CHAPTER

8

HEREDITY

CLASS 10TH

NCERT EXERCISE AND SOLUTIONS - SCIENCE

Q. 1. A Mendelian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flowers, but almost half of them were short. This suggests that the genetic make-up of the tall parent can be depicted as

(a) TTWW
(b) TTww
(c) TtWW
(d) TtWw

ANSWER:-

(c) The flowers displayed two colors: violet and white. However, only violet flowers appeared in the F1 generation, indicating that violet flower color (W) is the dominant trait that masks the recessive white flower color (w). The F1 progeny consisted of both tall and short plants in equal proportions, suggesting that both dominant and recessive traits were expressed. This implies that the tall plants were not true-breeding but genetically heterozygous for height (Tt). Thus, the genetic composition of the tall parent can be represented as TtWW. Therefore, the cross in the given scenario is:

TtWW×ttww
↓
TtWw ttWw

As a result, half of the progeny was tall, but all exhibited violet flowers.

Q. 2. A study found that children with light-coloured eyes are likely to have parents with light-coloured eyes. On this basis, can we say anything about whether the light eye colour trait is dominant or recessive? Why or why not?

ANSWER:-

Children with light-coloured eyes could have LL, L, or II genotypes. We can assume that the children have the LL genotype (both dominant alleles), which would only occur if both parents also possessed the LL genotype. In this case, the cross would be:

LL×LL
↓
LL

If the children with light-coloured eyes have the ll genotype, then both parents must also carry the ll genotype. This cross would be:

ll×ll
↓
ll

Therefore, it is challenging to determine whether light eye color is dominant, or recessive based solely on this information.

Q. 3. Outline a project which aims to find the dominant coat colour in dogs.

ANSWER:-

Dogs have several genes that control coat color, with at least eleven identified gene series (A, B, C, D, E, F, G, M, P, S, T) influencing their coat color. Each dog inherits one gene from each parent, with the dominant gene being expressed in the phenotype.

For example, if a dog inherits the "B" gene, it could be genetically either black or brown. Assume the following:

(i) One parent is homozygous black (BB),

(ii) The other parent is homozygous brown (bb).

bb	BB		
		B	B
	b	Bb	Bb
	b	Bb	Bb

In this case, the phenotype will be black, as black (B) is dominant, and all offspring will be black. However, genetically, they are all heterozygous for the B allele (Bb), meaning all offspring are heterozygous black.

If the F1 heterozygous pups are crossed, the offspring will be 25% homozygous black (BB), 50% heterozygous black (Bb), and 25% homozygous brown (bb).

	B	b
B	BB	Bb
b	Bb	Bb

Q. 4. How is the equal genetic contribution of male and female parents ensured in the progeny?

ANSWER:-

Each human somatic cell contains 23 pairs of chromosomes, of which 22 pairs are autosomes, and the remaining pair consists of sex chromosomes, represented as X and Y. Females have two X chromosomes, while males have one X and one Y chromosome. During gametogenesis (the formation of gametes), meiosis occurs, resulting in gametes that contain half the number of chromosomes. As a result, male gametes carry 22 autosomes and either an X or Y chromosome, while female gametes carry 22 autosomes and an X chromosome.

In sexual reproduction, the fusion of male and female gametes restores the full chromosome number in the zygote. Therefore:

(i) The male contributes 22 autosomes and either an X or Y chromosome,

(ii) The female contributes 22 autosomes and one X chromosome to the progeny.