

5.3 Mendelian Genetics

Name: _____ Class: _____ Date: _____

Total: 10 marks

Objective

Build the skills to answer exam questions on **Mendelian genetics** —monohybrid crosses.

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

1 Worked examples

Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

■ 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).

■ 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**.

■ Genotype vs phenotype

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

■ A test cross

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

2 Practice

Now apply the methods above.

2.1 How many recessive alleles are needed to show a recessive trait? [1]

2.2 For $Aa \times Aa$, state the phenotype ratio. [1]

2.3 What is the difference between genotype and phenotype? [1]

3 Exam-style questions

3.1 A cross $Aa \times Aa$ gives a phenotype ratio of [1]

- A 1:1
- B 3:1
- C 9:3:3:1
- D all dominant

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

(a) Complete a Punnett square. [2]

(b) State the genotype and phenotype ratios. [2]

3.3 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. [2]

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **5.3 Mendelian Genetics** lesson on the **Learn** page;
- read the **Mendelian Genetics** section of the AP Biology handout on the **Know** page.

Solutions

2.1 Two.

2.2 3 dominant : 1 recessive.

2.3 Genotype is the alleles present; phenotype is the observable trait.

3.1 B —3:1.

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

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