Biotechnology: Principles and Processes

Assertion & Reason Type Questions

consists of two statements, one is Assertion (A) and the other is Reason (R). Select the correct answer to these questions from the codes a, b, c and d as given below:

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. Assertion is false but Reason is true.

Q 1. Assertion (A): Vector DNA and foreign DNA are cut by same restriction endonuclease.

Reason (R): Digestion of vector DNA and foreign DNA with same enzyme produces complementary sticky ends.

Answer : (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Q 2. Assertion (A): Restriction endonuclease recognises palindromic sequence in DNA and cuts them.

Reason (R): Palindromic sequence has two unique recognition sites Pst I and PvuI recognised by restriction endonuclease.

Answer : (c) Assertion is true, but Reason is false.

Q 3. Assertion (A): Bacteriophage vectors are more advantageous than plasmid vectors.

Reason (R): Bacteriophage vectors can be easily detected at the time of cloning experiments.

Answer : (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion. Bacteriophages are a better vectors than the plasmids due to the following reasons:

(i) It can clone the DNA segment of a relatively large size (24 kbp).

(ii) Every bacteriophage produces one plaque area in the culture through which testing is comparatively easy.

Q 4. Assertion (A): Type I restriction endonucleases are not used in recombinant DNA technology.
Reason (R): Type I restriction endonucleases recognise specific sites within the DNA but do not cut these sites.

Answer : (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Q 5. Assertion (A): Amplification of a gene of interest can be done by polymerase chain reaction.
Reason (R): It is possible to amplify DNA segment approximately 1 billion times within a span of one day.

Answer : (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

Q 6. Assertion (A): PCR is a powerful technique to identify genetic disorders.
Reason (R): PCR can detect mutations in low amounts of DNA.

Answer : (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Q 7. Assertion (A): Synthetic oligonucleotide polymers are used during annealing in a PCR.
Reason (R): The primers bind to the double stranded DNA at their complementary regions.

Answer : (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Q8. Assertion: Restriction enzymes recognize palindromic sequence.

Reason: Palindromic sequences read same in both directions of the two strands.

Q9. Assertion: Restriction enzymes Hind II and Hpa are produced from two different genera of bacteria.
Reason: Hind II is produced from Haemophilus while Hpa is produce from Hematococcus.

Q10. Assertion: Restriction enzymes of different organisms that recognize the identical sequences are called isoschizomers.
Reason: They are present only in eukaryotes.

Q11. Assertion: Restriction digestion is a process of cutting DNA by restriction enzyme.
Reason: DNA ligase joins two DNAs.

Q12. Assertion: Restriction endonucleases are also called 'molecular scissors'.
Reason: When fragments generated by restriction endonucleases are mixed, they join together due to their sticky ends.

Q13. Assertion: A bacterial cell with no restriction enzymes will be easily infected and lysed by bacteriophages.
Reason: Restriciton enymes catalyse synthesis of protective coat around bacterial cell that prevents bacteriophage attack.

Q14. 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. [AIIMS 2009]

Q15. Assertion: The matrix used in gel electrophoresis should have controllable pore size.
Reason: Agarose concentration can be changed to change pore sizes.

Q16. Assertion: Foreign DNA and vector DNA cut with the help of ligase.
Reason: Ligase act on sugar phosphate backbone of DNA.

Q17. Assertion: In gel electrophoresis, DNA fragments are separated.
Reason: DNA is negatively charged, so it moves towards anode under electric field.

Q18. Assertion: All endonuclease cut DNA at specific sites.
Reason: Endonucleases are found in viruses.

Q19. Assertion: Genetic engineering requires both nucleases and ligases.
Reason: Ligases produce the nick in the recombinant DNA molecule.

Q20. Assertion: Enzyme application in industry is enhanced by its immobilization.
Reason: Immobilization provides protection to enzymes without affecting their activity.

Q21. Assertion: The uptake of DNA during transformation is an active, energy requiring process.

Reason: Transformation occurs in only those bacteria, which possess the enzymatic machinery involved in the active uptake and recombination.

Q22. 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 population which express the desired gene.

