Solution

CET25B9 BIOTECHNOLOGY PRINCIPLES AND PROCESSES

Class 12 - Biology

1. **(a)** Thermocycler
   Explanation: A thermocycler is a machine that is used for PCR. It can be set to run in patterns, heating, and cooling the DNA samples. PCR involves denaturation, primer annealing, and extension of primers.
2. **(d)** Salmonella typhimurium
   Explanation: Salmonella typhimurium
3. **(c)** Gene transfer without a vector
   Explanation: Gene transfer without a vector
4. **(a)** Fluoroquinolone
   Explanation: Bacterium E.coli carries resistance to antibiotic Fluoroquinolone due to the presence of plasmid having extranuclear DNA.
5. **(c)** PCR
   Explanation: DNA amplification is done by using the technique of polymerase chain reaction in which millions of copies of DNA segments are produced.
6. **(d)** Digestion of DNA by restriction enzyme.
   Explanation: Digestion of DNA by restriction enzyme.
7. **(c)** Cut DNA at specific locations.
   Explanation: Cut DNA at specific locations.
8. **(b)** Transposon
   Explanation: Transposon
9. **(d)** Rye
   Explanation: Rye
10. **(a)** Eco RV
    Explanation: Eco RV
11. **(c)** Restriction endonucleases
    Explanation: Restriction endonucleases
12. **(d)** Salmonella typhimurium
    Explanation: Salmonella typhimurium
13. **(b)** Ethidium bromide-stained DNA can be seen under exposure to UV light.
    Explanation: The separated DNA fragments by gel electrophoresis can be visualized only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation (you cannot see pure DNA fragments in the visible light and without staining).
14. **(c)** Shotgun cloning
    Explanation: Shotgun cloning

15.

(c) Ligases

Explanation:

- DNA ligase is a DNA-joining enzyme. If two pieces of DNA have matching ends, ligase can link them to form a single, unbroken molecule of DNA.
- In DNA cloning, restriction enzymes and DNA ligase are used to insert genes and other pieces of DNA into plasmids.
- The plasmid of bacteria replicates these DNA strands along with others which can be further transferred to target cells.

16.

(b) 28-32 times

Explanation: To produce billions of copies of a DNA segment PCR (polymerase chain reaction) is done.
This is a theoretical consideration, as PCR depends on a number of factors as optimal priming, salt concentration, enzyme activity, available dNTPs, and so on. Ideally, the number of DNA molecules is doubled with every cycle. So the general formula to calculate the number is:

$n \times 2^{cycles}$ = number of DNA molecules at the end of the PCR
n is the number of molecules set into the reaction.
The number of times PCR to get a billion copies should be done is about 28-32 times.

17. **(a)** Alec Jeffreys

Explanation: Alec Jeffreys

18.

(c) Prevention of the multiplication of bacteriophage by the host bacteria.

Explanation: In the year 1963, the two enzymes responsible for restricting the growth of bacteriophage in *Escherichia coli* were isolated. One of these added methyl groups to DNA, while the other cut DNA. The later was called restriction endonuclease. Hence, the word restriction is for restricting the growth of bacteriophage in E.coli.

19.

(d) Restriction endonuclease

Explanation: Restriction endonuclease

20.

(b) Protease

Explanation: Proteases are involved in digesting long protein chains into shorter fragments by splitting the peptide bonds that link amino acid residues.
Protein can be digested by using enzyme protease to obtain DNA. In the chromosome, DNA is wrapped on histone protein.

21.

(d) Restriction endonuclease

Explanation: Restriction enzymes are also called 'molecular scissors' as they cleave DNA at or near specific recognition sequences known as restriction sites. These enzymes make one incision on each of the two strands of DNA and are also called restriction endonucleases.

22. **(a)** Transformation

Explanation: Transfer of DNA into bacterial cell by phage or virus is called transformation. Phage kills the bacterium so called bacteriophage.

23.

(b) E.coli

Explanation: E.coli acts as a host to multiply the recombinant DNA. While forming a recombinant DNA we need a restriction enzyme that will cut out the required DNA fragments which are later joined with the help of DNA ligase.

24.

(b) mixing of all the components and prevent their settling.

Explanation: Blades in a bioreactor help in the mixing of all the components and prevent their settling at the bottom of the reactor tank. It also increases the oxygen level in a bioreactor.

