

Chapter 5

Principles of Inheritance and Variation

(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: Mendel was successful in his hybridization.

Reason: Garden pea proved ideal experimental material.

Q.2. Assertion: Mendel used true-breeding pea lines for artificial pollination experiments for his genetic studies.

Reason: For several generations, a true-breeding line shows the stable trait inheritance and expression.

Q.3. Assertion: On true breeding lines, Mendel conducted cross pollination experiments.

Reason: For several generations, true breed line have stable trait inheritance.

Q.4. Assertion: Cross of F₁ individual with recessive homozygous parent is test cross.

Reason: No recessive individual are obtained in the monohybrid test cross progeny.

Q.5. Assertion: The progeny produced have both the characters of parents.

Reason: The process by which characters pass from parent to progeny is known as inheritance.

Q.6. Assertion: The progeny in F₂-generation traits were identical to their parental type.

Reason: The progeny show no blending of traits.

Q.7. Assertion: Genes pass from one generation to another.

Reason: The unit of inheritance are genes.

Q.8. Assertion: In a monohybrid cross, F₁ generation indicate dominant characters.

Reason: Dominance occurs only in heterozygous state.

Q.9. Assertion: In monohybrid cross, at F₂ stage, both parental traits are expressed in 3: 1 proportion.

Reason: At F₂ stage, the contrasting parental traits show blending.

Q.10. Assertion: The cross between the F₁ progeny and either of the parent types is a test cross.

Reason: The cross between F₁ progeny and the double recessive genotype is back cross.

Q.11. Assertion: A pair of contrasting characters is termed as allele.

Reason: Only one gene of an allele is expressed in an individual.

Q.12. Assertion: In *Mirabilis*, selfing of F₁ pink flower plants produces same phenotypic & genotypic ratio.

Reason: Flower colour gene shows incomplete dominance.

Q.13. Assertion: Gametes receives only one allele of a gene.

Reason: During gamete formation, meiosis takes place leads to formation of haploid cells.

Q.14. Assertion: In F_2 generation of plant *Mirabilis jalapa*, the pink coloured flowers appear.

Reason: This is observed due epistatic suppression of white colour alleles in one of parental flowers by red colour alleles.

Q.15. Assertion: A good example of multiple alleles is ABO blood group system.

Reason: When I^A and I^B alleles are present together in ABO blood group system, they both express their own types.

-X-X-X-

ANSWER KEY

Q.1 : (b) Mendel chose garden pea as plant material for his experiments, since it had the following advantages:

- (i) Well defined characters.
- (ii) Bisexual flowers.
- (iii) Predominantly self-fertilization.
- (iv) Easy hybridization.

Besides these features, garden pea, being self-fertilized, had pure lines due to natural self-fertilization for a number of years. Therefore, any variety used was pure for the characters it carried. Mendel's success was mainly based on the fact that he considered a single character at one time.

Q.2 : (a) On garden pea for many years mendel carried out hybridization experiments. He performed various types of cross breeding and then allowed the offspring for self breeding. He selected varieties and used pure lines of true breeding lines, i.e., they produce offspring resembling the parents. these lines show the stable trait inheritance and expression for several generations making them suitable for genetic studies.

Q.3 : (a) True breeding lines have inheritance of pure characters for several generations.

Q.4 : (c) In the monohybrid test cross progeny both heterozygous and recessive individuals are obtained in 1 : 1 ratio.

Q.5 : (b) According to Mendelian inheritance, genes come in different varieties called alleles. Somatic cells contain 2 alleles with one allele provided by each parent of an organism.

Q.6 : (a) Both the characters appear during the formation of F₂-generation, so no blending occurs.

Q.7 : (b) Chromosomes carry gene that passes on the traits of parents to the off springs during genetic recombination.

Q.8 : (c) Monohybrid cross is a cross between two organisms of a species which is made to study the inheritance of a single pair of alleles or factors of a character. Dominant character is one of a pair of alleles which can express itself whether present in homozygous or heterozygous state. In F₁, generation, the generation of hybrids produced from a cross between the genetically different homozygous individuals called parents the progenies are heterozygous dominant.

Q.9 : (c) Both the parental traits of a character in F₂ generation are expressed in the ratio of three dominant to one recessive. Whereas, in F₁ generation only one of the parental traits is expressed and the other lies hidden or unexpressed. However, in the hybrid there is no mixing of two characters. At the time formation of gamete, two factors separate or segregate and passes into different gametes, that hence have one factor of a pair. During fertilization, gametes fuse randomly so that factors come together in new generation and freely express themselves.

Q.10 : (d) Back cross is a cross of F₁ hybrid with either of the two parents. When F₁ off springs are crossed with the dominant parents, all the F₂ generation off springs develop dominant character. On the other hand, when F₁ hybrids are crossed with recessive parent, individuals with both the phenotypes appear in equal proportions. Crossing of F₁ individual with dominant phenotype with its homozygous recessive parent is called test cross. It is used to determine whether the individuals exhibiting dominant characters are homozygous or heterozygous.

Q.11 : (c) An allele is an alternative form of a gene one member of a pair that is located at a specific position on a specific chromosome. Diploid organisms, for example, humans, have paired homologous chromosomes in their somatic cells, and these contain two copies of each gene.

Q.12 : (a)

Q.13 : (c) Meiosis is the process by which gametes are formed and during this process only one variant of gene pass to the gamete.

Q.14 : (c) In *Mirabilis jalapa* (four o'clock) have two types, of flower colour in pure state: red and white. When the two types of plants are crossed, the hybrid or plants of F₁ generation produce pink flowers. If the latter are selfed, the plants of F₂ generation are of three types-red, pink and white flowered in the ratio of 1 : 2 : 1. Due to incomplete dominance of red (dominant) over white (recessive), the pink colour apparently appears. Thus, pink is differentiated from red and white.

Q.15 : (b) In the ABO system, consists four blood groups A, B, AB and O. ABO blood groups are controlled by gene I. The gene has three alleles I^A, I^B and i. This phenomenon is known as multiple allelism. I^A and I^B are completely dominant over i. When I^A and I^B are present together, they both express themselves and produce AB blood group. This phenomenon is known as codominance.