2+} during annealing process of PCR?

214) Write the function of a bioreactor.

215) Define modern biotechnology.

216) Expand PCR. Give the name of scientist who discovered this technique.

217) What is the main function of sampling port in a bioreactor?

218) Name the natural source of
(a) agarose and
(b) Ti plasmid.

219) Why cannot DNA gain entry into a cell through the plasma membrane?

220) What does 'Restriction' refer to in the Restriction endonucleases?

221) Name the scientist who developed the PCR technique.

222) Name the two enzymes that are essential for constructing a recombinant DNA.

223) Name the enzyme that helps to join DNA fragments.

224) What does 'R' stand for, in the restriction endonuclease, EcoRI?

225) A plasmid and a DNA sequence in a cell need to be cut for producing recombinant DNA. Name the enzyme that acts as molecular scissors to cut the DNAs

226) Name the material used as matrix in gel electrophoresis and mention its role.

227) Why are engineered vectors preferred these days?

228) Mention the uses of cloning vectors in biotechnology.

229) Why are antibiotic-resistance genes used as markers in E.coli?

230) Name two antibiotic-resistance genes in the pBR 322 of E.coli plasmid.

231) A plasmid without a selectable.marker was chosen as vector for cloning a gene. How does this affect the experiment?

232) Identify the reason for selection of DNA polymerase from Thermus aquaticus for Polymerase Chain Reaction.

233) Name the commonly used vector for cloning genes into higher organisms.

Find the odd one 3 x 1 = 3

234) Cellulose, Lysozyme, Chitinase, Endonuclease

235) Hind III, EcoRI, Sal I, Rop

236) Denaturation, Elution, Annealing, Extension

Assertion and reason 27 x 1 = 27

237) **Assertion:** Bacterial cells are made competent by treating them with specific concentration of a divalent cation.
Reason: Treatment of bacterial cell with a divalent cation increases the efficiency with which DNA enters the bacterium through pores in its cell wall.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

238) **Assertion:** Both the passenger and vehicle DNAs are treated separately with separate restriction endonuclease.
Reason: Ligation is done by the use of alkaline phosphatase and DNA ligase.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

239) **Assertion:** Vector DNA and foreign DNA are cut by same restriction endonuclease.
Reason: Digestion of vector DNA and foreign DNA with same enzyme produces complementary sticky ends
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

240) **Assertion:** Selectable marker is meant for distinguishing a recombinant from non-recombinant.
Reason: Every recombinant can flourish in medium having both ampicillin and tetracycline, while the non - recombinants cannot.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

241) **Assertion:** Restriction endonuclease recognises palindromic sequence in DNA and cuts them.
Reason: Reason; Palindromic sequence has two unique recognition sites Pst I and Pvu I recognised by restriction endonuclease.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

242) **Assertion:** Bacteriophage vectors are more advantageous than plasmid vectors.
Reason: Bacteriophage vectors can be easily detected at the time of cloning experiments.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

243) **Assertion:** Type I restriction endonucleases are not used in recombinant DNA technology.
Reason: Type I restriction endonucleases recognise specific sites within the DNA but do not cut these sites.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

244) **Assertion:** YAC vectors have been exploited extensively in the mapping of large genomes.
Reason: YAC vectors have a composite structure made of bacteriophage and plasmid.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

245) **Assertion:** cDNA is copy DNA which is synthesised in vivo on a DNA template using DNA polymerase.
Reason: cDNA of all possible genes are ligated with different plasmids and maintained in either plant or animal cells.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

246) **Assertion:** Amplification of a gene of interest can be done by polymerase chain reaction.
Reason: It is possible to amplify DNA segment approximately 1 billion times within a span of one day.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

247) **Assertion:** In recombinant DNA technology, human genes are often transferred into bacteria (prokaryotes) or yeast (eukaryote).
Reason: Both bacteria and yeast multiply very fast to form huge populations which express the desired gene.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

248) **Assertion:** Restriction enzymes cut the strand of DNA to produce sticky ends.
Reason: Stickiness of the ends facilitates the action of the enzyme DNA polymerase.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

249) **Assertion:** DNA fingerprinting involves identifying differences in specific regions of DNA sequence.
Reason: DNA fingerprinting is the basis of paternity testing.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

250) **Assertion:** Soil inhabiting bacterium Agrobacterium tumefaciens is called a natural plant genetic engineer.
Reason: Agrobacterium tumefaciens produce crown galls in several dicot plants.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

251) **Assertion:** The insertion of DNA fragment into pBR 322 plasmid using enzyme Pst I or Pvu I make ampicillin resistant gene non functional.
Reason: Bacterial cells containing recombinant pBR322 is unable to grow in the presence of ampicillin.
Codes:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

252) **Assertion (A)** Biotechnology deals with techniques that use living organism to produce products useful for humans.
Reason (R) It uses only a unicellular organism.
(a) If both A and R are true and R is the correct explanation of A
(b) If both A and R are true, but R is not the correct explanation of A
(c) If A is true, but R is false
(d) If A is false, but R is true

253) **Assertion (A)** The first restriction endonuclease was Hind II.
Reason (R) The Hind II always cut DNA molecule at particular point by recognising a specific sequence of 6-base pair.
(a) If both A and R are true and R is the correct explanation of A
(b) If both A and R are true, but R is not the correct explanation of A
(c) If A is true, but R is false
(d) If A is false, but R is true

254) **Assertion (A)** In EcoRI, the letter 'R' derived from the order.
Reason (R) Exonuclease and endonuclease are the types of nucleases enzyme.
(a) If both A and R are true and R is the correct explanation of A
(b) If both A and R are true, but R is not the correct explanation of A
(c) If A is true, but R is false
(d) If A is false, but R is true

255) **Assertion (A)** Foreign DNA and vector DNA cut with the help of ligase.
Reason (R) Ligase acts by forming phosphodiester bonds.
(a) If both A and R are true and R is the correct explanation of A
(b) If both A and R are true, but R is not the correct explanation of A
(c) If A is true, but R is false
(d) If A is false, but R is true

256) **Assertion (A)** E. coli having pBR322 with DNA insert at BamHI site cannot grow in medium containing tetracycline.

Reason (R) Recognition site for BamHI is present in tet^R region of pBR322.

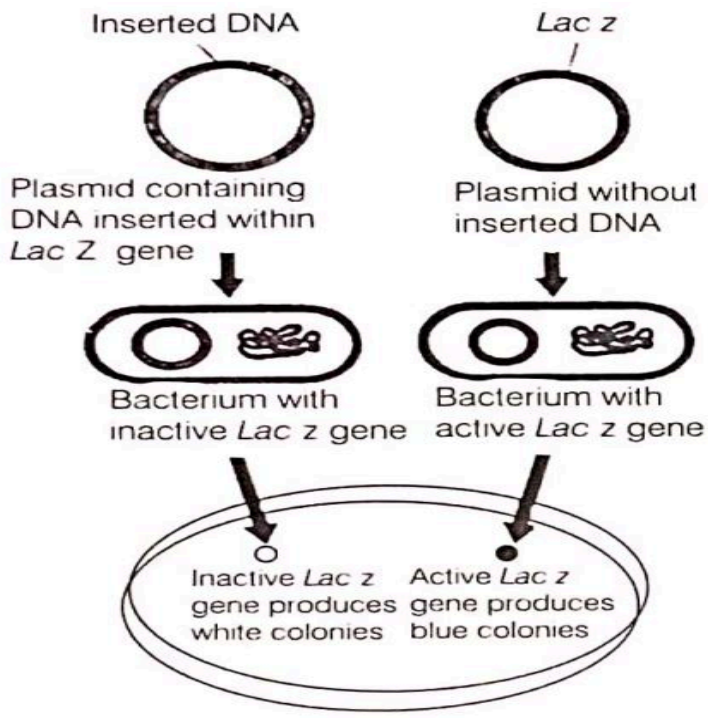
(a) If both A and R are true and R is the correct explanation of A

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

(c) If A is true, but R is false

(d) If A is false, but R is true

257) Figure given below representing the insertional inactivation of lac z gene. Study the figure and comment upon the appropriateness of the Assertion and Reason.



Assertion (A) Present of insert in the above figure results in inactivation of enzyme β-galactosidase.

Reason (R) Insertion of recombinant DNA within the coding sequence of β-galactosidase results in colourless colonies.

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

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

(c) If A is true, but R is false

(d) If A is false, but R is true

258) **Assertion (A)** If one wants to recover many copies of target DNA it should be cloned in a vector whose origin support high copy number.

Reason (R) Cloning site is responsible for controling the copy number of the linked DNA/target DNA.

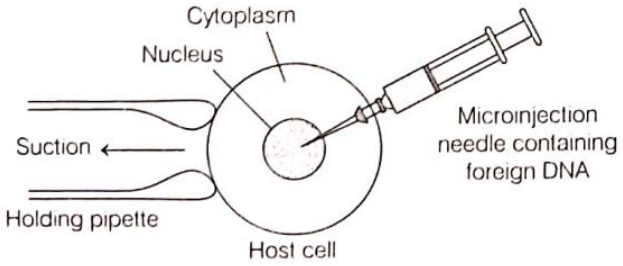
(a) If both A and R are true and R is the correct explanation of A

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

(c) If A is true, but R is false

(d) If A is false, but R is true

259) Given below is the figure of a method of gene transfer. Study the figure and comment upon the appropriatness of the Assertion and Reason.



Assertion (A) The foreign DNA is injected directly into the nucleus.

Reason (R) This pipette can puncture the plasma membrane.

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

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

(c) If A is true, but R is false

(d) If A is false, but R is true

260) **Assertion (A)**The tumour inducing plasmid (Ti plasmid) of Agrobacterium tumefaciens acts as a cloning vector in recombinant DNA technology.
Reason (R) The Ti-plasmid which is used in the mechanisms of delivering genes to a cell remains pathogenic.
(a) If both A and R are true and R is the correct explanation of A
(b) If both A and R are true, but R is not the correct explanation of A
(c) If A is true, but R is false
(d) If A is false, but R is true

261) **Assertion (A)** In gel electrophoresis, DNA fragments are separated.
Reason (R) DNA is negatively charged, so it moves towards anode under electric field.
(a) If both A and R are true and R is the correct explanation of A
(b) If both A and R are true, but R is not the correct explanation of A
(c) If A is true, but R is false
(d) If A is false, but R is true

262) **Assertion (A)** Agrobacterium tumefaciens is a pathogen of several monocot plants.
Reason (R) It is able to deliver a piece of DNA known as T-DNA to transform normal plant cells into a tumor.
(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

263) **Assertion (A)** Functional ADA cDNA genes must be inserted in the lymphocytes at the early embryonic stage in gene therapy for ADA deficiency.
Reason (R) Cells in the embryonic stage are immortal, differentiated and easy to manipulate.
(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

2 Marks 151 x 2 = 302

264) Can you recall meiosis and indicate at what stage a recombinant DNA is made?

265) Besides better aeration and mixing properties what other advantages do stirred tank bioreactors have over shake flasks?

266) Do eukaryotic cells have restriction endonucleases? Justify your answer.

267) From what you have learnt, can you tell whether enzymes are bigger or DNA is bigger in molecular size? How did you know?

268) Make a chart (with diagrammatic representation) showing a restriction enzyme, the substrate DNA on which it acts, the site at which it cuts DNA and the product it produces.

