BIOTECHNOLOGY: PRINCIPLE AND PROCESSES

1. The controlled use of biological agents, such as live organisms or enzymes from organisms to produce products and processes useful to humans is called as
   (A) biochemistry
   (B) molecular biology
   (C) biotechnology
   (D) microbiology

2. EFB stands for
   (A) European Federation of Biotechnology
   (B) Eurasian Federation of Biotechnology
   (C) East Asia Federation of Biotechnology
   (D) Ethiopian Federation of Biotechnology

3. Genetic engineering techniques include
   (A) altering genetic material
   (B) sequencing genetic material
   (C) studying genetic material
   (D) None of the above

4. The specific sequence of DNA that initiate replication of alien DNA in rDNA technology is called as
   (A) initiation sequence
   (B) origin of replication
   (C) origin of DNA
   (D) initiation of DNA

5. The different basic steps of genetically modifying an organism are given below randomly.
   I. Identification of DNA with desirable genes.
   II. Transfer of the DNA to its progeny.
   III. Maintenance of introduced DNA in the host.
   IV. Introduction of identified DNA into the host.
   Which of the following represents the correct sequence of steps?

   (A) I, II, III and IV
   (B) I, IV, III and II
   (C) III, IV, II and I
   (D) I, III, IV and II

6. The enzymes, commonly used in genetic engineering are
   (A) restriction endonuclease and polymerase
   (B) endonuclease and ligase
   (C) restriction endonuclease and ligase
   (D) ligase and polymerase

7. In the naming of restriction enzymes, the first letter of the name is derived from .....A ....and next two letters from the ..... B .....and fourth letters from the name of ..... C ....of ....D ....from which the enzymes are extracted. A to D in the statement can be

	A	B	C	D
(A)	genus	species	strain	bacteria
(B)	species	genus	strain	bacteria
(C)	genus	species	variety	eukaryote
(D)	species	genus	variety	eukaryote

8. Restriction endonuclease binds to DNA and cuts two strands of double helix at specific points in their
   (A) sugar-phosphate backbone
   (B) hydrogen bond
   (C) glycosidic bonds
   (D) None of the above

9. Restriction enzyme cuts the DNA strand a little away from the centre of palindrome site between
   (A) same two bases on same strand
   (B) same two bases on opposite strand
   (C) opposite bases on same strand
   (D) opposite bases on opposite strand

10. How many fragments will be generated, if a closed circular DNA molecule is digested using a restriction enzyme having six recognition sites on the DNA?
   (A) 4
   (B) 6
   (C) 7
   (D) 5

11. Which of the following option(s) is not correct regarding Eco RI enzyme?
    (A) Restriction endonuclease enzyme
    (B) Isolated from Escherichia coli RY13
    (C) Cuts at specific position within the DNA
    (D) None of the above

12. The cutting of DNA by …… results in the fragments of DNA. Choose the appropriate option.
    (A) restriction endonucleases
    (B) exonuclease
    (C) endonuclease
    (D) anhydro L-galactose

13. Which of the following techniques is most commonly used to separate DNA molecules by size?
    (A) Chromatography
    (B) PCR
    (C) RFLP
    (D) Gel electrophoresis

14. Having become an expert on gel electrophoresis, you are asked to examine a gel for a colleague. Where would you find the smallest fragments of DNA?
    (A) Near the positive electrode, farthest away from the wells
    (B) Near the negative electrode, close to the wells
    (C) Near the top, near the negative pole
    (D) Near the middle they tend to slow-down after the first few minutes

15. In gel electrophoresis, the separated bands of DNA are cut out and extracted from the gel piece. This step is called
    (A) elution
    (B) origin of replication
    (C) competency
    (D) transformation

16. 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 host cell
    (C) collection of entire genome in the form of plasmid
    (D) enzyme, cuts the DNA at specific sites

17. Which of the following is used in recombinant DNA technique?
    (A) Cell wall of virus
    (B) Gene which produces capsid of virus
    (C) Bacteriophage
    (D) Capsid of virus