25.

(d) Agrobacterium tumefaciens

Explanation: Agrobacterium tumefaciens

26.

(d) They are small circular DNA molecules with their own origin of replication site.
Explanation: They are small circular DNA molecules with their own origin of replication site.

27. **(a)** Either DNA or RNA
Explanation: Either DNA or RNA

28. **(a)** Transduction
Explanation: Transduction is the process by which foreign DNA is introduced into a cell by a virus or viral vector. An example is the viral transfer of DNA from one bacterium to another and hence an example of horizontal gene transfer.

29.

(b) Polymorphism in sequence
Explanation: Polymorphism in sequence

30.

(b) Recombinant DNA
Explanation: Recombinant DNA is the general name for taking a piece of one DNA and combining it with another strand of DNA. Thus, the name recombinant! Recombinant DNA is also sometimes referred to as "chimera." By combining two or more different strands of DNA, scientists are able to create a new strand of DNA. The most common recombinant process involves combining the DNA of two different organisms.

31.

(b) Separation of DNA fragments according to their size.
Explanation: Gel electrophoresis is used to separate macromolecules like DNA, RNA, and proteins. DNA fragments are separated according to their size and proteins can be separated according to their size and their charge (different proteins have different charges) to study the genome of the individual organism.

32.

(d) pBR 322
Explanation: pBR 322

33. **(a)** Kary Mullis
Explanation: Polymerase chain reaction (PCR) was discovered by Kary Mullis. PCR technique is used to amplify the DNA segments to obtain large number of identical copies.

34.

(b) Yeast
Explanation: The nucleosome is the fundamental subunit of chromatin. Nucleosome is clearly seen in a fungus called Yeast.

35. **(a)** Thermus aquaticus
Explanation: Thermus aquaticus

36.

(d) Resistance to high temperature
Explanation: Taq polymerase is a thermostable DNA polymerase. Taq polymerase is an enzyme that copies DNA. It is isolated from a heat-loving bacterium that is naturally found in hot springs, so the enzyme doesn't break down at the high temperatures necessary for copying DNA using a polymerase chain reaction.

37. **(a)** DNA fingerprinting
Explanation: DNA fingerprinting

38.

(d) Join vector and goi (gene of interest)
Explanation: DNA ligase is a specific type of enzyme, a ligase, that facilitates the joining of DNA strands together by catalyzing the formation of a phosphodiester bond. It plays a role in repairing single-strand breaks in duplex DNA in living organisms.
The enzyme ligase is used to join vector and gene of interest to form a hybrid genome that can be introduced into vectors.

39.

(b) Single stranded
Explanation: Single stranded

40.

(b)

Sample	Temperature used for Denaturation	Enzyme used for extension
I	High temp./90^{o}C	Heat stable

Explanation:

Sample	Temperature used for Denaturation	Enzyme used for extension
I	High temp./90^{o}C	Heat stable

41.

(b) Tungsten
Explanation: DNA is coated with tungsten before used in the biolistic gun for inserting the DNA directly into target cells for obtaining a particular protein.

42. **(a)** Yeast artificial chromosome
Explanation: Yeast artificial chromosome

43.

(c) Origin of replication (ori)
Explanation: Origin of replication (ori) is a sequence from where replication starts and any piece of DNA, when linked to this sequence, can be made to replicate within the host cells. This sequence is also responsible for controlling the copy number of the linked DNA.

44.

(d) YAC
Explanation: Yeast artificial chromosome (YAC) is the vector of choice used to clone a very large DNA fragment (>1000kb) to prepare a genomic library. YAC vector is like a chromosome as it has ARS sequences, centromere sequence, and telomere at the two ends to give stability.

45.

(d) Extension and amplification
Explanation: Extension and amplification

46.

(d) B-cells are fused with myeloma cells.
Explanation: B-cells are fused with myeloma cells.

47.

(d) Ligase
Explanation: Ligase

48.

(d) DNA is negatively charged molecules
Explanation: To separate DNA using agarose gel electrophoresis, the DNA is loaded into pre-cast wells in the gel and a current applied. The phosphate backbone of the DNA (and RNA) molecule is negatively charged, therefore when placed in an electric field, DNA fragments will migrate to the positively charged anode.

