CBSE Test Paper 03

Ch-11 Biotechnology Principles and Processes

1. PCR was discovered by
   a. Kary Mullis
   b. Stanley Cohen
   c. Hargobind Khorana
   d. Herbert Boyer
2. DNA fragments move at different distances in Gel Electrophoresis because
   a. The voltage is too high
   b. Molecular weights of the fragments are different
   c. DNA has a positive charge
   d. DNA gets denatured
3. DNA can be isolated from fungi using chitinase as
   a. It carries out isolation fast
   b. Its cell wall is made up of chitin
   c. It makes DNA soluble in the aqueous solution
   d. Cell membrane of fungi is made up of chitin
4. EtBr fluoresces at the wavelength
   a. 400 nm
   b. 254 nm
   c. 340 nm
   d. 500 nm
5. The ability to multiply copies of antibiotic resistance gene in E.coli was called
   a. Transformation
   b. Restriction
   c. Mutation
   d. Cloning
6. DNA is amplified by PCR as it can be used for
   a. It requires primers
   b. It requires dNTP's
   c. To produce multiple copies of the fragment DNA
   d. It requires Mg^{2+}

7. Name the polymerase which is generally used in PCR? What is the source of this enzyme?

8. Why is the enzyme cellulose used for isolating genetic material from plant cells but not for animal cells?

9. Starting from double stranded DNA, suggest a strategy for obtaining large amounts of pure single stranded DNA for sequencing purpose.

10. 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.

11. Give the characteristic feature and source organism of the DNA polymerase used in PCR.

12. What is the principle of Gel electrophoresis? Name the compound used for staining DNA to be used in recombinant technology. What is the colour of such stained DNA?

13. Describe briefly the following: Bioreactors.

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

15. Can you list 10 recombinant proteins which are used in medical practice? Find out where they are used as therapeutics.

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Answer

1. 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.
2. b. Molecular weights of the fragments are different, **Explanation:** Gel electrophoresis is a technique used to separate DNA fragments (or other macromolecules, such as RNA and proteins) based on their size and charge. Electrophoresis involves running a current through a gel containing the molecules of interest. Based on their size and charge, the molecules will travel through the gel in different directions or at different speeds, allowing them to be separated from one another.
   During gel electrophoresis different fragments move at different distances due to difference in their molecular weight of the fragments. Smaller fragments move more towards anode.
3. b. Its cell wall is made up of chitin, **Explanation:** The cell of fungi is made of chitin. Chitinase enzyme can hydrolyses this and DNA can be isolated from fungi.
4. a. 254 nm, **Explanation:** Ethidium bromide is an intercalating agent commonly used as a fluorescent tag (nucleic acid stain) in molecular biology laboratories for techniques such as agarose gel electrophoresis. It is commonly abbreviated as "EtBr", which is also an abbreviation for bromoethane. When exposed to ultraviolet light, it will fluoresce with an orange colour, intensifying almost 20-fold after binding to DNA. It fluoresces at the wavelength at 254 nm.
5. d. Cloning, **Explanation: There are three basic steps in genetically modifying an organism:** hen recombinant DNA is transferred into Escherichia coli, a bacterium closely related to Salmonella, it could replicate using the new host's DNA polymerase enzyme and make multiple copies. The ability to multiply copies of antibiotic resistance gene in E. coli was called cloning of antibiotic

resistance gene in E. coli. .

- Identification of DNA with desirable genes;
- Introduction of the identified DNA into the host;
- Maintenance of introduced DNA in the host and transfer of the DNA to its progeny

6. a. To produce multiple copies of the fragment DNA, **Explanation:** DNA is amplified by PCR as it can be used for to produce multiples copies of fragment DNA. These copies are used to produce recombinant DNA having desired traits.
7. T. aquaticus is a bacterium that lives in hot springs and hydrothermal vents, and Taq polymerase was identified as an enzyme able to withstand the protein-denaturing conditions (high temperature) required during PCR. Its name is often abbreviated to Taq Pol or simply Taq.
   It is isolated from Thermus aquaticus bacterium.
8. Because plant cells have cell wall, so to digest it enzyme cellulase is required. Animals do not have cell wall so no cellulase required.
9. PCR (Polymerase Chain Reaction).
10. a. By treating the bacteria with lysozyme.
    b. By incubating the bacteria with r DNA on ice, followed by placing them briefly at 42°C (heat shock), and then putting them back on ice.
11. The DNA polymerase is thermostable i.e. remains active during the high-temperature induced denaturation of double-stranded DNA. DNA polymerase used in PCR reaction is known as Taq polymerase, which is obtained from a bacterium Thermus aquaticus.
12. Since DNA fragments are negatively charged molecules, they can be separated by forcing them to move towards the anode under an electric field through a medium or matrix. This matrix gel acts as sieve and DNA fragments resolve according to their size.
    - Ethidium bromide used for staining DNA.
    - Stained DNA becomes orange.
13. Bioreactors are vessels in which raw materials are biologically converted into specific products, individual enzymes, etc. using microbial plant, animal or human cells. A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions. The most commonly used bioreactors are of stirring type. A biogas plant can be a good example of bioreactor.

14. Stanley Cohen and Herbert Boyer conducted one of the first genetic engineering experiments. They invented the technique of DNA cloning. Cohen developed a method of removing plasmids from the cell and then reinserting them in other cells. Combining this process with that of DNA splicing enabled Boyer and Cohen to recombine segments of DNA in desired configurations and insert the DNA in bacterial cells, which could then act as manufacturing plants for specific proteins. Stanley Cohen and Herbert Boyer accomplished this in 1972.
15.

Recombinant proteins	**Therapeutic uses**
(a) Insulin	Used in diabetes mellitus
(b) OKT - 3	Therapeutic antibody, used for reversal of transplantation rejection.
(c) DNase	Treatment of cystic fibrosis
(d) Reo Pro	Prevention of blood clots
(e) Blood clotting factor VIII	Treatment of Haemophilia A
(f) Blood clotting factor IX	Treatment of Haemophilia B
(g) Tissue plasminogen activator	For acute myocardial infarction
(h) Interferon alpha (INF alpha)	Used for Hepatitis C
(i) Interferon beta (INF beta)	Used for multiple sclerosis
(j) Interferon gamma (INF gamma)	Used for granulomatous desease<