

Practice paper

Class 12

Case Study:

A biology student crossed a pure-breeding red-flowered snapdragon plant (RR) with a pure-breeding white-flowered snapdragon plant (WW). In the F_1 generation, all plants had pink flowers.

When the F_1 pink-flowered plants were self-crossed, the F_2 generation showed 120 plants in the ratio: 30 Red flowers, 60 Pink flowers, 30 White flowers.

The student noted that neither red nor white was completely dominant. Instead, the heterozygote showed a phenotype intermediate between the two parents. The student also observed that if a pink-flowered plant was crossed with a red-flowered plant, the progeny were 50% red and 50% pink.

5 MCQs from the Case Study

1. The F_1 phenotype in this cross is pink because:

- A. Red allele is dominant over white allele
- B. White allele is dominant over red allele
- C. Both alleles express partially, producing an intermediate phenotype
- D. It is a case of codominance

2. The F_2 phenotypic ratio observed is:

- A. 3:1
- B. 1:2:1
- C. 9:3:3:1
- D. 1:1

3. The genotype of a pink-flowered plant is:

- A. RR
- B. WW
- C. RW
- D. Both RR and WW

4. If a pink-flowered plant (RW) is crossed with a white-flowered plant (WW), the expected phenotypic ratio is:

- A. 1 Red : 1 Pink

B. 1 Pink : 1 White

C. 3 Pink : 1 White

D. 1 Red : 2 Pink : 1 White

5. Incomplete dominance differs from complete dominance because:

A. In incomplete dominance, the heterozygote shows the dominant phenotype

B. In incomplete dominance, the heterozygote shows a blending of both parental traits

C. Incomplete dominance occurs only in animals

D. Incomplete dominance violates Mendel's Law of Segregation

6. Subjective:

Thomas Hunt Morgan performed dihybrid test crosses on *Drosophila melanogaster* to study linkage. He crossed a female fruit fly heterozygous for two genes: Body colour: Grey (G) dominant over Black (g) Wing size: Long wings (L) dominant over Vestigial wings (l) So the genotype of the F₁ female was GgLl. She was crossed with a double recessive male ggll. Morgan observed that if the two genes assorted independently, the test cross should give a 1:1:1:1 ratio: Grey Long : Grey Vestigial : Black Long : Black Vestigial

But his results were: 965 Grey Long, 944 Black Vestigial, 206 Grey Vestigial, 185 Black Long. He noted that the parental combinations appeared in much higher numbers than the new combinations.

Question: 1. Why did Morgan not get the expected 1:1:1:1 ratio in the test cross?

2. What do the high numbers of Grey Long and Black Vestigial flies indicate about the genes?

3. What are the 206 Grey Vestigial and 185 Black Long flies called, and how are they formed?