269) How is copy number of the plasmid vector related to yield of recombinant protein?

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

271) Name two commonly used bioreactors. State the importance of using a bioreactor.

272) (a) Mention the diference in the mode of action of exonuclease and endonuclease.
(b) How does restriction endonuclease function?

273) (a)Explain how to find whether an E.Coli bacterium has transformed or not when a recombinant DNA bearing ampicillin-resistant gene is transferred into it.
(b)What does the ampicillin-resistant gene act as, in the above case?

274) Name the source of the DNA polymerase used in PCR technique. Mention why it is used.

275) Name the source organism that possesses Taq polymerase. What is so special about the function of this enzyme?

276) Name the organism from where the thermostable DNA polymerase is isolated. State its role in genetic engineering.

277) Write any four ways used to introduce a desired DNA segment into a bacterial cell i recombinant DNA technology experiments.

278) (a)A recombinant vector with a gene of interest inserted within the gene of α -galactosidase enzyme is introduced into a bacterium. Explain the method that would help in selection of recombinant colonies from non-recombinant ones.
(b)Why is this method of selection referred to as 'insertional inactivation'?

279) How can the following be made possible for biotechnology experiments?
(a) Isolation of DNA from bacterial cell.
(b)Reintroduction of the recombinant DNA into a bacterial cell.

280) List the key tools used in recombinant DNA technology.

281) Explain the role of Ti plasmids in biotechnology

282) Name the source organism from which Ti plasmid is isolated. Explain the use of this plasmid in biotechnology.

283) How are recombinant vectors created? Why is only one type of restriction endonuclease required for creating one recombinantvector?

284) Explain giving reaons why an alien piece of DNA needs to be integrated to a specific sequence of host DNA for its cloning.

285) Why is 'origin o replication' (Ori) required to facilitate cloning into a vector?

286) A recombinant DNA is formed when sticky ends of vector DNA and foreign DNA join. Explain how the sticky ends are formed and get joined.

287) How are the DNA fragments seperated by gel electrophoresis visualised and separated for use in constructing recombinant DNA?

288) How can the DNA segments separated by gel electrophoresis be visualised and isolated?

289) Explain the action of the restriction endonuclease EcoRI.

290) (a) Illustrate the recognition sequence o EcoRI and mention what such sequences are called.
(b) How does restriction endonuclease act on a DNA molecule?

291) What are recombinant proteins? How do bioreactors help in their production?

292) How is DNA isolated in purified form from a bacterial cell?

293) List the our steps to isolate DNA from a bacterium.

294) Name the natural source o agarose. Mention one role of agarose in biotechnology

295) Describe briefly origin of replication.

296) A plasmid DNA and a linear DNA (both of the same size) have one site for a restriction endonuclease. When cut and separated on agarose gel electrophoresis, plasmid shows one DNA band, while the linear DNA shows two fragments. Explain.

297) While carrying out a PCR, 'denaturation' step was missed. What will be its effect on the process?

298) Describe the two techniques that enabled the birth of modern biotechnology.

299) Bring out the disadvantages in conventional as compared to rDNA rechnology.

300) Who was the first to constuct rDNA?Name the bacterium from which they isolated the genes.

301) Why do prokaryotes(bacteria) have restriction enzymes but not eukaryotes?

302) Name any four restriction enzymes.

303) How is the gene z used as a marker?

304) what is meant by continuous culture system?

305) How can the desired products ormed ater genetic engineering be produced in a commercial scale?

306) How are the DNA fragments separated and isolated for DNA fingerprintig? Explain

307) What is meant by gene cloning?

308) Both the wine marker and a molecular biologist who has developed a recombinant vaccine claim to be biotechnologist. Who in your opinion is correct?

309) You have created a recombinant DNA molecule by ligating a gene to a plasmid vector. By mistake, your friend adds exonuclease enzyme to the tube containing the recombinant DNA. How will your experiment get affected as you plan to go transformation now?

310) A mixture of fragmented DNA was electrophoresed in an agarose gel. After staining the gel with ethidium bromide, no DNA bands were observed. What could be the reason?

311) What is genetic engineering?

312) How artificial recombinant DNA molecule is constructed?

313) What is gene cloning?

314) List three important features necessary for preparing genetically modifying organism.

315) What does EcoRI signify? How its name is derived?

316) What are molecular scissors? Explain their role.

317) How does restriction endonuclease function?

318) Give the source of restriction enzyme, Bam HI and Kpn I.

319) What are recognition sequences or recognition sites?

320) How are restriction endonuclease enzymes are named? Write Example.

321) Explain any three methods of vectorless gene transfer.

322) Why is "Agrobacterium medicated genetic transformation" in plants described as mutual genetic engineering of plants?

323) Name the technique used for separation of DNA fragments.What is its principle? How are they observed?

324) Define vector. Give the properties of a "Good Vector".

325) What is the difference between cloning and expression vectors?

326) Write a note on cloning vector.

327) What do you understand by the term selectable marker?

328) Give the overall steps involved in Gene cloning.

329) You have chosen a plasmid as vector for cloning your gene. However this vector plasmid lacks a selectable marker. How would it affect your experiment?

330) Give the applications of PCR technology.

331) Differentiate direct gene transfer and indirect gene transfer.

332) Name the various cloning vectors and explain how a plasmid can be used for genetic engineering.

333) Why and how bacteria can be made 'component'?

334) How is recombinant DNA transferred to host?

335) How and why is the bacterium Thermus aquaticus employed in DNA technology? Explain

336) Differentiate gene therapy and gene cloning.

337) What are the proposed benefits of genetic engineering in crop improvement?

338) Describe importance of cloning site in a vector. Illustrate with an example.

339) How is repetitive/satellite DNA separated from bulk genomic DNA for various genetic experiments?

340) How are 'Sticky ends' formed on a DNA strand? Why are these so called?

341) (i) Name two genetically engineered recombinant proteins used for treatement of specific disorders.
(ii) Name a substance produced by certain bacteria used in blood transfusion.
(iii) Who is credited with synthesis og gene.

342) In the daily Tribune dt. August 20, 2012 there was a news under heading 'New Stem Cell treatement to cure cancer'. Professor Revenue head of bone marrow transplantation at Israel's Hadassah' Medical Centre in Jerusalem said: The technique uses specialised harvested cells to produce infection - fighting bone marrow. Patients with blood cancers have most of their bone marrow destroyed when given radiation or chemotherapy to destroy their disease.
(i) What are stem cells?
(ii) What is the source of stem cells?
(iii) What are the infection - fighting cells produced by bone marrow?
(iv) Name the diseases which can be curved by this life saving treatements.
(v) What is the effect of bone marrow transplantation?

343) What are DNA ligases?

344) What is the function of enzyme alkaline phosphatase?

345) Define genetic engineering.

346) Name the scientists who generated first recombination DNA molecules.

347) What are palindromic nucleotide sequences?
5' _____ G A A T T C _____3'
3' _____ C T T A A G _____5'

348) What is cloning?

349) What are the transgenic plants?

350) Study the linking of DNA fragments shown
Name 'a' DNA and 'b' DNA

351) Name the restriction enzyme that recognises this palindrome

352) Name the enzyme that can link these two DNA fragments.

353) Explain the contribution of Thermus aquaticus in the amplification of a gene of interest.

354) How does a restriction nuclease function? Explain.

355) (i) How are recombinant vectors created?
(ii) For creating one recombinant vector only one type of restriction endonuclease is required. Give reason.

356) Write the role of 'Ori' and 'restriction site' in a cloning vector pBR322.

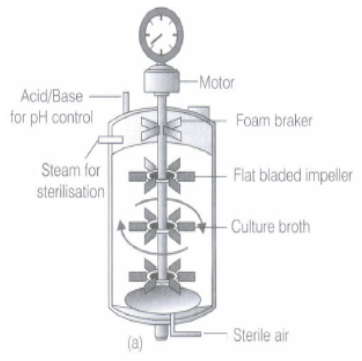
357) An alien piece of DNA needs to be integrated to a specific sequence of host DNA for its cloning. Is it true? if yes, explain. If this is DNA is not picked up by host cells. Can you suggest a reason for it?

358) From what have you learnt, can you tell whether enzymes are bigger or DNA is bigger in molecular size? How did you know?

359) Give the name of the organism from where the thermostable DNA polymerase is isolated. State its role in genetic engineering.

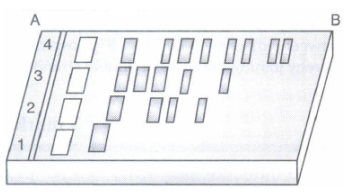
360) Describe the role of $CaCl_2$ in the preparation of competent cells.

361) Give the name of the type of bioreactor shown. Write the purpose for which it is used.



362) What would happen if you grow a recombinant in a bioreactor but forget to add antibiotic to the medium in which the recombinant is growing?

363) Given below is the diagram of agarose gel kept under UV light:



(a)Mark the positive and negative terminals.
(b) What is the charge carried by DNA molecule and how does it help in its separation?
(c)How are the separated DNA fragments finally isolated?

364) Explain palindromic nucleotide sequence with the help of a suitable example.

365) Why are molecular scissors so called? Write their use in biotechnology.

366) Explain with the help of a suitable example the naming of a restriction endonuclease.

367) How are' sticky ends' formed on a DNA strand? Why are they so called?

368) How does a restriction endonuclease help in DNA recombinant technology ?

369) Discuss the role the enzyme DNA ligase plays during DNA replication.

370) Write the functions of :
(a) Cry 1ACgene
(b) RNA interference (RNAi

371) What is EcoR! ? How does EcoR! differ from an exonuclease?

372) How is insertional inactivation of an enzyme used as a selectable marker to differentiate recombinants from non-recombinants?

373) (a) A recombinant vector with a gene of interest inserted within the gene of a-galactosidase enzyme, is introduced into a bacterium. Explain the method that would help in selection of recombinant colonies from non-recombinant ones.
(b) Why is this method of selection referred to as "insertional inactivation" ?

374) What is a primer ? What is its role in PCR ?

375) Agrobacterium tumefaciens is called natural genetic engineer. It infects only dicot plants. Unfortunately, many important crop plants, including corn, rice, and wheat, are monocots and thus could not be easily transfected using this bacterium. Scientists discovered that by using certain processes, naked DNA molecules can be introduced into plant cell types that are not susceptible to A. tumefaciens transfection. Explain any two.

376) Each restriction enzyme cuts DNA at a specific base sequence. For example, EcoRI always cuts DNA at GAATTC

3'—GTAAGAATTCTTTAGAATTCCGCCATTATCGAATTCAGGATCTTAC—5'

5'—CATTCTTAAGAAATCTTAAGGCGGTAATAGCTTAAGTCCTAGAATG—3'

a. How many times EcoRI cuts this long strand?

b. How many small DNA pieces are formed from this long strand?

c. These fragments show **overhangs** of single stranded DNA. What are they known as? Why are they called so?

d. Which enzyme is used to seal these fragments together?

377) A dicot leaf is punched and is incubated in a suspension of soil bacteria. The cells on the edge of the punch are transformed and developed into new plants through tissue culture.

a. Name the technology.

b. Name the soil bacteria responsible for this transformation.

378) Dicot plants do show tumorous growth (crown gall disease) on the stem.

a. Name the microorganism responsible for this growth?

b. What causes the production of tumors?

