

Chapter 6

Molecular Basis of Inheritance

(Assertion Reason Questions)

Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Mark the correct choice as:

- (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) If Assertion is true but Reason is false.
- (d) If both Assertion and Reason are false.

Q.1. Assertion: In a DNA molecule, A–T rich parts melt before G–C rich parts.

Reason: In between A and T there are three H-bond, whereas in between G and C there are two H-bonds. [AIIMS 2010, 2015]

Q.2. Assertion: The two chains of DNA have anti-polarity.

Reason: In one chain of DNA, ribose sugar at 5' end consists of a free phosphate moiety while at the other end the ribose has a free 3' OH group.

Q.3. Assertion: Adenine cannot pair with cytosine.

Reason: Adenine and cytosine do not have a perfect match between hydrogen donor and hydrogen acceptor sites. Hence, they cannot pair.

Q.4. Assertion: The sugar phosphate backbone of two chains in DNA double helix show anti-parallel polarity.

Reason: The phosphodiester bonds in one strand go from a 3' carbon of one

nucleotide to a 5' carbon of adjacent nucleotide, whereas those in complementary strand go vice versa.

Q.5. Assertion: DNA is considered to be better genetic material than RNA for most organisms.

Reason: 2'-OH group present in DNA makes it labile and less reactive.

Q.6. Assertion: Histones are basic proteins of major importance in packaging of eukaryotic DNA. DNA and histones comprise chromatin forming the bulk of eukaryotic chromosome.

Reason: Histones are of five major types H1, H2A, H2B, H3 and H4. [AIIMS 2000]

Q.7. Assertion: DNA is associated with proteins.

Reason: DNA binds around histone proteins that form a pool and the entire structure is called a nucleosome. [AIIMS 2013]

Q.8. Assertion: Histones are basic in nature.

Reason: Histones are rich in the amino acids lysine and arginine.

Q.9. Assertion: DNA acts as a genetic material in all organisms.

Reason: It is a single-stranded biomolecule.

Q.10. Assertion: In Griffith's experiment, a mixture of heat-killed virulent bacteria R and live non-virulent bacteria S, lead to the death of mice.

Reason: 'Transforming principle' got transferred from heat killed R strain to S strain and made it virulent.

Q.11. Assertion: Template or antisense strand, having 3' → 5' polarity takes part in transcription.

Reason: Non-template or sense strand, having 5' → 3' polarity, does not take part in transcription.

Q.12. Assertion: The uptake of DNA during transformation is an active, energy requiring process.

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

Q.13. Assertion: Killer strain of *Paramecium aurelia* can kill sensitive strain.

Reason: If sensitive strain is provided kappa particle, it becomes killer.

Q.14. Assertion: Scaffold proteins are nonhistone chromosomal proteins.

Reason: They are rich in lysine and arginine.

Q.15. Assertion: Viruses having RNA genome have shorter life span and mutate faster.

Reason: RNA is unstable and thus mutates faster.

-X-X-X-

ANSWER KEY

Q.1 : (c) In a DNA molecule, A-T rich parts melt before G-C rich parts because there are two H-bond between A and T whereas in between G and C, there are three H-bond.

Q.2 : (a) The two chains of DNA have anti-parallel polarity this is because one chain has free phosphate moiety at 5'-end of the sugar and another chain has free phosphate moiety at 3'-end.

Q.3 : (a) In DNA, the code letters are A, T, G, and C, which stand for the chemicals adenine, thymine, guanine, and cytosine, respectively. In base pairing, adenine always pairs with thymine, and guanine always pairs with cytosine.

Q.4 : (a)

Q.5 : (c)

Q.6 : (a)

Q.7 : (a)

Q.8 : (a) Histones contain a large proportion of the positively charged (basic) amino acids, lysine and arginine in their structure. DNA is negatively charged due to the phosphate groups on its backbone.

Q.9 : (d) DNA is the hereditary material found in the nucleus of eukaryotic cells and the cytoplasm of prokaryotic cells that determines the composition of the organism. There is another type of genetic material found in cells and viruses known as

ribonucleic acid (RNA). DNA is double stranded as well as single stranded biomolecule.

Q.10 : (d) When bacteria *Streptococcus pneumoniae* are grown on a culture plate, some produce smooth shiny colonies (S) while others produce rough colonies (R). This is because the S strain bacteria have a mucous (polysaccharide) coat, while R strain does not. Mice infected with the S strain (virulent) die from pneumonia infection but mice infected with the R strain do not develop pneumonia. In Griffith's experiment, some 'transforming principle', transferred from the heat-killed S strain, had enabled the R strain to synthesize a smooth polysaccharide coat and become virulent which must be due to the transfer of the genetic material. This is known as transformation.

Q.11 : (b)

Q.12 : (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.

Q.13 : (b) *Paramecium aurelia* has two strains : killer and sensitive. The killer strain is able to kill the sensitive strain protist by means of chemical paramecin, secreted by minute cytoplasmic particles called kappa particle. The sensitive strain protists do not have kappa particles. The sensitive strain can also become killer if it receives sufficient kappa particles.

Q.14 : (c) Structural nonhistone chromosomal proteins are called scaffold proteins as they constitute the core axis of the chromosome. They contain very little lysine and arginine but instead possess abundant tyrosine and tryptophan types of amino acids.

Q.15 : (a) Unlike DNA, RNA is usually singlestranded. Additionally, RNA contains ribose sugars rather than deoxyribose sugars, which makes RNA more unstable and more prone to degradation. RNA is synthesized from DNA by an enzyme known as RNA polymerase during a process called transcription. Viruses having RNA have shorter life span and mutate at faster rate.