49.

(b) Gene bank
Explanation: Gene bank

50. **(a)** Fragments of DNA are transferred from one organism to another, usually carried on a DNA vector.
Explanation: Fragments of DNA are transferred from one organism to another, usually carried on a DNA vector.

51. **(a)** Air bubbles enhance the oxygen transfer area.
Explanation: Bioreactors are used to obtain biological products on large scale continually for commercial purposes. The sparged stirred tank bioreactor is advantageous over the simply stirred tank bioreactor as there is an increased surface area for oxygen transfer. The bubbles increase the oxygen transfer area.

52.

(c) DNA probes

Explanation: DNA probes

53. **(a)** $\begin{matrix} 5'G \overset{\downarrow}{-} A - A - T - T - C - 3' \\ 3'C - T - T - A - A \underset{\uparrow}{-} G - 5' \end{matrix}$

Explanation: $\begin{matrix} 5'G \overset{\downarrow}{-} A - A - T - T - C - 3' \\ 3'C - T - T - A - A \underset{\uparrow}{-} G - 5' \end{matrix}$

54.

(b) Thermophilic bacterium

Explanation: Thermophilic bacterium

55. **(a)** Polymerase chain reaction

Explanation: Polymerase chain reaction

56.

(d) Coli

Explanation: Coli

57.

(c) Endonuclease

Explanation: Endonuclease

58. **(a)** Recombinant DNA technique

Explanation: Recombinant DNA technique

59.

(d) Transformed recipient cells will grow and untransformed recipient cell will die.

Explanation: Transformed recipient cells will grow and untransformed recipient cell will die.

60.

(b) Agarase

Explanation: Elution is the process of extracting one material from another by washing with a solvent. Elution can be done by using enzyme agarase that can catalyze the hydrolysis of agar.

61.

(b) Bt-cotton

Explanation: Bt-cotton

62. **(a)** Translocation

Explanation: Translocation

63. **(a)** Agrobacterium

Explanation: Agrobacterium

64.

(b) Nucleases

Explanation: A restriction enzyme (or restriction endonucleases) recognizes a specific base pair sequence in DNA called a restriction site and cleaves the DNA (hydrolyses the phosphodiester backbones) within the sequence. Restriction enzymes are widely found in prokaryotes and provide protection to the host cell by destroying foreign DNA that makes entry to it. It acts as a part of the defense mechanism.

Restriction enzymes belong to a larger class of enzymes called nucleases. They are of two types: endonucleases and exonucleases.

65.

(b) Ethanol Precipitation

Explanation: The piece of DNA obtained by gel electrophoresis contains agarose gel also. Ethanol precipitation is a commonly used technique for concentrating and de-salting nucleic acids (DNA or RNA) preparations in aqueous solution. The basic procedure is that salt and ethanol are added to the aqueous solution, which forces the precipitation of nucleic acids out of solution.

66.

(b) Extension of primer end on the template DNA

Explanation: Taq DNA polymerase enzyme extends the primers using the nucleotides provided in the reaction and the genomic DNA as a template.

67.

(d) DNA amplification

Explanation: DNA amplification

68.

(b) Frederick Sanger

Explanation: Frederick Sanger

69.

(b) transformation of plant cells

Explanation: transformation of plant cells

70.

(d) Ti genes are removed

Explanation: *Agrobacterium tumefaciens* is called a natural genetic engineer in which Ti plasmid is modified by removing Ti genes used as a cloning vector.

71. **(a)** Anode

Explanation: Gel electrophoresis technique involves separation of different segments of DNA according to their size. The smallest bands in the agarose gel will be towards positively charged anode.

72.

(b) Elution

Explanation: The extraction of specific bands of DNA from agarose gels in which they are separated through electrophoresis is known as elution. There are many methods for eluting DNA from a piece of agrose.

73.

(c) Individual 1 and 3

Explanation: Individual 1 and 3 show actual parents/parents of child.

74.

(b) Bioreactors

Explanation: Bioreactor is a large vessel in which large scale raw materials are biologically converted into specific products. Bioreactor is used to produce large scale production.

75.

(c) Palindrome

Explanation: A palindrome is a word, phrase, number, or other sequences of characters that reads the same backward as forward. For example, MALAYALAM which read the same from both side.