379) In Gel electrophoresis, the DNA fragments are placed in wells on a sheet of gelatin and an electric current is applied to the sheet. Based on DNA biochemistry in which side are the wells located? In which direction and why do the fragments migrate?

380) Agrobacterium tumifaciens is a pathogen of several dicot plants. But for biotechnologists it is a boon. Justify?

381) Suppose you want to make a billion copies of a small region of the chromosome in vitro, which biotechnological mechanism will you prefer? Name the three main steps involved?

382) A foreign DNA fragment is introduced into the plasmid at the 'Bam H-1' site of the tetracycline resistant gene in the vector 'pBR 322'.

a) How does it affect the recombinant plasmid?

b) What is this mechanism known as?

c) Mention its advantages?

383) In nature A. tumifaciens which is called a natural genetic engineer, infects only dicots. Unfortunately many important crop plants are monocots and thus could not be easily transfacted. Scientists have discovered certain processes to introduce naked DNA molecules into the plant tissue that are not susceptible to A. tumefactions ? Explain any two.

384) After completion of the biosynthetic stage the products has to be subjected through a series

a) List these processes?

b) What are they collectively known as?

c) List any other measures to be taken care of?

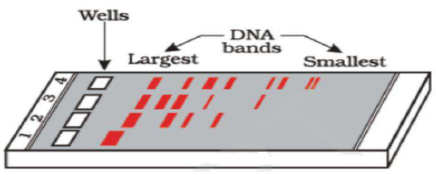
385) Traditional hybridization procedures used in plant and animal breeding very often leads to inclusion and multiplication of undesirable genes along with the desirable ones. What are the steps involved in genetic engineering to over come this limitation?

386) Selection of recombinant due to inactivation of antibiotics is a cumbersome procedure. why? Explain the alternative method to overcome this difficultly?

387) Match the following

	A	B
i)	Bacteria	Celluase
ii)	Chitinase	Microparticles of gold or tungsten coated with DNA
iii)	Plant cell	Microinjection
iv)	Recombinant DNA injected to nucleus of an animal cell	Lysozyme
v)	Biolistic /Gene gun	Fungus

388) Write the pallinodromic sequence of the following
5'_____ GAATTC_____ 3'

389) 

i)What dose the fig shows?
ii)What is the matrix used for the above process?
Iii)Name the chemical compound used for staining?
iv)Name the process for the separation of DNA from the agarose gel.

390) State how has Agrobacterium tumefaciens been made a useful cloning vector to transfer DNA to plant cells.

391) Explain the work carried out by Cohen and Boyer that contributed immensely in biotechnology.

392) Briefly explain PCR.

393) Explain gene cloning.

394) State the difference between simple stirred-tank bioreactor and sparged stirred-tank bioreactor. What are the advantages of these bioreactors?

395) Restriction enzymes that are used in the construction of recombinant DNA are endomicleases which cut the DNA at 'specific recognition s,equence'. What would be the disadvantage if they do not cut the DNA at specific-recognition sequence.

396) 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 the source organism of the DNA polymerase used in PCR.

397) (a) If a desired gene is identified in an organism for some experiments explain the process of cutting this desired gene at specific location.
(b) Mention the function of stirrer in a bioreactor

398) (a) What is the advantage of bubbling air into the sparged stirred-tank bioreactors?
(b) Name the two main processes involved in down stream processing.

399) How is a continuous culture system maintained in bioreactors and why ?

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

401) Explain the role of Ti plasm ids in biotechnology.

402) Why and how can bacteria be made 'competent'?

403) What is EcoRl? How does EcoRl differ from an exonuclease?

404) What is origin of replication in a chromosome? State its function.

405) Who was the first to construct rDNA? ame the bacterium whose plasmid was used. How was it possible to cut the specific genes / DNA?

406) Write the basis of naming the restriction endonuclease EcoRI. Explain.

407) What are sticky ends? State their significance in recombinant DNA technology.

408) All cloning vectors do have a selectable marker. Describe its role in recombinant DNA technology.

409) (i) Write the scientific name of the source organism of the thermostable DNA polymerase used in PCR.
(ii) State the advantage of using thermostable DNA polymerase.

410) While doing a PCR, denaturation step is missed. What will be its effect on the process?

411) Which techniques uses living organisms or enzymes from organisms to produce products and process useful to human?

412) Why is a thermostable DNA polymerase needed in amplification/genetic engineering?

413) (i) State the principle involved in separation of DNA fragments using gel electrophoresis.
(ii) How are DNA fragments visualised once they are separated by gel electrophoresis?

414) 5' - G↓ A A T T C - 3'
3' - C T T A A↑ G - 5'
(a) Name the restriction enzyme that recognises the given specific sequence of bases.
(b) What are the arrows in the given figure indicating ? Write the result obtained thereafter.

3 Marks 124 x 3 = 372

415) Collect 5 examples of palindromic DNA sequences by consulting your teacher. Better try to create a palindromic sequence by following base-pair rules.

416) Can you think and answer, how a reporter enzyme can be used to monitor transformation of host cells by foreign DNA in addition to a selectable marker?

417) Describe briefly the following:
(a) Origin of replication
(b) Bioreactors
(c) Downstream processing

418) Explain briefly
(a) PCR
(b) Restriction enzymes and DNA
(c) Chitinase

419) What does 'Hind' and 'III' refer to in the enzyme 'Hind III'?

420) A and B are two different cloning vectors in two different bacterial colonies cultured in chromogenic substrate Bacterial colonies with cloning vector A were colourless, whereas those with B were blue coloured. Explain by giving reasons the cause of difference in colour that appeared.

421) Name and describe the technique that helps in separation and isolation of DNA fragments

422) (a) Name the technique used for the separation of DNA fragments.
(b) Write the type of matrix used in this technique
(c) How is the separated DNA visualised and extracted for use in recombinant DNA technology.

423) Name and explain the technique used in the separation and isolation of DNA fragments to be used in recombinant DNA technology.

424) Explain the basis on which the gel electrophoresis technique works. Write and two ways the products obtained through this technique can be utilised.

425) Explain in sequence the process of amplification of a gene of interest using polymerase chain reaction.

426) Explain the different steps involved in each cycle of polymerase chain reaction.

427) How is the amplification of a gene of interest carried out using polymerase Chain Reaction(PCR)?

428) Describe the process of gene amplification for rDNA technology experiments.

429) Draw a schematic sketch of pBR 322 plasmid and label the following in it
(a) Any two restriction sites
(b) Ori and rop genes
(c) An antibiotic resistant gene.

430) (a)Why are restriction endonucleases so called?
(b)What is a palindromic nucleotide sequences? How do restriction endo-nucleases act on palindromic sites to create 'sticky ends'?

431) How are the following used in biotechnology?
(a) Plasmid DNA
(b) Recognition sequence
(c) Gel electrophoresis

432) Explain the process by which a bacterial cell can be made 'competent'. Why is it essential to make bacterial cells 'competent in recombinant' to take up plasmid/rDNA.

433) (a)EcoRI is a restriction endonuclease. How is it named so? Explain.
(b) Write the sequence of DNA bases that the enzyme recognises. Mention the point at which the enzyme makes a cut in the DNA segment.

434) (a) What is EcoRI? What does R represent in this?
(b) Give the palindromic nucleotide sequence recognised by it.
(c) Explain its action.

435) Why are genes encoding resistance to antibiotics considered useful selectable markers for E.coli. cloning vector? Explain with the help of one example.

436) (a) Write the palindromic nucleotide sequence for the following DNA segment:5' - GAATTC -3'
(b) Name the restriction endonuclease that recognises this sequence.
(c) How are 'sticky ends' produced? Mention their role.

437) Read the following base sequence of a certain DNA strand and answer the questions that follow:

A	A	G	A	A	T	T	C	A	A
T	T	C	T	T	A	A	G	T	T

(i) What is called a palindromic sequence of DNA?
(ii) Write the palindromic nucleotide sequence shown in the DNA strand given and mention the enzyme that will recognise such a sequence
(iii) State the significance of enzymes that identify palindromic nucleotide sequences.

438) (a)What are 'molecular scissors'? Give one example.
(b)Explain their role in recombinant DNA technology.

439) (a)Name the category of enzymes function. Mention their use in genetic engineering.

440) Why are restriction endonucleases so called? Explain their role as 'molecular scissors' in recombinant DNA technology.

441) Why is Agrobacterium tumefaciens a good cloning vector? Explain

442) DNA being hydrophilic cannot pass through the cell membrane of a host cell. Explain how the recombinant DNA gets introduced into the host cell to transform the latter.

443) Explain any three methods to force 'alien' or recombinant DNA into host cells.

444) A vector is engineered with three features which facilitate its cloning within host cell. List three features and explain each one of them.

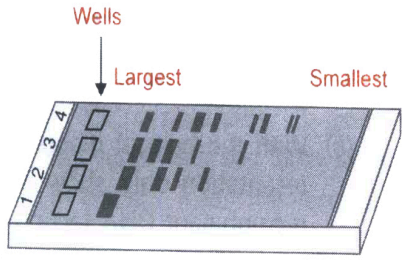
445) What are bioreactors? List five growth conditions that a bioreactor provides for obtaining the desired product.

446) Describe briefly Downstream processing.

447) Enumerate the process included under Biotechnology.

448) Describe the naming of the restriction enzymes with an example.

449)



(a) What does this diagram depict?

(b) What is meant by largest and smallest in the picture?

(c) Name the compound used to visualise them.

(d) Define elution.

450) An interesting property of restriction enzymes is molecular cutting and pasting. Restriction enzymes typically recognize a symmetrical sequence of DNA.

Notice that the top strand is the same as the bottom strand, but reads backward.

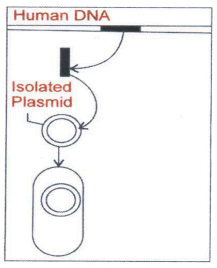
When the enzyme cuts the strand between G and A, it leaves overhanging chains:

A.What is this symmetrical sequence of DNA known as?

B.What is the significance of these overhanging chains?

C. Name the restriction enzyme that cuts the strand between G and A.

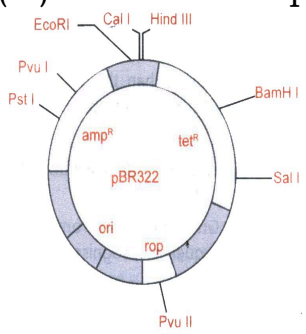
451) Name the particular technique in Biotechnology whose steps are shown in the figure. USe the figure to summarise the technique in three steps.



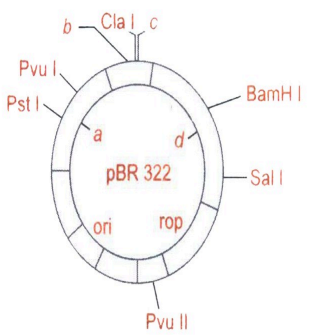
452) (i) Name the organism in which the vector shown is inserted to get the copies of the desired gene.

(ii) Mention the area labelled in the vector responsible for controlling the copy number of the inserted gene.

(iii) Name and explain the role of a selectable marker in the vector shown.



