

# GCSE Combined Science: Trilogy

## Worksheet: Genetic inheritance

|                       |                          |                              |                                   |
|-----------------------|--------------------------|------------------------------|-----------------------------------|
| TIME<br><b>35 min</b> | TOTAL<br><b>32 marks</b> | CALCULATOR<br><b>Allowed</b> | DIFFICULTY<br><b>Easy, Medium</b> |
|-----------------------|--------------------------|------------------------------|-----------------------------------|

**Topics:** Genetic inheritance

**NAME** \_\_\_\_\_ **CLASS** \_\_\_\_\_ **DATE** \_\_\_\_\_

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

In pea plants, the allele for round seeds (R) is dominant to the allele for wrinkled seeds (r). Two pea plants that are both heterozygous for this gene were crossed. Table 1 is a Punnett square for this cross.

**Table 1**

| <b>Gametes</b> | <b>R</b> | <b>r</b> |
|----------------|----------|----------|
| <b>R</b>       |          |          |
| <b>r</b>       |          |          |

0 1 . 1 Give the genotype of each parent.

.....

.....

**[1 mark]**

0 1 . 2 Complete Table 1 to show the genotypes of the offspring.

.....

.....

**[2 marks]**

0 1 . 3

Give the expected ratio of offspring with round seeds to offspring with wrinkled seeds.

.....

.....

.....

Ratio = .....

[1 mark]

0 2

Genetic terms are used to describe alleles and characteristics.

0 2 . 1

What does the term 'homozygous' mean?

.....

.....

[1 mark]

0 2 . 2

A pea plant has the genotype Tt for height, where T (tall) is dominant.  
What is the plant's phenotype?

Tick (✓) **one** box.

Heterozygous

☐

Homozygous

☐

Short

☐

Tall

☐

[1 mark]

0 2 . 3

Which pair of terms correctly completes the sentence?

An organism's ..... is its genetic make-up, and its ..... is its physical characteristics.

Tick (✓) **one** box.

genotype; phenotype

☐

phenotype; genotype

☐

allele; gene

☐

gene; allele

☐

[1 mark]

0 3

Some characteristics are controlled by a single gene.

0 3 . 1

What is an allele?

Tick (✓) **one** box.

A different form of a gene

☐

A section of a chromosome made of protein

☐

A sex cell

☐

The physical appearance of an organism

☐

[1 mark]

0 3 . 2

What is meant by the term **heterozygous**?

.....

.....

[1 mark]

0 3 . 3

What is meant by the term **phenotype**?

.....

.....

[1 mark]

0 3 . 4

Which genotype is homozygous recessive?

Tick (✓) **one** box.

BB

☐

Bb

☐

bb

☐

B

☐

[1 mark]

0 3 . 5

A dominant allele is always expressed, even if only one copy is present.  
When is a recessive allele expressed?

.....

.....

[1 mark]

0 4

In sweet pea plants, the allele for purple flowers (P) is dominant to the allele for white flowers (p). A sweet pea plant that is heterozygous for this gene was crossed with a sweet pea plant with white flowers.

0 4 . 1

Give the probability that an offspring from this cross will have white flowers.  
Give your answer as a fraction or a decimal.

.....

.....

.....

Probability = .....

[1 mark]

0 4 . 2

200 offspring were produced from many crosses like this.  
Calculate the number of these offspring expected to have white flowers.

.....

.....

.....

.....

Number of offspring = .....

[2 marks]

0 4 . 3

Two of the offspring with purple flowers from this cross were crossed with each other.  
Give the expected ratio of offspring with purple flowers to offspring with white flowers from this second cross.

.....

.....

.....

.....

Ratio = .....

[2 marks]

0 5

In hamsters, the allele for dark eyes (D) is dominant to the allele for red eyes (d). A male hamster that is heterozygous for this gene was crossed with a female hamster with red eyes.

0 5 . 1

Give the probability that an offspring from this cross will have red eyes.  
Give your answer as a fraction or a decimal.

.....

.....

.....

Probability = .....

[1 mark]

0 5 . 2

120 offspring were produced from many crosses like this.  
Calculate the number of these offspring expected to have red eyes.

.....

.....

.....

.....

Number of offspring = .....

[2 marks]

0 5 . 3

Two of the offspring with dark eyes from this cross were crossed with each other.  
Give the expected ratio of offspring with dark eyes to offspring with red eyes from this second cross.

.....

.....

.....

.....

Ratio = .....

[2 marks]

0 6

A characteristic is controlled by a single gene with two alleles. In a population, 84% of individuals show the dominant phenotype and 16% show the recessive phenotype.

0 6 . 1 Explain how you can be certain of the genotype of the 16% showing the recessive phenotype, but cannot be certain of the genotype of the 84% showing the dominant phenotype without more information.

.....

.....

.....

.....

.....

.....

[3 marks]

0 7

In mice, the allele for black fur (B) is dominant to the allele for brown fur (b). A heterozygous black mouse was crossed with a brown mouse.