18. The DNA used as a carrier for transferring a fragment of foreign DNA into a suitable host is called
    (A) cloning vector
    (B) vehicle DNA
    (C) gene carrier
    (D) All of these

19. Identify A, B, C and D in the given diagram of E. coli cloning vector pBR322.
    (A) A–Eco RI, B–Bam HI, C–ori, D–ampR
    (B) A–ampR , B–ori, C–Bam HI, D–Eco RI
    (C) A–ori, B–Bam HI, C–Eco RI, D–ampR
    (D) A–Bam HI, B–Eco RI, C–ampR , D–ori

20. The function of ori in a vector is
    (A) help in replication of linked DNA
    (B) control copy number of the linked DNA
    (C) help in selecting recombinants
    (D) Both(A) and(B)

21. If recombinant DNA carrying antibiotic resistance gene(e.g. ampicillin) is transferred into E. coli cell, the host cell is transformed into ampicillin resistant cells. The ampicillin resistant gene in this case is called a
    (A) vectors
    (B) plasmid
    (C) selectable marker
    (D) cloning sites

22. The method(s) that is/are used to differentiate recombinants and non-recombinants is/are
    (A) antibiotic affected gene
    (B) insertional inactivation
    (C) gene cloning
    (D) Both(A) and (b)

23. In insertional inactivation, the recombinant DNA is inserted within the coding sequence of
    (A) b-galactosidase
    (B) tetracycline resistant gene
    (C) restriction enzyme
    (D) ampicillin resistant gene

24. Agrobacterium tumefaciens delivers a piece of DNA into dicot plant. The piece of DNA is called as
    (A) rDNA
    (B) T-DNA
    (C) mDNA
    (D) cDNA

25. The treatment of host cell with divalent cation leads to the
    (A) change in permeability of DNA
    (B) increased efficiency with which DNA enters the bacterium
    (C) decreased efficiency with which DNA enters the bacterium
    (D) change in permeability of host

26. Which of the following methods(s) is used to introduce foreign DNA into plant host cells?
    (A) Gene gun method
    (B) Gel electrophoresis
    (C) Elution
    (D) Extension

27. The different steps involved in the process of recombinant DNA technology are given below randomly?
    Arrange these in correct order.
    I. Extraction of the desired gene product.
    II. Amplification of the gene of interest.
    III. Isolation of a desired DNA fragment.
    IV. Ligation of the DNA fragment into a vector.
    V. Insertion of recombinant DNA into the host.
    Correct order is
    (A) I, II, III, IV and V
    (B) III, II, IV, V and I
    (C) II, IV, V, III and I
    (D) I, IV, V, III and II

28. RNA is removed by the treatment with
    (A) ribonuclease
    (B) protease
    (C) chitinase
    (D) cellulase

29. Polymerase Chain Reaction(PCR) needs
    (A) DNA template
    (B) Primers
    (C) Taq polymerase
    (D) All of these

30. A single PCR amplification cycle involves
    (A) denaturation
    (B) extension
    (C) annealing
    (D) All of these

31. Protein encoding gene which is expressed in heterologous host is
    (A) foreign protein
    (B) heterologous protein
    (C) recombinant protein
    (D) alien protein

32. Stirred-tank bioreactors have been designed for the
    (A) purification of the product
    (B) addition of preservatives to the product
    (C) availability of oxygen throughout the biorector
    (D) ensuring anaerobic conditions in the culture vessel

33. Stirred-tank bioreactors are advantageous over shake flasks because they
    (A) provide high temperature and pH
    (B) provide better aeration and mixing properties
    (C) do not allow the entry of CO_2
    (D) are easy to operate

34. The components of a bioreactor are
    I. an agitator system.
    II. an oxygen delivery system.

III. foam control system.
IV. temperature control system
V. pH control system.
VI. sampling ports to withdraw cultures periodically.

Choose the correct option.