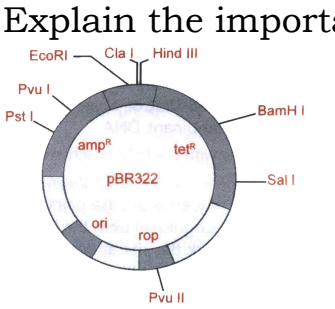
453)



(a) Identify the selectable markers in the diagram of E.coli vector shown above.

(b) How is the coding sequence of α-galactosidase considered a better marker than the ones identified by you in the diagram? Explain.

454) Explain the importance of (a) ori, (b) amp and (c) rop in the E.coli vector shown below:



455) What essential features must be present in a cloning vehicle?

456) What is the principle of PCR?

457) Write the major steps involved in gene cloning.

458) Give reasons :
(a) Plasmids are suitable for use as a vehicle DNA.
(b) Restriction endonucleases are used in genetic engineering.
(c) Recombinant DNA is formed of DNA from two sources.

459) Fill in the blanks :
(a) The _____ used as a carrier for transferring a suitable host is called vehicle DNA.
(b) Genetic engineering is also known as _____ DNA technology.
(c) Large scale production of biotechnological products involves use of._____
(d) The source DNA and the vector DNA are cut at specific points with the help of ._____endonucleases.
(e) DNA fragments are ligated with the help of enzyme._____

460) Match the following :

Column I	Column II
1. Genetic engineering	(a) Vectorless gene transfer
2. Vehicle DNA	(b) Large scale production
3. Electroporation	(c) Cloning vector
4. rDNA	(d) Restriction Endonucleases
5. Sticky ends	(e) Vector + insert
6. Bioreactors	(f) Recombinant DNA technology

461) Few gaps have been left in the following table. Fill up the gaps.

Restriction Enzyme	**Source**	**Recognition sequence and site of cleavage**
Bam HI	Bacillus amyloliquiefaciens H	a
Eco RI	b	↓ 5'-G-A-A-T-T-C-3' 3'-C-T-T-A-A-G-5' ↑
c	Haemophillus influenzae Rd	↓ 5'-G-T-C-G-A-C-3' 3'-C-A-G-C-T-G-5' ↑

462) Give an example of a natural form of genetic engineering in which the bacterium inserts gene into plants to cause gall or tumour formation.

463) Do you see the prospects of viroids being used as plant vectors in near future?

464) Give an example where a disease causing pathogen of animals has been transformed into useful vector for delevering genes to humans.

465) Write the name of genus, species, strain of source bacteria from which the following endonucleases are obtained. Also write the order of their identification in the bacteria.
(i) Eco R I
(ii) Hind II

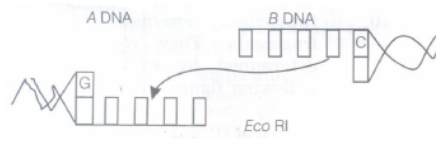
466) What is the function of restriction endonuclease inside the host bacterial cell ? How do bacteria prevent their own DNA from being cut by endonucleases.

467) Name the method/s by which the transgenic sheeps and goats are made. What are other methods?

468) What will happen if -
(i) A plasmid vector is digested with Eco RI at a single site
(ii) A sample of human DNA is digested with Eco RI.
(iii) The two samples (plasmid and human DNA) are allowed to hybridise in presence of DNA ligase.

469) Youn have been given a task to break the cells of following organisms and release DNA along with other macromolecules from them. Name the specific enzymes you will select for the task:
(i) Bacterial cell
(ii) Plant cell
(iii) Fungal cell

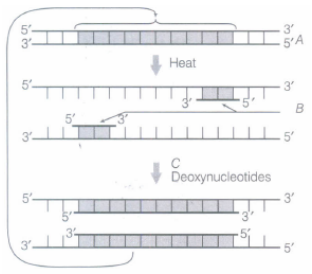
470) The following illustrates the linking of DNA fragments



(i) Write the name of A and B.
(ii) Complete the palindrome, which is recognised by Eco RI.
(iii) Write the name of the enzymes that can link the two DNA fragments.

471) Rearrange the following in the correct sequence to accomplish an important biotechnological reaction:
(a) In vitro synthesis of copies of DNA of interest
(b) Chemically synthesised oligonucleatides
(c) Enzyme DNA-polymerase
(d) Complementry region of DNA
(e) Genomic DNA template
(f) Nucleotides provided
(g) Primers
(h) Thermostable DNA-polymers (From Thermus aquaticus)
(i) Denaturation of dsDNA

472) A schematic representation of Polymerase Chain Reaction (PCR) up to the extension stage is given below. Give answers of the following questions.



(i) Name the process A.
(ii) Identify B
(iii) Identify C and mention its importance in PCR.

473) Mention three uses of PCR.

474) How bacterial cells are made competent to take up DNA?

475) Draw a labelled sketch of sparged-stirred tank bioreactor. Write its application.

476) The sequence given below shows some of the steps involved in the production of bacteria capable of synthesising human insulin.

mRNA for human insulin isolated
↓
DNA coding for human insulin produced
↓
DNA coding for human insulin cloned
↓
DNA coding for human insulin inserted into a plasmid vector
↓
Plasmid vector inserted into bacterium

State that role of each of the following enzymes in the production of bacteria capable of synthesising human insulin, reverse transcriptase, DNA polymerase, restriction enzymes (restriction endonucleases), DNA ligase.

477) Agrobacterium tumifaciens is a soil bacterium; known as a plant pathogen as well a plasmid vector for plant transformation (genetic engineering). Enlist other bacterial plant pathogens or their relatives that have widely used in agriculture and food production.

478) Bacteriophages are virus infecting bacteria, that are used as vectors because of their high copy number. Lambda phage is a non-contractile bacteriophage used as vector that follows two life cycle, lysogenic and lytic. Explain, both the life cycles with the help of a diagram

479) A purified DNA can be extracted from a cell only after lysis. Different cells like plant, fungal and algal cell require different enzymes for breaking of cell wall. Give reasons for the some.

480) The fungus Penicillium chrysogenum is grown in fermentors on an industrial scale to produce penicillin, using a batch culture system.
Explain why, batch culture rather than continuous culture is used for production of penicillin.

481) (i) A bacterial cell is shown in the figure given below. Label the part 'A' and 'B'. Also mention the use of part 'A' in rDNA technology.

(ii) Suppose a linear DNA fragment and a plasmid has three restriction sites for Eco RI. How many fragments will be produced from linear DNA and plasmid respectively.

482) (i) Name the selectable markers in the cloning vector pBR322.Mention the role they play.
(ii) Why is the coding sequence of an enzyme β- galactosidase a preferred selectable marker in comparison to the ones named above?

483) (a) Why must a cell be made 'competent' in biotechnology experiments? How does calcium ion help in doing so?
(b) State the role of 'biolistic gun' in biotechnology experiments.

484) How does Agrobacterium tumifaciens act as a suitable vector in the biotechnological experiments? Site an example where it has been successfully used as a vector.

485) Make a list of three household products along with the names of the micro-organism producing them.

486) Explain with the help of an example the relationship between restriction endonuclease and a palindromic nucleotide sequence.

487) Explain enzyme-replacement therapy to treat adenosine deaminase deficiency. Mention two disadvantages of this procedure.

488) Explain the role of the enzyme EcoRl in recombinant DNA technology.

489) Explain the mode of action of EcoRl.

490) Why is Taq polymerase preferred to peR? Mention the source of this enzyme?

491) (a) Differentiate between exons and introns.
(b) What is a plasmid? Why is it selected as a vector?

492) (a) Draw the figure of vector pBR322and label the following:
Origin of replication Ampicillin resistance site Tetracycline resistance site Ban HI restriction site.
(b) Identify the significance of origin of replication.

493) Name and describe the technique that helps in separating the DNA fragments formed by the use of restriction endonuclease.

494) Eco RI is used to cut a segment of foreign DNA and that of a vector DNA to form a recombinant DNA. Show with the help of schematic diagrams.
(i)The set of palindromic nucleotide sequence of base pairs the Eco RI will recognise in both the DNA segments. Mark the site at which Eco RI will act and cut both the segments. .
(ii) Sticky ends formed on both the segments where the two DNA segments will join later to form a recombinant DNA.

495) How can following be made possible for biotechnology experiments?
(a) Isolation of DNA from bacterial cell.
(b) Reintroduction of recombinant DNA into a bacterial cell.

496) What is biotechnology? Describe its different forms.

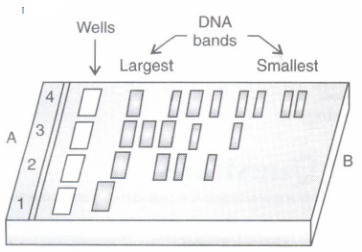
497) What does Taq represent in Taq polymerase?

498) Suggest and describe a technique to obtain multiple copies of a gene of interest in vitro.

499) (a) What is Gene therapy?
(b) Describe the procedure of such a therapy that could be a permanent cure for a diesease.Name the disease.

500) (i) Why was a bactenum used m the first instance of the construction of an artificial recombinant DNA molecule.
(ii) Name the scientists who accomplished this and how?

501) Rajesh was doing gel electrophoresis to purify DNA fragments. Given below is the sketch of the observations of the experiment performed by him.



(a)At which end he would have loaded the samples and where?
(b) Analyse the reason for different positions taken up by the DNA bands.
(c) Elabora the step he would have followed to visualize DNA bands.

502) (a) List the three steps involved in Polymerase Chain Reaction (PCR).
(b) Name the source organism of Tag polymerase. Explain the specific role of this enyme in PCR.

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

504) "A very small sample of tissue or even a drop of blood can help determine paternity". Provide a scientific explaination to substantiate the statement.

505) Restriction enzyme should not have more than one site of action in the cloning site of vector. Comment

506) What is called molecular glue and why?

507) In a Polymerase Chain Reaction (PCR),give the temperature required for the steps
(i) denaturation (ii) annealing and (iii) extension, respectively.

508) Write the function of the following in biotechnology.
(i) Polymerase chain reaction technique.
(ii) Restriction endonucleases.
(iii) Bacterium Thermus aquaticus.

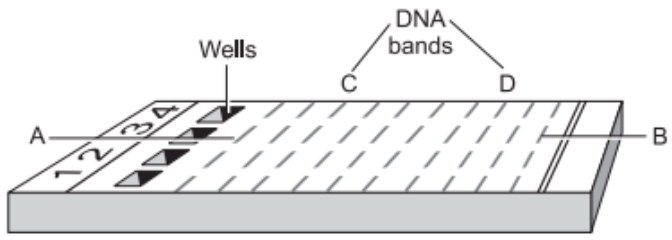
509) Briefly describe the following
(i) Bioreactors
(ii) Downstream processing

510) What essential features must be present in a cloning vehicle/ cloning vector?

511) Agrobacterium tumefaciens is considered as a good cloning vector. Explain why?

512) How do antibiotic-resistance genes function as selectable markers? Explain with the help of E.coli cloning vector pBR 322

513) Study the diagram given below and answer the following questions:



(a) Why have DNA fragments in band 'D' moved farther away in comparison to those in band 'C'?
(b) Which is the anode end, A or B?
(c) What is the role of the matrix in this experiment?
(d) How are the separated DNA fragments visualised?

514) Explain the three basic steps to be followed during genetic modification of an organism.

515) What is a recombinant DNA? List its features. How do enzymes restriction endonuclease and DNA ligase help its formation?

