

Exercise walk-through

Mendelian Genetics ■ 5.3

eXercise

You must be able to

- use **dominant** 显性 and **recessive** 隐性 alleles
- complete a **Punnett square** 庞纳特方格
- predict **genotype** 基因型 and **phenotype** 表现型 ratios

Method — Alleles and dominance

A **dominant** allele (capital, e.g. A) is expressed even with one copy; a **recessive** allele (a) is expressed only when **both** copies are recessive (aa).

Method — The Punnett square

A **Punnett square** predicts offspring by crossing the parents' alleles. For $Aa \times Aa$:

	A	a
A	AA	Aa
a	Aa	aa

Genotypes: 1 AA : 2 Aa : 1 aa . Phenotypes: **3 dominant** : **1 recessive**.

Method — Genotype vs phenotype

- **Genotype** — the alleles present (AA , Aa , aa).
- **Phenotype** — the observable trait (dominant or recessive appearance).

Method — A test cross

Crossing an unknown dominant ($A_$) with aa : if any recessive offspring appear, the unknown was Aa .

Practice 2.1 ■ 1 mark

How many recessive alleles are needed to show a recessive trait?

Solution 2.1

Method: Genotype vs phenotype

Worked steps

Two **B1**.

Practice 2.2 ■ 1 mark

For $Aa \times Aa$, state the phenotype ratio.

Solution 2.2

Worked steps

3 dominant : 1 recessive **B1**.

Practice 2.3 ■ 1 mark

What is the difference between genotype and phenotype?

Solution 2.3

Method: Genotype vs phenotype

Worked steps

Genotype is the alleles present; phenotype is the observable trait **B1**.

Exam-style 3.1 ■ 1 mark

A cross $Aa \times Aa$ gives a phenotype ratio of

A 1:1

B 3:1

C 9:3:3:1

D all dominant

Solution 3.1

A 1:1

B 3:1



C 9:3:3:1

D all dominant

Worked steps

B — 3:1.

Exam-style 3.2 ■ 2 marks

In pea plants, tall (T) is dominant to short (t). Cross $Tt \times tt$.

- (a) Complete a Punnett square.
- (b) State the genotype and phenotype ratios.

Solution 3.2

Method: The Punnett square

Worked steps

(a) Square gives Tt, Tt, tt, tt **M1** **A1**. (b) Genotype 1 Tt : 1 tt ; phenotype 1 tall : 1 short **M1** **A1**.

Exam-style 3.3 ■ 2 marks

A tall plant of unknown genotype is crossed with a short plant, and some short offspring appear. State the tall parent's genotype, with a reason.

Solution 3.3

Method: A test cross

Worked steps

Tt — a short offspring is tt , so it received a t from the tall parent, which must therefore carry a t **M1** **A1**.