ANSWER KEY 8 to 22

Q8 : (b) The palindrome in DNA is a sequence of base pairs that reads same on the two strands when orientation of reading strand is kept same. Restriction enzymes cut the strand of DNA a little away from the centre of the palindrome sites, but between the same two bases on opposite strands.

Q9 : (d) In nomenclature of restriction enzymes, the first letter of the name of the genus in which given enzyme is discovered is written first in capital. It is followed by the first two letters of species name of the organism and these three letters are generally written in italics. Hind II and Hpa, both are produced from a single genus Haemophilus but from two different species i.e., H. influenzae and H. parainfluenza respectively.

Q10 : (c) Isoschizomer are pairs of restriction enzymes specific to the same recognition sequence. e.g., SphI (CGTAC/G) and BbuI (CGTAC/G) are isoschizomers of each other. These are isolated from different strains of bacteria.

Q11 : (b) DNA ligase joins complementary sticky ends to two DNAs.

Q12 : (b) Restriction endonuclease are molecular scissors, which cut a DNA molecule within certain specific site called restriction site. Common restriction endonucleases are Eco RI, Bam II, Hind III, etc.

Q13 : (d) Restriction enzymes were named due to the phenomenon of host restriction of bacterial phages. Restriction enzymes produced in a bacterial cell, recognize and cleave foreign DNA introduced (such as from bacteriophage) into the cell. Thus, bacterial cell cannot be infected and lysed by bacteriophage and hence a bacterial cell lacking restriction enzymes is easily susceptible to infection of phages. The DNA of the host bacterial cell is protected from its own restriction endonucleases by methylation (usually of A and C) within their recognition sites.

Q14 : (c) Restriction enzyme, a type of endonuclease, functions by "inspecting" the length of a DNA sequence. Once it finds a recognition sequence, it binds and cut each of the two strands of the double helix at specific point leaving single stranded portions at the ends. This results in overhanging stretches called sticky ends. These are named so because they form hydrogen bonds with their complementary counter parts i.e., they can join similar complementary ends of DNA fragment from some other source with the help of DNA ligase. This stickness of the ends facilitates the action of the enzyme DNA ligase, not DNA polymerase.

Q15 : (b) Agarose is a polysccharide obtained from red algae. Agarose dissolves in hot water and when it is cooled, it forms gel. Pore size depends upon agarose concentration. In general, a 1% (w/v) gel will have a pore size of 150 nm. While a 0.16% gel has pore size of 500 nm.

Q16 : (d) In formation of rDNA, restriction endonucleases cut both foreign DNA and vector DNA and act on sugar phosphate backbone of DNA.

Q17 : (a) DNA fragments can be isolated with the help of gel electrophoresis, where DNA moves towards the anode (+vely charged).

Q18 : (d) Restriction endonuclease is a type of endonuclease which cut DNA at specific sites, not all endonuclease cut DNA at specific sites. These are not found in virus. There were discovered from bacteria.

Q19 : (c) Nucleases are the enzymes that remove nucleotides or produce nick in the DNA strand. Exonucleases remove nucleotides from the free ends of DNA while endonucleases produce internal nick in DNA. Now, the desired gene is inserted and the cut ends are sealed with the help of DNA ligase. Ligases are also called molecular glue as they join together two strands by forming phosphodiester bonds between adjacent nucleotides.

Q20 : (a) An immobilized enzymes is physically entrapped or covalently bonded by chemical means to an inert and usually insoluble matrix, where it can act upon its natural substrate. The matrix is usually a high molecular weight polymer such as polyacrylamide, cellulose, starch, glass, beads, etc. Because of its binding with a matrix the immobilized enzyme has better stability in many cases. Efficiency of immobilized enzyme is better. The enzyme can be recovered at the end of the reaction and can be used repeatedly.

Q21 : (a) Transformation does not involve passive entry of DNA molecules through permeable cell walls and membranes. It does not occur 'naturally' in all species of bacteria, only in those species possessing the enzymatic machinery involved in the active uptake and recombination processes. Even in these species, all cells in a given population are not capable of active uptake of DNA. Only competent cells, which possess a so called competence factor are capable of serving as recipients in transformation.

Q22 : (a) Bacteria and yeast are easily grow in culture medium and multiply very fast so it is best for making the many copies of recombinant DNA, and express character of desired gene.