516) Describe a palindrome with the help of an example.

517) Describe the formation of recombinant DNA by the action of ECORI.

518) a) Draw schematic diagrams of segments of a vector and a foreign DNA with the sequence of nucleotides recognised by EcoRI.
(b) Draw the vector DNA segment and foreign DNA segment after the action of EcoRI and label the sticky ends produced.

519) Name and explain the technique used for separating DNA fragments and making them available for biotechnology experiments.

520) Draw a diagram of a typical agarose gel electrophoresis, showing migration of undigested and digested sets of DNA fragments. Label:
(a) the digested and undigested-DNA fragments.
(b) Anode and cathode ends of the plate Mention the role of electrophoresis in biotechnology

521) What are 'cloning sites' in a cloning vector? Explain their role. Name any two sites in pBR 322

522) Mention the role of the following in E. coli cloning vector pBR322.
(i) Selectable marker
(ii) ori
(iii) rop

523) How does β-galactosidase coding sequence act as a 'selectable marker'? Explain, why is it a preferred selectable marker to antibiotic resistance genes?

524) (a) Why must bacterial cells be first made 'competent' in rDNA technology? How is the process carried out?
(b) Name the methods by which an alien DNA can be made to enter
(i) a plant cell.
(ii) an animal cell

525) List in proper sequence the processes involved in recombinant DNA (rDNA) technology.

526) Describe the roles of (i) high temperature, (ii) primers and (iii) bacterium- Thermus aquaticus in carrying the process of polymerase chain reaction.

527) (a) Why is polymerase used instead of ordinary DNA polymerase in polymerase chain reaction (PCR)? Name the source organism of Taq polymerase.
(b) What is PCR used for ?

528) What is a bioreactor used for? Name a commonly used bioreactor and any two of its components.

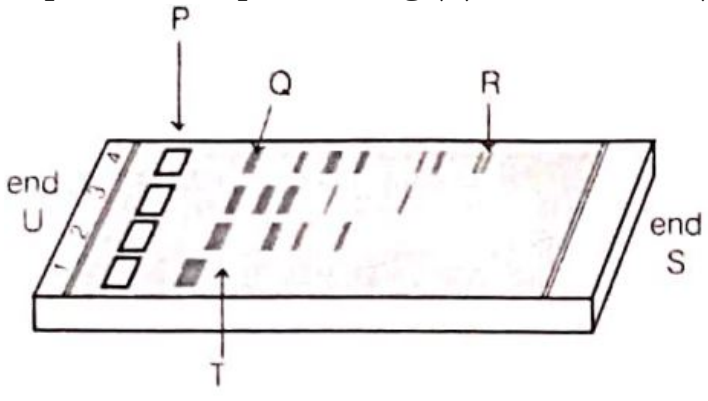
529) (a) How has the development of bioreactor helped biotechnology?
(b) Name the most commonly used bioreactor and describe its working.

530) Why is a recombinant protein so called? How can it be harvested on a large scale? Write two precautions to maintain a higher yield.

531) Outline how restriction enzymes are used for removing sections of DNA from a chromosome.

532) Only with the help of a labelled diagram, show the steps of formation of recombinant DNA by the action of restriction endonuclease enzyme EcoRI.

533) (i) Given below is the stepwise schematic representation of the process of electrophoresis. Identify the 'alphabets' representing (a) Anode end, (b) smallest/lightest DNA strand in the matrix, (c) Agarose gel.



(ii) What is elution? State the importance of elution in this process.

534) Causative agents of HIV-AIDS and Covid-19 belong to the same group of viruses. To diagnose and amplify the genetic material for further study of Covid-19 virus, RT-PCR' test is carried out.
(i) What does 'RT-PCR' stand for?
(ii) Explain the various steps of PCR technique.

535) Expand 'BAC' and 'YAC'. What are they and what is the purpose for which they are used?

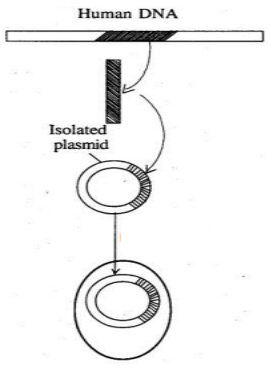
536) (i) Mention the importance of gel electrophoresis in biotechnology.
(ii) Explain the process of this technique.

537) (i) Explain the convention for naming EcoRI.
(ii) With the help of an illustration only, show the action of EcoRI on a DNA polynucleotide.

538) (a) Why must a cell be made 'competent' in biotechnology experiments. How does calcium ion help in doing so?
(b) State the role of 'biolistic gun' in biotechnology experiments.

Case Study Questions 29 x 4 = 116

539)

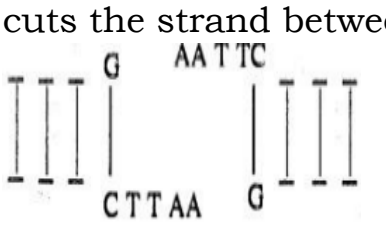


(a) Name the particular technique in Biotechnology, whose steps are shown in the figure.
(b) Name the steps 1 to 4 marked in the figure.
(c) Give an example where a human gene product is. obtained from transgenic bacteria.

540) (a) Name and write the significance of enzyme X.
(b) Name and write the role of enzyme Y.
(c) Name the processes A and B.

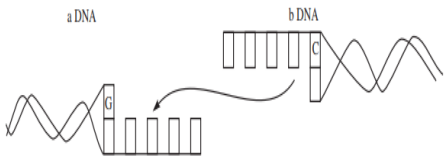
541) Restriction enzymes typically recognize a symmetrical sequence of DNA.

Notice that the top strand is the same as the bottom strand, but reads backward. When the enzyme cuts the strand between G and A, it leaves overhanging chains:



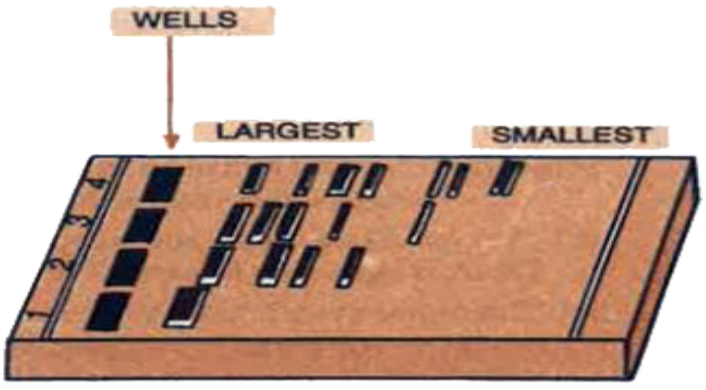
(a) What is this symmetrical sequence of DNA known as?
(b) What is the significance of these overhanging chains?
(c) Name the restriction enzyme that cuts the strand between G and A.

542) The following diagram illustrates the linking of DNA fragements. Answer the questions that follow the illustration.



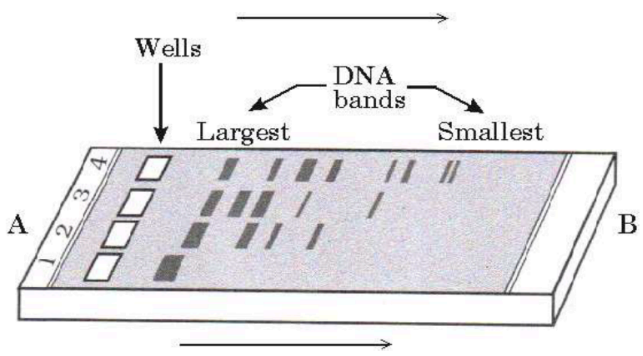
(a) Name 'a' and 'b'.
(b) Complete the palindrome, which is recognised by EcoRI.
(c) Name the enzyme that can link the two DNA fragments.

543)



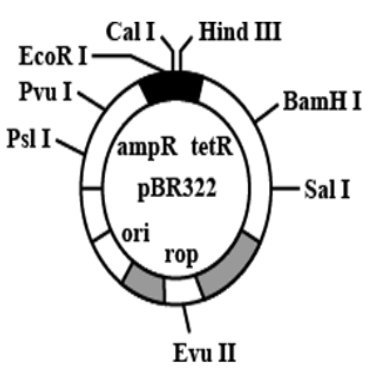
(a) What does the diagram given above, depict?
(b) What is meant by 'largest' and 'smallest' in the diagram'?
(c) Name the compound used to visualise them.
(d) Define elution.

544)



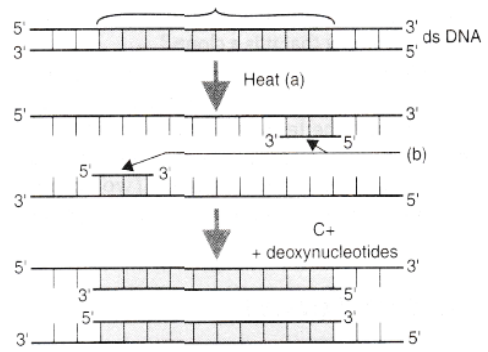
A picture of gel electrophoresis showing the separation of DNA fragments is shown above. Answer the following questions.
(a) Identify the positive and negative terminals.
(b) What is the matrix used and mention its source?
(c) Identify the undigested DNA.

545)



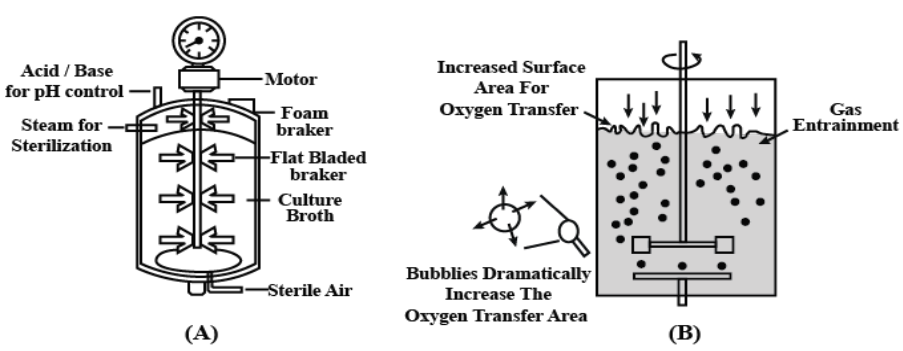
The E.coli cloning vector pBR322 is shown above.
(a) Identify and name two selectable markers.
(b) Identify and name the restriction enzymes that can be used to ligate an alien DNA fragment at the tetracycline gene.
(c) Identify EcoRI.
(d) Name the gene that controls the copy number of the vector.

546) A schematic representation of the steps in Polymerase Chain Reaction (PCR) is shown below. Answer the questions that follow:



(a) Name the steps A and D in the PCR.
(b) Identify B. What are they chemically?
(c) What is C? Name its source organism.

547)



(a) Name the type of bioreactor shown above.
(b) Why does it have a curved base?
(c) What is the significance of the stirrer?

548) When a gene product is required in large quantities, the transformants with N2 the plasmid inside the cell are cultured in a large scale in an industrial fermenter, which then synthesise the desired protein. This product is extracted from the fermenter for commercial use.
(a) Why is the used medium drained out from one side while the fresh medium is added from the other. Explain.
(b) List any four optimum conditions for achieving the desired product in a bioreactor.