0 7 . 1 Give the genotype of each parent.

.....

.....

.....

.....

[2 marks]

0 7 . 2

Table 2

| Gametes |  |  |
|---------|--|--|
|         |  |  |
|         |  |  |

Complete the Punnett square in Table 2 to show the gametes of each parent and the genotypes of the offspring.

[3 marks]

0 7 . 3

Give the expected ratio of black offspring to brown offspring.

.....

.....

[1 mark]

0 7 . 4

The mice had 9 offspring.

Explain why the numbers of black and brown offspring could not match this ratio exactly.

.....

.....

[1 mark]

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### END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

# Mark scheme

## GCSE Combined Science: Trilogy · Worksheet: Genetic inheritance · 32 marks

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### Question 1 (4 marks)

01.1 [1 mark]

**Answer:** Rr and Rr

- both parents Rr (1)
- 

01.2 [2 marks]

**Answer:** Top row: RR, Rr; bottom row: Rr, rr

- top row: RR and Rr (1)
  - bottom row: Rr and rr (1)
- 

01.3 [1 mark]

**Answer:** 3 : 1

- 3 : 1 (1)
- 
- 

### Question 2 (3 marks)

02.1 [1 mark]

**Answer:** Having two identical alleles of a gene (e.g. BB or bb)

- having two identical alleles of a gene (e.g. BB or bb) (1)
- 

02.2 [1 mark]

**Correct:** Tall

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02.3 [1 mark]

**Correct:** genotype; phenotype

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### Question 3 (5 marks)

03.1 [1 mark]

**Correct:** A different form of a gene

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03.2 [1 mark]

**Answer:** Having two different alleles of a gene

- two different alleles (of a gene) (1)
- 

03.3 [1 mark]

**Answer:** The characteristic that is expressed (the physical appearance)

- the characteristic(s) expressed / physical appearance (produced by the alleles) (1)
- 

03.4 [1 mark]

**Correct:** bb

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03.5 [1 mark]

**Answer:** Only when two copies are present (no dominant allele)

- only when two copies are present / when there is no dominant allele (1)
- 

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### Question 4 (5 marks)

04.1 [1 mark]

**Answer:**  $\frac{1}{2}$  (0.5)

- $\frac{1}{2}$  / 0.5 (1)

**Notes:** Allow 50%.

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04.2 [2 marks]

**Answer:** 100

- $200 \times 0.5$  (1)
- 100 (1)

**Notes:** Correct answer with no working scores 2 marks.

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04.3 [2 marks]

**Answer:** 3 : 1

- offspring with purple flowers from the first cross must be heterozygous (Pp), because the parent with white flowers could only pass on p (1)
  - Pp  $\times$  Pp gives a ratio of 3 : 1 (1)
-

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## Question 5 (5 marks)

### 05.1 [1 mark]

**Answer:**  $\frac{1}{2}$  (0.5)

- $\frac{1}{2}$  / 0.5 (1)

**Notes:** Allow 50%.

---

### 05.2 [2 marks]

**Answer:** 60

- $120 \times 0.5$  (1)
- 60 (1)

**Notes:** Correct answer with no working scores 2 marks.

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### 05.3 [2 marks]

**Answer:** 3 : 1

- offspring with dark eyes from the first cross must be heterozygous (Dd), because the parent with red eyes could only pass on d (1)
  - Dd  $\times$  Dd gives a ratio of 3 : 1 (1)
- 

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## Question 6 (3 marks)

### 06.1 [3 marks]

**Answer:** A recessive phenotype is always caused by two copies of the recessive allele, since one dominant allele would be expressed instead; but the dominant phenotype could be produced by either a homozygous dominant or a heterozygous genotype, which look the same

- a recessive phenotype is always caused by two copies of the recessive allele (homozygous recessive) (1)
  - this is because even one copy of the dominant allele would be expressed instead (1)
  - individuals with the dominant phenotype could be homozygous dominant **or** heterozygous, since both genotypes produce the same (dominant) phenotype (1)
-

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## Question 7 (7 marks)

### 07.1 [2 marks]

**Answer:** Black parent Bb; brown parent bb

- black (heterozygous) parent: Bb (1)
- brown parent: bb (1)

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### 07.2 [3 marks]

**Answer:** Gametes B and b from one parent, b and b from the other; offspring Bb, Bb, bb, bb

- gametes of the black parent: B and b (1)
- gametes of the brown parent: b and b (1)
- offspring genotypes: Bb, Bb, bb, bb (1)

**Notes:** Allow ECF from incorrect parental genotypes for the offspring mark.

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### 07.3 [1 mark]

**Answer:** 1 : 1

- 1 : 1 (1)

**Notes:** Allow 2 : 2 or 50% : 50%.

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### 07.4 [1 mark]

**Answer:** 9 cannot be divided equally in a 1 : 1 ratio, and fertilisation is random so the ratio is only a probability

- 9 is an odd number / fertilisation is random so the ratio is only a probability / small number of offspring (1)
-