

Exercise walk-through

5.5

Environmental Effects on Phenotype

AP Biology

Mendelian genetics

The **law of segregation** : alleles separate, so each gamete carries one. A **Punnett square** predicts the cross.

- **genotype** (Bb) vs **phenotype** (trait)
- **dominant** (capital) hides **recessive**

$Bb \times Bb \Rightarrow$ phenotype ratio **3:1**. Test the fit with $\chi^2 = \sum \frac{(O - E)^2}{E}$.

	B	b
B	BB	Bb
b	Bb	bb

Exam tips

- Contrast mitosis (2 identical, full chromosome number) with **meiosis** (4 non-identical gametes, half the number).
- Explain variation from **crossing over, independent assortment, and random fertilisation**.
- Use the multiplication rule for dihybrid crosses (each gene's 3:1 multiplied), and a **chi-square** test ($\chi^2 = \sum \frac{(o-e)^2}{e}$) to judge observed vs expected ratios.
- Keep **genotype** (the alleles) separate from **phenotype** (what you see) – AA and Aa can look the same.
- Recognise non-Mendelian patterns: incomplete dominance, codominance, and sex linkage.

Check yourself

- 1 How many cells, and what ploidy, does meiosis produce?
- 2 What phenotype ratio comes from $Bb \times Bb$?
- 3 Red + white flowers give pink – which inheritance pattern?
- 4 Two identical clones differ in colour – what is this called?

BB	Bb
Bb	bb

Answers 1. four haploid cells 2. 3:1 3. incomplete dominance 4. phenotypic plasticity

Exercises 2.1-2.3

2.1 Phenotype is determined by genotype and what else? [1]

2.2 Give one example of an environmental effect on phenotype. [1]

2.3 Is a suntan an inherited trait? Explain briefly. [1]

Exercises 2.1-2.3

2.1 Phenotype is determined by genotype and what else? [1]

2.1

- The environment
-

2.2 Give one example of an environmental effect on phenotype. [1]

2.2

- Any one: hydrangea color and soil pH, height and diet, fur color and temperature
-

2.3 Is a suntan an inherited trait? Explain briefly. [1]

2.3

- No – it is caused by sunlight (environment), not coded in DNA, so it is not inherited

Exercise 3.1

3.1 Two genetically identical plants grown in different light look different. This shows^[1]

☐

A a mutation

B an environmental effect on phenotype

C codominance

D meiosis

Exercise 3.1

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☐

A a mutation

B an environmental effect on phenotype

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3.1 B

- an environmental effect on phenotype

Exercise 3.2 (a)

3.2 Identical twins are raised in different countries and one is much taller.

(a) Explain how twins with the same genes can differ in height.

[2]

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(a) Explain how twins with the same genes can differ in height. [2]

(a)

- Phenotype depends on genes **and** environment; different diets/nutrition can produce different heights despite identical genes

Exercise 3.2 (b)

3.2 Identical twins are raised in different countries and one is much taller.

(b) State whether the height difference would be passed to their children.

[1]

Exercise 3.2 (b)

3.2 Identical twins are raised in different countries and one is much taller.

(b) State whether the height difference would be passed to their children.

[1]

(b)

- No – an environmentally-caused difference is not inherited

Exercise 3.3

3.3 Explain how you could tell whether a difference between two organisms is genetic or environmental. [2]

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3.3

- Raise them in the **same** environment: any remaining difference is genetic; a difference that disappears was environmental