549) **Read the following and answer any four questions from (i) to (v) given below:**
Gene manipulation is a fast emerging science. It started with development of recombinant DNA molecule. It is named variously as DNA manipulation biotechnology, recombinant DNA technology and genetic engineering. This technology, that mostly involves cutting and pasting of desired DNA fragments, is based on two important discoveries in bacteria, i.e., presence of plasmid in bacteria and restriction endonucleases. Paul Berg was able to introduce a gene of SV-40 into a bacterium. The science of recombinant DNA technology took birth when Cohen and Boyer (1973) were able to introduce a piece of gene containing foreign DNA into plasmid of E.coli.
(i) Biotechnology is also known as
(a) DNA manipulation biotechnology (b) recombinant DNA technology
(c) genetic engineering (d) all of these.
(ii) A bacterial plasmid is a/an
(a) extra chromosomal material that do not replicate (b) extra chromosomal material that undergo replication with or without chromosomal DNA
(c) tubular structures that help in conjugation (d) bristle like solid structure that help in adhesion.
(iii) Father of genetic engineering is
(a) Paul Berg(b) Arber(c) Nathan(d) Smith.
(iv) Which of the following is used by Paul Berg to introduce a gene of SV-40 in a bacterium?
(a) E. coli (b) cos-plasmids (c) Lambda phage (d) None of these
(v) Read the given statements and select the correct option.
Assertion : Biotechnology started with the development of recombinant DNA molecule.
Reason : Biotechnology mostly involves cutting and pasting of desired DNA fragments.
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

550) **Read the following and answer any four questions from (i) to (v) given below:**

Restriction endonuclease was isolated for the first time by W Arber in 1962 in bacteria. Restriction endonucleases cut the DNA duplex at specific points therefore they are also called as molecular scissors or biological scissors. Three types of restriction endonucleases are Type I, Type II and Type III but only Type II restriction endonucleases are used in recombinant DNA technology. Restriction endonuclease EcoR I recognises the base sequence GAATTC in DNA duplex and cut strands between G and A.

(i) Only type II restriction enzymes are used in gene manipulation because

(a) ATP is not required for cleaving

(b) it consists of three different subunits

(c) it makes cleavage or cut in both the strands of DNA molecule

(d) both (a) and (c).

(ii) Which of the following ions are used by restriction endonucleases for restriction?

(a) Mg^{2+} ions(b) Mn^{2+} ions(c) Na^{+} ions(d) K^{+} ions

(iii) Restriction endonuclease was isolated for the first time in a

(a) plant cell(b) animal cell(c) prokaryotic cell(d) germinal cell

(iv) Restriction endonucleases are also called as molecular or biological scissors because

(a) they cleave base pairs of DNA only at their terminal ends

(b) they cleave one or both the strands of DNA

(c) they act only on single stranded DNA

(d) none of these

(v) Select the option that correctly states the working action of restriction endonuclease EcoR 1 on DNA sequence GAATTC

(a)
```
      ↓
5' - GAATTC - 3'
3' _ CTTAAG - 5'
      ↑
```
(b)
```
      ↓
5' - GAATTC - 3'
3' - CTTAAG - 5'
      ↑
```
(c)
```
      ↓
5' - GAATTC - 3'
3' - CTTAAG - 5'
      ↑
```
(d)
```
      ↓
5' - GAATTC - 3'
3' - CTTAAG - 5'
      ↑
```

551) **Read the following and answer any four questions from (i) to (v) given below:**

Tools used in the formation of recombinant DNA are of three types. These are enzymes, cloning vectors and competent host. Lysing enzymes are used to extract DNA for experimental purpose from the cells. Cleaving enzymes break the DNA molecules. They are of three types : exonucleases, endonucleases and restriction endonucleases. A competent host is required for transformation with recombinant DNA and cloning vectors help to propagate DNA.

(i) Which of the following is an example of natural lysing activity in a human body?

(a) Lysozyme present in tears dissolve the bacterial cell wall.

(b) Conversion of starch to maltose in the buccal cavity

(c) Absorption of digested food into the intestinal cells.

(d) Conversion of protein molecules into amino acids in the stomach.

(ii) The enzyme which has polymerizing activity in 5'→3' direction but exonuclease activity in 3'→5' direction only is

(a) RNA polymerase III(b) DNA polymerase II

(c) DNA polymerase I (d) All of these

(iii) Cloning vectors are the DNA molecules that

(a) carry foreign DNA segment but do not replicate inside the host cell

(b) carry foreign DNA segment and replicate inside the host cell

(c) transfer nuclear DNA form nucleus to the cytoplasm of the same cells

(d) help in sealing gaps in DNA segments.

(iv) Transfer of DNA into a eucaryotic cell is called

(a) transformation(b) transduction(c) transfection(d) electroporation.

(v) **Assertion:** Type I restriction enzymes are not used in rDNA technology.

Reason: Type I restriction endonucleases consist of two different subunits and require ATP for restriction activity.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

(b) Both assertion and reason are true but reason is not the correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

552) **Read the following and answer any four questions from (i) to (v) given below:**

The foundations of recombinant DNA (rDNA) were laid by the discovery of restriction enzymes. These enzymes are present in many bacterias where they function as a part of their defense mechanism called the Restriction Modification system (RM system). Molecular basis of this system was explained first by Werner Arber in 1962. The Restriction t-'l0dification system consists of two components:

1. A restriction enzyme (called restriction endonuclease) identifies the introduced foreign DNA and cuts it into pieces.

2.The second component is a modification enzyme (methylase) that adds a methyl group to DNA at specific site to protect it from the restriction enzyme cleavage.

(i) Restriction endonucleases are enzymes present in (i) where they function as a part of (ii) mechanism.

(a) (i) bacteria (ii) digestive **(b) (i) protists (ii) transcription** **(c) (i) plant cells (ii) replication** **(d) (i) prokaryotes (ii) defence**

(ii) Which of the following statements regarding modification enzyme is correct?

(a) It adds methyl group to one or two bases usually within the host DNA sequence to protect it from the restriction enzyme.

(b) It adds ethyl group to one or two bases usually within the sequence recognised by the restriction enzymes.

(c) It adds methyl group to only one of bases within the foreign DNA sequence that is recognised by the restriction enzymes.

(d) None of these

(iii) Which of the following is a type II restriction enzyme?

(a) Alu I (b) EcoR I (c) BamH I (d) All of these

(iv) Which of the following is the first discovered restriction endonuclease?

(a) Sal I (b) EcoR I (c) Hind II (d) EcoR II

(v) Components of Restriction Modification System include

(a) restriction enzyme (b) modification enzyme (c) lysing enzyme (d) both (a) and (b).

553) **Read the following and answer any four questions from (i) to(v) given below:**

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) Gel electrophoresis is used for the separation of

(a) DNA only **(b) DNA and RNA only**

(c) DNA and proteins only **(d) DNA, RNA and proteins.**

(ii) Most commonly used matrix is (i) which is a (ii) extracted from (iii).

(a) (i) agarose (ii) polysaccharide (iii) sea weed **(b) (i) agarose (ii) protein (iii) sea weed**

(c) (i) EtBr (ii) polysaccharide (iii) sea weed **(d) (i) EtBr (ii) protein (iii) bacteria**

(iii) A DNA molecule was treated with a restriction endonuclease and three fragments of size (i) 426 kb, (ii) 129 kb and (iii) 46 kb were obtained. Identify the order in which these bands will arrange themselves in the gel plate after gel electrophoresis is completed. (Assuming that negative part of electrode is towards the well)

(a) (iii) → (ii) → (i) (b) (i) → (ii) →(iii) (c) (i) → (iii) → (ii) (d) (iii) → (i) → (ii)

(iv) Which of the following statements regarding gel electrophoresis is incorrect?

(a) Separated DNA fragments can be seen only after staining DNA with EtBr.

(b) DNA fragments are separated according to their size.

(c) Under the influence of electric field, positively charged molecules move towards the anode and negatively charged molecules move towards the cathode.

(d) None of these

(v) The factor that will not affect the rate of DNA migration in gel electrophoresis is

(a) size of DNA molecule (b) concentration of DNA (c) voltage supplied (d) concentration of the gel

554) **Read the following and answer any four questions from (i) to (v) given below :**

Rama lives in a society where a robbery occurred last night. Robbers came into the flat and murdered the old lady residing there. Police came and restricted the entry into the flat. They took samples from the room, where the dead body was found. While examining, they found that there is some blood and tissue in the nails of old lady. According to their observation, police filtered out their inspection to three suspects viz. servant, cook and milkman. Finally after two days of robbery, police caught the criminal. It was the old lady's cook. Rama was amazed to see that how quickly police completed and shut the case. She asked the inspector that how they did it? The police man told her that it become possible due to the sample collected from the victim, that lead them to the criminal. The sample taken from nail scraping was amplified using PCR and then tested.

(i) What technique was used by the police to identify the criminal?

(a) DNA fingerprinting (b) Gel electrophoresis (c) Molecular diagnosis (d) Clonning

(ii) In PCR, the temperature used to denature the DNA is about

(a) 76° C (b) 25°C (c) 95°C (d) 40°C.

(iii) Which of the following statements regarding PCR is correct?

(a) Taq polymerase, which is isolated from bacterium Thermus aquaticus is stable at low temperature only.

(b) With the help of DNA ligase, the complementary sticky ends of the DNA are joined to produce a rDNA.

(c) Since the sequence of primers are complementary to 5' end of the template DNA, they anneal to it.

(d) DNA purified from the cell is precipitated by adding hot ethanol.

(iv) Taq polymerase synthesises DNA region between the primers using

(a) Mg^{2+} (b) dNTPs (c) DNA ligase (d) both (a) and (b).

The correct order of steps in Polymerase Chain Reaction (PCR) is

(a) Denaturation, Extension, Annealing **(b) Extension, Denaturation, Annealing** **(c) Denaturation, Annea**

555) **Read the following and answer any four questions from (i) to (v) given below:**

The vectors are DNA molecules that can carry a foreign DNA segment and replicate inside the host cell. Vectors may be plasmids, bacteriophages (viruses that attack bacteria), cosmids, yeast artificial chromosomes (YACs), Bacterial artificial chromosomes (BACs) and viruses. The most widely used, versatile, easily manipulated vector pBR 322 is an ideal plasmid vector. Features that are required to facilitate cloning into a vector includes origin of replication (Ori) which is a specific sequence of DNA bases responsible for initiating replication, selectable marker genes and cloning sites.

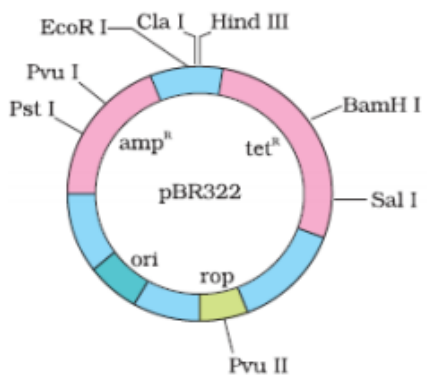
(i) P in pBR 322 denotes that it is a

(a) plasmid (b) prokaryote (c) protist (d) plant cell.

