

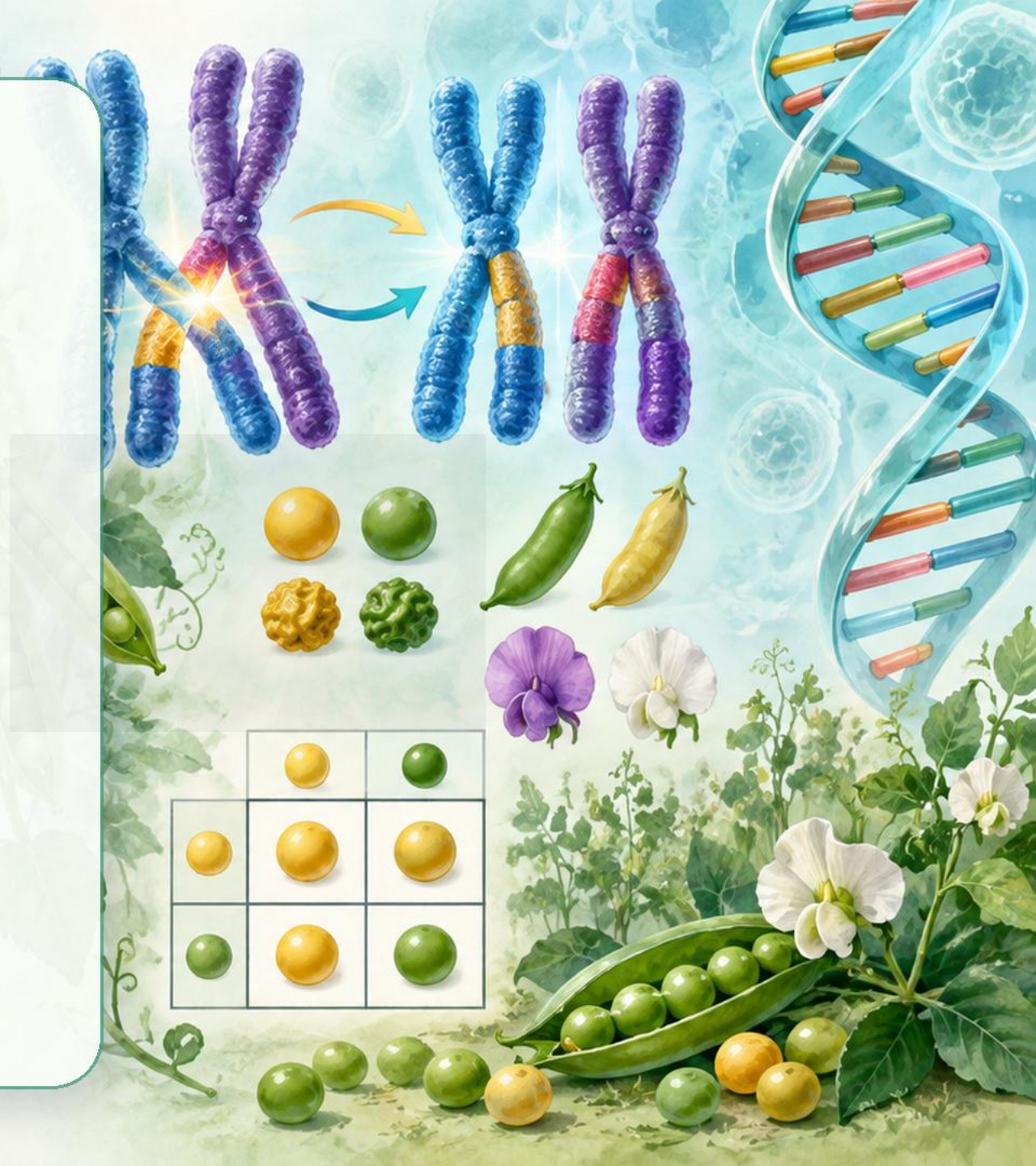
BIOLOGY • CLASS 12

4

CHAPTER

Principles of Inheritance and Variation

NCERT SOLUTIONS



EXERCISE SOLUTION: QUESTION 1

1. Mention the advantages of selecting pea plant for experiment by Mendel.

Answer:

Mendel selected the garden pea because it was suitable for controlled inheritance experiments:

- It is easy to grow and has a short life cycle.
- It produces many seeds, so many offspring can be studied.
- It has several clear, contrasting traits, such as tall and dwarf plants or round and wrinkled seeds.
- Natural self-pollination helps maintain true-breeding varieties.
- Self-pollination can be prevented and cross-pollination can be done by hand.
- Both parents can therefore be selected, and inheritance can be followed over generations.

True-breeding plants produce offspring with the same trait after repeated self-pollination.

EXERCISE SOLUTIONS: QUESTIONS 2-3

2. Differentiate between (a) Dominance and recessiveness, (b) Homozygous and heterozygous, (c) Monohybrid and dihybrid.

(a) **Dominance**

A dominant allele is expressed in a heterozygote, e.g. tallness in Tt.

Recessiveness

A recessive allele is masked in a heterozygote; dwarfness appears in tt.

(b) **Homozygous**

Both alleles at a locus are the same: TT or tt.

Heterozygous

The two alleles at a locus differ: Tt.

(c) **Monohybrid cross**

Follows inheritance of one character, e.g. plant height.

Dihybrid cross

Follows two characters, e.g. height and seed colour.

3. A diploid organism is heterozygous for 4 loci. How many types of gametes can be produced?

Answer: Assuming independent assortment:

$$\text{Number of gamete types} = 2^n = 2^4 = 16$$

Here, n is the number of heterozygous loci.

EXERCISE SOLUTION: QUESTION 4

4. Explain the Law of Dominance using a monohybrid cross.

Answer: When two contrasting alleles occur together, only the dominant allele is expressed in the heterozygote. The recessive allele is present but is not expressed.

T = tall; t = dwarf

TT (tall) $\times$ tt (dwarf) $\rightarrow$ all Tt (tall) in F_1 .

Tallness is dominant over dwarfness.

F_1 self-cross: Tt $\times$ Tt

		Gametes	
		T	t
Gametes	T	TT	Tt
	t	Tt	tt

F_2 genotype ratio = 1 TT : 2 Tt : 1 tt

F_2 phenotype ratio = 3 tall : 1 dwarf

The dwarf trait reappears in F_2 because its allele was not lost or blended.

EXERCISE SOLUTION: QUESTION 5

5. Define and design a test-cross.

Answer: A test-cross is a cross between an individual showing a dominant phenotype but an unknown genotype and a homozygous recessive individual. It helps identify the unknown genotype.

Example: tall pea plant (TT or Tt) x dwarf pea plant (tt).

If the tall parent is homozygous

TT x tt

	T	T
t	Tt	Tt
t	Tt	Tt

All offspring are tall.

If the tall parent is heterozygous

Tt x tt

	T	t
t	Tt	tt
t	Tt	tt

1 tall : 1 dwarf

The appearance of dwarf offspring proves that the tall parent carries the recessive allele.



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