(A) I, II, III, IV and V
(B) II, IV, V and VI
(C) I, II, III, IV and VI
(D) All of these

Answer Key

1	(C)	2	(A)	3	(A)	4	(B)	5	(B)
6	(C)	7	(A)	8	(A)	9	(B)	10	(B)
11	(D)	12	(A)	13	(D)	14	(A)	15	(A)
16	(B)	17	(C)	18	(D)	19	(A)	20	(D)
21	(C)	22	(B)	23	(A)	24	(B)	25	(B)
26	(A)	27	(B)	28	(A)	29	(D)	30	(D)
31	(C)	32	(C)	33	(B)	34	(D)		

HINTS & EXPLANATIONS

5(B) The correct sequence of step of genetic engineering are as follows
- The first step involves the identification of DNA with desirable genes.
- These genes are introduced into the host and are maintained in the host.
- Finally, the transfer of this DNA to the host progeny takes place.

6(C) The enzymes, commonly used in genetic engineering are restriction endonuclease and ligase. Restriction endonuclease make cuts at specific positions within the DNA and these DNA fragments can be joined together end-to-end by using ligase enzyme.

7(A) The convention for naming restriction enzymes is as follows The first letter of the name comes from the genus(A), the second two letters come from the species(B) and the fourth letter comes from the strain(C) of bacteria(D), e.g. Eco RI comes from Escherichia coli RY13.

8(A) Restriction endonucleases recognise their specific sequence and bind to the DNA and cut each of the two strands of the double helix at specific points in their sugar-phosphate backbone.

9(B) Restriction enzymes cut DNA strands a little away from the centre of the palindrome site between the same two bases on the opposite strands.

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

13(D) A molecule of DNA can be cut into fragments by the enzyme restriction endonucleases. These fragments of DNA can be separated on the basis of size by a technique of gel electrophoresis. It is the most common method used to separate DNA molecules on the basis of their size.

14(A) The smallest fragments of DNA are found near the positive electrodes as DNA is negatively charged. These fragments travel towards anode(farthest away from the leading wells).

16(B) In recombinant DNA technology, vector refers to a plasmid used to transfer foreign DNA into a host cell, where the genes may be amplified(gene cloning) or otherwise manipulated.

17(C) Bacteriophage are used in recombinant DNA technique. These are used as vectors due to their high number per cell and high copy numbers of their genome within the bacterial cells.

20(D) Origin of replication is the sequence from where replication starts and any piece of DNA when linked to this sequence can be made to replicate within host cells. This sequence is also responsible for controlling the copy number of the linked DNA. Thus, the function of ori in a vector is to help in replication of linked DNA and control the copy number of the linked DNA.

21(C) Gene encoding resistance to antibiotics like ampicillin, chloramphenicol, tetracycline or kanamycin, useful for cloning are called selectable markers. These are suitable selectable markers for E. coli as the normal E. coli cells do not carry resistance against any of these antibiotics.

22(B) Insertional inactivation is used to differentiate recombinants and nonrecombinants, on the basis of the inability of the recombinants to produce colour in the presence of a chromogenic substrate.

23(A) In insertional inactivation, the recombinant DNA is inserted within the coding sequence of the enzyme b-galactosidase. This results into inactivation of the gene synthesising this enzyme.. 24(B) Agrobacterium tumefaciens, a pathogen of several dicot plants is able to deliver a piece of DNA known as T-DNA to transform normal plant cells into tumour cells.

25(B) Host is made competent by treating them with specific concentration of a divalent cation such as calcium, which increases the efficiency with which DNA enters the bacterium through the creation of pores in its cell wall or cell membrane.

29.(D) PCR is a technique of synthesising multiple copies of the desired gene(or DNA) of interest in vitro. The basic requirements of PCR are DNA template, two sets of primers and the enzyme(Taq polymerase).

33.(B) A stirred-tank bioreactor is more advantageous than shake flasks as these provide better aeration and mixing properties. It has an agitator system to mix the contents properly and also an oxygen delivery and also system to ensure better availability of oxygen.