(ii) Ori is a specific DNA sequence that help in

(a) attachment of primers **(b) initiation of replication** **(c) extension of DNA base** **(d) initiation of denaturation.**

(iii) A and B shown in the figure respectively indicates



(a) Pvu II and Cla I (b) ROP and Sal I (c) amp^R and tet^R (d) tet^R and amp^R

(iv) Selectable markers in vector

(a) are responsible for replication

(b) help in selecting transformants from non-transformants

(c) code for proteins involved in the replicating plasmids

(d) contain unique recognition sites.

(v) Plasmid vectors are

(a) dsDNA molecule (b) extra-chromosomal (c) present in bacteria and yeast (d) all of these

556) **Read the following and answer any four questions from (i) to (v) given below:**

Rajat is a student of biotechnology. His professor tells him that for transformation with recombinant DNA the bacterial cells must be made capable of taking up DNA as DNA do not pass through membrane. While doing experiment in the lab, Rajat noticed that bacterial cells were not taking up the foreign DNA even after treating it with sodium ion. He asked his professor, the reason behind this. His professor explained that he should check the valency and charge of the ion that he is using for the treatment.

(i) It is difficult for DNA to pass through the membrane as

(a) it is a hydrophilic molecule (b) it is a hydrophobic molecule

(c) it is a circular molecule (d) it changes its shape when it comes in contact with host cell.

(ii) What type of ions are used for DNA mediated gene transfers?

(a) Divalent anions (b) Divalent cations (c) Monovalent cations (d) Monovalent anions

(iii) rDNA stands for

(a) reduced DNA (b) red DNA (c) recombinant DNA (d) related DNA.

(iv) Which of the following statements with regard to DNA is correct?

(a) DNA is a positively charged molecule having two polynucleotide chains.

(b) Nitrogen bases of two polynucleotide chain form complementary pairs, i.e., A opposite G and T opposite C.

(c) Backbone of DNA chain is built up of alternate deoxyribose sugar and phosphate group.

(d) Both (a) and (c)

(v) **Assertion:** Competent host is essential for transformation with rDNA.

Reason: Transfer of DNA in a prokaryotic cell is called transfection.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

(b) Both assertion and reason are true but reason is not the correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

557) Read the following and answer any four questions from (i) to (v) given below:

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, 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.

(i) Bioreactor are useful in

(a) amplifying a gene **(b) isolation of genetic material**

(c) processing large volume of culture **(d) infecting DNA in a cell.**

(ii) Which of the following is essential to obtain desired product in a bioreactor?

(a) Size of the bioreactor **(b) Sterile condition**

(c) Quantity of the raw material **(d) All of these**

(iii) **Assertion :** The stirred-tank is well suited for large scale production of microorganisms under aseptic conditions.

Reason: In sparged stirred tank bioreactor, surface area for oxygen transfer is increased.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

(b) Both assertion and reason are true but reason is not the correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

(iv) Growth condition that could affect the quality of obtained product in a bioreactor are

(a) temperature and pH only **(b) pH and oxygen supply only**

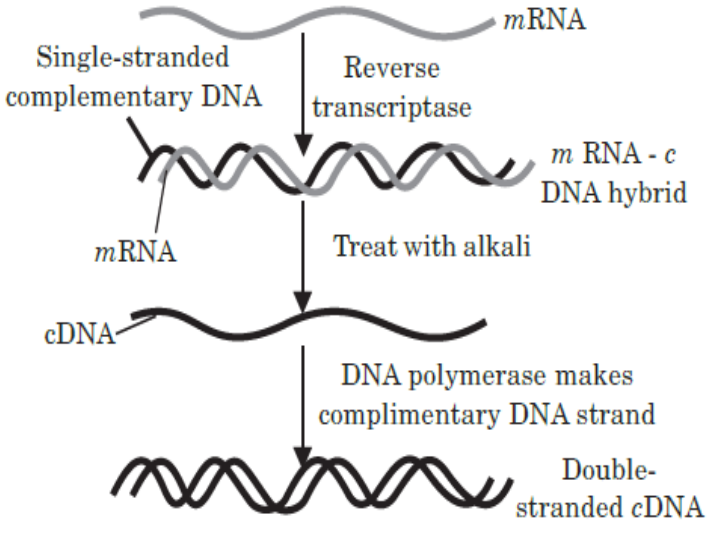
(c) temperature and oxygen supply only **(d) temperature, pH and oxygen supply.**

(v) Vessels in which raw materials are biologically converted into specific products are

(a) bioreactors (b) fermentors (c) gene guns (d) both (a) and (b).

558) **Read the following and answer any four questions from (i) to (v) given below:**

The DNA, which is transferred from one organism into another by joining it with the vehicle DNA is called passenger or foreign DNA. Generally three types of passenger DNAs are used. These are complementary DNA (cDNA), synthetic DNA (sDNA) and random DNA. Complementary DNA (cDNA) is synthesized on RNA template (usually mRNA) with the help of reverse transcriptase. Synthetic DNA (sDNA) is synthesized on DNA template or without a template. Random DNA are small fragments formed by breaking a chromosome of an organism in the p.resence of restriction endonucleases.



(i) Reverse transcriptase enzyme was discovered by

(a) Temin and Baltimore **(b) Cohen and Boyer** **(c) Arber and Nathan** **(d) Paul Berg.**

(ii) During cDNA formation, what would happen if DNA formed by reverse transcriptase is not treated with the alkali?

(a) cDNA will not be digested **(b) mRNA will not be digested**

(c) Hydrogen bonds will not form between base pairs **(d) mRNA will not be formed.**

(iii) Enzyme that helps in the formation of double stranded cDNA is

(a) DNA synthetase **(b) ligase** **(c) DNA polymerase** **(d) helicase.**

(iv) DNA polymerase can be obtained form

(a) retrovirus **(b) Agrobacterium** **(c) tobacco mosaic virus** **(d) Thermus aquaticus**

(v) DNA synthesised without a template is referred to as

(a) complementary DNA **(b) random DNA** **(c) synthetic DNA** **(d) Z-DNA**

559) Read the following passage and answer the questions given below.

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, the recombinant

(a) become tetracycline resistant

(b) will loose tetracycline resistant

(c) will remain same

(d) None of the above

(ii) In insertional inactivation, the recombinant DNA is inserted within the coding sequence of

(a) β - galactosidase

(b) tetracycline resistant gene

(c) restriction enzyme

(d) ampicillin resistant gene

(iii) Recombinant colonies in insertional inactivation are differentiated on the basis of

(a) production of blue colour

(b) production of no colour

(c) production of red colour

(d) production of green colour

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

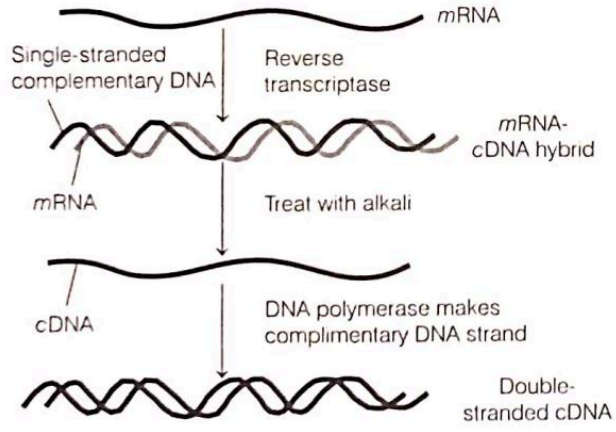
(a) Provides resistance against a substrate

(b) Inhibits the growth of normal cell in a culture

(c) Helps to create a chromosome map

(d) Both (a) and (b)

560) Read the following passage and answer the questions given below.
The DNA, that is transferred from one organism into another by joining it with the vehicle DNA is called foreign DNA. Usually, three types of foreign DNA are used. These are complementary DNA (cDNA), synthetic DNA (sDNA) and random DNA. Complementary DNA (cDNA) is synthesised on RNA template (usually mRNA) with the help of reverse transcriptase. Synthetic DNA (sDNA) is synthesised on DNA template or without a template. Random DNA are small fragments formed by breaking a chromosome of an organism in the presence of restriction endonucleases.



(i) The reverse transcriptase enzyme was discovered by
(a) Temin and Baltimore
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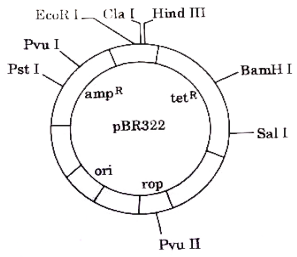
(ii) During cDNA formation,what DNA would happen if formed by reverse transcriptase is not treated with alkali?
(a) cDNA will not be digested
(b) mRNA will not be digested
(c) Hydrogen bonds will not form between base pair
(d) mRNA will not be formed
(iii) DNA polymerase can be obtained from
(a) Retrovirus **(b) Agrobacterium**
(c) Tobacco mosaic virus **(d) Thermus aquaticue**
(iv) DNA synthesised without a template is referred to as
(a) random DNA **(b) synthetic DNA**
(c) complementary DNA **(d) Z- DNA**

561) Read the following passage and answer the questions given below.
Some restriction enzymes break a phosphodiester bond on both the DNA strands, such that only one end of each molecule is cut and these ends have regions of single-stranded DNA. BamHI is one such restriction enzyme which binds at the recognition sequence, 5'-GGATCC- 3' and cleaves these sequences just after the 5'- guanine on each strand.
(i) What is the objective of this action?
(ii) Explain how the gene of interest is introduced into a vector.
(iii) You are given the DNA shown below.
5' ATTTTGAGGATCCGTAATGTCCT 3'
3'TAAAACTCCTAGGCATTACAGGA 5'
If this DNA was cut with BamHI, how many DNA fragments would you expect? Write the sequence of these double-stranded DNA fragments with their respective polarity.
(iv) A gene M was introduced into E. coli cloning vector pBR322 at BamHI site. What will be its impact on the recombinant plasmids? Give a possible way by which you could differentiate non-recombinant to recombinant plasmids.

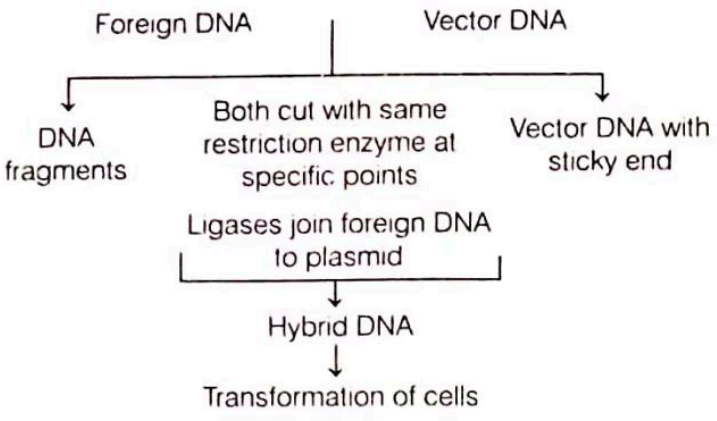
562) Gene of interest/alien gene is introduced by a cloning vector into a host cell to bring about desired phenotypic expression in a host cell. The cloning vectors used are plasmid and bacteriophages. Biotechnologists in their labs for desired results engineered specialised cloning vectors. One such vector is pBR322 Study the diagram carefully and answer the questions that follow.



(i) What do 'EcoRI', 'BamHI' and 'Hind III' represent? State their functions.
(ii) Identify the gene you would select for the role of a selectable marker in pBR322. Explain why?
(iii) Write the property/characteristic of plasmid and bacteriophage that makes them efficient cloning vectors.
(iv) Biotechnologists always insert 'ori' gene in their engineered cloning vector. Justify the statement.
(v) Will the experiment be successful if the alien DNA is ligated at Hind III restriction site? Give reason in support of your answer.

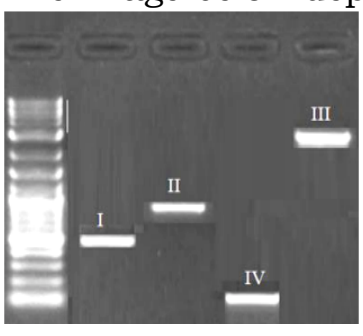
563) Enzyme Taq polymerase, is extracted from a eubacterial microorganism Thermus aquaticus from Yellowstone National Park in Montana, USA and isolated by Chien et at., (1976). Taq polymerase successfully replaced the DNA polymerase from E. coli that was being used in PCR earlier and this shift revolutionised the PCR technique.
(i) Taq polymerase after its discovery replaced E. coli. DNA polymerase in PCR technique. Explain giving reasons why was the need felt for the change?
(ii) What is a primer and its importance in PCR?
(iii) Write the importance of PCR as a diagnostic tool.

564) Refer to the following flow diagram and answer the questions that follows



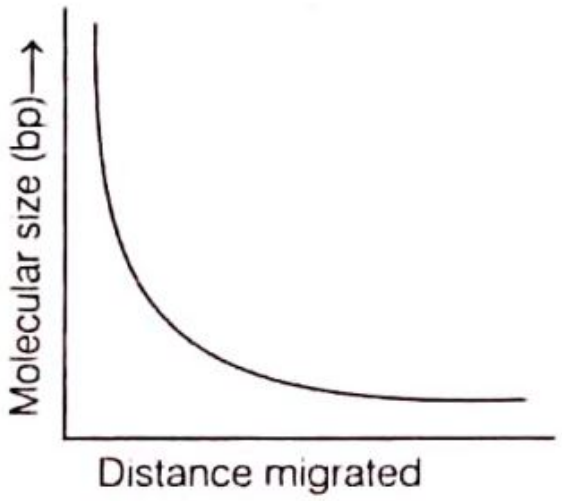
(i) A plasmid DNA and a linear DNA (both of same size) have one site for a restriction endonuclease. When cut and separated on agarose gel electrophoresis, plasmid shows one DNA band, while linear DNA shows two fragments. Justify.
(ii) How are transformed cells selected?

565) The image below depicts the result of gel electrophoresis.



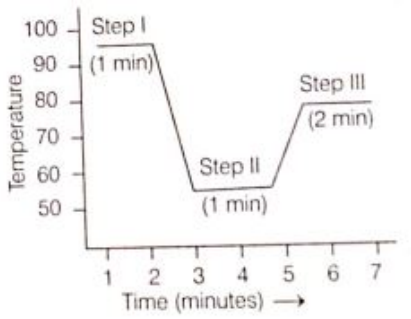
If the ladder represents sequence length upto 3000 base pairs (bp),
(i) Which of the bands (I - IV) correspond to 2500 bp and 100 bp, respectively?
(ii) Explain the basis of this kind of separation and also mention the significance of this process

566) Given below is the graph representing the relationship between DNA fragment size and distance migrated in gel electrophoresis.
Observe the graph given below and answer the questions that follows



(i) With the reference to the above graph, explain the relationship between DNA fragment size and distance migrated.
(ii) When you should use agarose gel electrophoresis?
(iii) How will you determine the exact size of separated DNA fragments in the gel electrophoresis?
(iv) Why is DNA size standard used in gel electrophoresis?

567) The graph given below represents a process used for the amplification of DNA. The steps involved in this process are temperature dependent. Observe the graph given below and answer the following questions



(i) On the basis of the above graph, what conclusion can you draw about the temperature dependence of different steps involved in the given process ?
(ii) If we are not able to maintain high temperature at step I, how this process will be affected ?
(iii) Mention the basic requirements involved in this process?
(iv) How this process is differ from conventional gene cloning ?

5 Marks 41 x 5 = 205

568) Can you list 10 recombinant proteins which are used in medical practice. Find out where they are used as therapeutics (use the internet).

569) Discuss with your teacher and find out how to distinguish between
(i) Plasmid DNA and chromosomal DNA
(ii) DNA and RNA
(iii) Exonuclease and endonuclease.

570) If a desired gene is identified in an organism for some experiments explain the process of the following:
(i) Cutting this desired gene at a specific location.
(ii) Synthesis of multiple copies of this desired gene.

571) (a)With the help of diagrams show the different steps in the formation of recombinant DNA by action of restriction endonuclease enzyme EcoRI.
(b)Name the technique that is used for separating the fragments of DNA cut by restriction endonucleases.

572) Draw a labelled diagram of a simple stirred-tank bioreactor and describe its functionating.

573) (a)Why are engineered vectors preferred by biotechnologists for transferring the desired genes into another organism?
(b)Explain how 'ori', 'selectable markers' and 'cloning sites' facilitate cloning into a vector.

574) What is a bioreactor? Draw a labelled diagram of a sparged stirred-tank-bioreactor. Explain its functionating.

575) (a)Mention the role of vectors in recombinant DNA technology. Give any two examples.
(b)With the help of diagrammatic representation only, Show the steps of recombinant DNA technology.

576) Make a chart showing a restriction enzyme, the substrate DNA on which it cuts DNA and the product it produces.

577) Describe briefly the bioreactors.

578) Explain briefly Restriction enzymes and DNA.

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

580) What are bioreactors? Sketch the two types of bioreactors. What is the utility? Which is the common type of bioreactors?

581) How do bioreactors help in production of recombinant proteins?

582) David came to India to meet hid friend Anil. Anil introduced him to his uncle and told that David is pursuing course in biotechnology. Uncle had never heard this term earlier and was curious to know about this term. David pointed towards a big tree at the base of which were present numerous tumour-like structures and said that this is the example of natural biotechnology.
Read the above passage and answer the following questions :
(i) What is biotechnology?
(ii) How are crown gall tumours formed ?
(iii) Why was uncle curious to know about biotechnology ?

583) Suresh thought of straight export of orchids as these flowers fetch high price in international market due to their beauty and longer vase life. He consulted his Botanist uncle who suggested him a fast method of propagation of orchids to earn good profits.
Read the above passage and answer the following questions:
(i) What is plant tissue culture ?
(ii) What is micropropagation ?
(iii) What value is displayed by Suresh's uncle ?

584) Shilpi heard about clones in cartoon serials on TV and also came to know about "Dolly" as a cloned sheep. She discussed it with her biology teacher who explained the meaning of clone and the method to raise the clones.
Read the above passage and answer the following questions :
(i) What is a clone ?
(ii) How clones are produced in plants ?
(iii) Why did Shilpi discuss the matter with her biology teacher ?

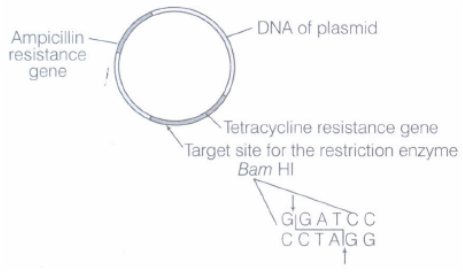
585) Hari was a grower. He used to grow tomatoes on his fertile land and got very good yields. Science the vegetable market was far from his village and also he had no transport facility, most of his harvest was rotten due to delay. He consulted his friend in a agriculture university for solution to this problem who suggested him to grow transgenic tomatoes with delayed ripening genes.
Read the above passage and answer the following questions:
(i) What are transgenics?
(ii) How are transgenic tomato produced?
What value was displayed by Hari's friend?

586) (i) Restriction enzymes cut into fragments.They cut at specific sites determined by the sequence of bases.Following figures shows the base sequences cut by three restriction enzymes and a section of DNA cut by one of these enzymes, Restriction enzymes DNA Sequence.

	↓
HindIII	AAGCTT
	↓
EcoRI	GAATTC
	↓
Bam HI	GGATTCC
Section of DNA	5'- TACGAATTCGTAA-3'
	3'-ATGCTTAAGCATT-5'
	↓
5'-TACG-3'	5'-AATTCGTTAA-3'
3' ATGCTTAA-5'	3'-GCATT-5'

(a) Identify the restriction enzyme that has cut the section of DNA shown in figure.
(b) State the name given to the unpaired base sequences that remain after DNA has been cut by the three restriction enzymes shown in figure.restriction
(iii) Human genes may be cloned by inserting lengths of DNA into bacteria. This may be carried out by inserting the required DNA plasmid Explain how lengths of DNA, cut by restriction enzymes, are inserted into plasmids?

587) Following figure shows one of the artificial plasmids constructed to act as a vector.



(i) With reference to above figure explain the importance of the plasmids having a single target site for a particular restriction enzyme, such as Bam HI.
(ii) The genes for ampicillin resistance and tetracycline resistance on the plasmid allow the genetic engineer to distinguish between bacteria that have taken up different circuits of DNA.
Complete the table to shoe whether bacteria which have taken up each of the different circuits of DNA are resistance to ampicillin, to tetracycline or to both. Show presence of resistance with a tick ($\surd$) and absence of resistance with a cross($\times$).
(iii) (a) Explain why genes for antibiotic resistance are now rarely used as markers in gene technology.
(b) Describe the use of one alternative marker gene that can be used instead of an antibiotic resistance gene..

588) What is genetic engineering? List the steps involved in rDNA technology.

589) Explain briefly Chitinase

590) Rahul introduced Ronit to his uncle and told him that Ronit is pursuing course in biotechnology in America.
His uncle had never of this term earlier and was curious to know about this term. Ronit pointed towards a big tree at the base of which were present numerous tumour-like structures and said that this is the example of natural biotechnology.
(i) What is biotechnology?
(ii) How these crown gall tumours are formed?
(iii) What are the value shown by Rahul's uncle?

591) The biology teacher was explaining about restriction enzymes and came to a point explaining that these enzymes are extracted from bacteria and are called as molecular scissors. Varun, a student got curious and asked some questions for more clarity on the concept to his teacher.
(i) From which part of microorganisms are restriction enzymes derived?
(ii) Why are restriction enzymes called molecular scissors?
(iii) What if some strands are needed to be cut from within. would that lead to wastage of DNA?
(iv) What value are shown by varun?

592) No evidence was found on a crime scene, other than only a few hair strands. The inspector wants to proceed for DNA fingerprinting but the amount of DNA is very less.
(i) In your opinion what could be the solution to this problem?
(ii) Write the basic steps of this technique.
(iii) Name the scientist who developed this technique.
(iv) What values show by the inspector?

593) Shubham was taught in the biotechnology class about the production of recombinant protein with the help of bioreactor. He was surprised by this new information. In the evening he discussed it with his elder brother, who is a biotechnologist. He smiled and explained him in detail.
(i) Why is bioreactors useful in industries?
(ii) What are the values shown by Shubham?

594) Unless the vector and source DNA are cut, fragments separated and joined, the desired recombinant vector molecule cannot be created.
(a) How are the desirable DNA sequence cut?
(b) Explain the technique used to separate the cut fragments.
(c)How are the resultant fragments joined to the vector DNA molecule?