

GCSE Combined Science: Trilogy

Worksheet: Acceleration

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Acceleration

NAME	CLASS	DATE
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- 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.

01

01.1

A bus accelerates from 4.0 m/s to 13 m/s in 6.0 s.
Calculate the acceleration of the bus.
Use the equation:
acceleration = change in velocity ÷ time taken

Acceleration = m/s²
[2 marks]

01.2

What is the acceleration of an object falling freely near the Earth’s surface?

Acceleration = m/s²
[1 mark]

0 1 . 3 What is meant by an object decelerating?

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[1 mark]

0 2

A student investigates the motion of a table-tennis ball as it falls through the air from rest. Table 1 shows its speed at different times.

Table 1

Time in s	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5
Speed in m/s	0.0	4.5	7.3	8.5	9.0	9.2	9.3	9.3

0 2 . 1 Use Table 1 to determine the terminal velocity of the ball.

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Terminal velocity = m/s

[1 mark]

0 2 . 2 Explain, in terms of the forces acting, why the ball reaches a terminal velocity.

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[3 marks]

0 2 . 3

Describe the shape of the velocity–time graph for the ball from 0.0 s to 3.5 s.

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[2 marks]

0 3

A trolley of mass 2.0 kg accelerates uniformly from rest to 3.0 m/s in 4.0 s.

0 3 . 1

Calculate the acceleration of the trolley.

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Acceleration = m/s²

[2 marks]

0 3 . 2

Use the equation resultant force = mass × acceleration to calculate the resultant force needed to produce this acceleration.

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Resultant force = N

[2 marks]

0 3 . 3

Describe the shape of the velocity–time graph for the trolley during this acceleration.

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[1 mark]

0 4

A student drops a shuttlecock and records its speed at different times as it falls. Table 2 shows the results.

Table 2

Time in s	0	0.5	1.0	1.5	2.0	2.5	3.0
Speed in m/s	0	3.8	6.2	7.6	8.3	8.5	8.5

0 4 . 1

Use Table 2 to determine the terminal velocity of the shuttlecock.

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Terminal velocity = m/s

[1 mark]

0 4 . 2

Explain, in terms of the forces acting, why the shuttlecock reaches a terminal (constant) velocity.

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[3 marks]

0 5

A rocket-powered sled accelerates uniformly from rest at 30 m/s^2 over a distance of 400 m.

0 5 . 1

Calculate the final speed of the rocket-powered sled.
Use the Physics Equations Sheet.

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Final speed = m/s

[3 marks]

0 6

0 6 . 1

A cyclist accelerates uniformly from 2.0 m/s to 8.0 m/s over a distance of 40 m.
Calculate the acceleration of the cyclist.
Use the Physics Equations Sheet.

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Acceleration = m/s^2

[3 marks]

0 6 . 2

A stone is dropped from rest from a bridge 20 m above a river. Air resistance is negligible.

acceleration due to gravity = 9.8 m/s^2

Calculate the speed of the stone when it reaches the water.

Use the Physics Equations Sheet.

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Speed = m/s

[3 marks]

0 7

A train accelerates uniformly from rest at 1 m/s^2 over a distance of 800 m.

0 7 . 1

Calculate the final speed of the train.

Use the Physics Equations Sheet.

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Final speed = m/s

[3 marks]

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: Acceleration · 31 marks

Question 1 (4 marks)

01.1 [2 marks]

Answer: 1.5 m/s^2

- $a = (13 - 4.0) \div 6.0$ (1)
 - $1.5 \text{ (m/s}^2\text{)}$ (1)
-

01.2 [1 mark]

Answer: 9.8 m/s^2

- $9.8 \text{ (m/s}^2\text{)}$ (1)
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01.3 [1 mark]

Answer: It is slowing down.

- it is slowing down / its velocity is decreasing (1)
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Question 2 (6 marks)

02.1 [1 mark]

Answer: 9.3 m/s

- 9.3 (m/s) (1)

02.2 [3 marks]

Answer: Weight exceeds air resistance at first; air resistance grows with speed until it equals the weight; the resultant force is then zero and the velocity is constant.

- at first the weight is much bigger than the air resistance, so there is a large resultant force downwards and the ball accelerates (1)
- as the speed increases, the air resistance increases, so the resultant force (and the acceleration) decreases (1)
- when the air resistance becomes equal to the weight, the resultant force is zero, so the ball falls at a constant (terminal) velocity (1)

02.3 [2 marks]

Answer: A curve from the origin whose gradient decreases until it is horizontal at 9.3 m/s.

- a curve that starts steep (from the origin) and becomes less steep (its gradient decreases) (1)
- then becomes horizontal (levels off) at the terminal velocity, 9.3 m/s (1)

Question 3 (5 marks)

03.1 [2 marks]

Answer: 0.75 m/s²

- $a = 3.0 \div 4.0$ (1)
- 0.75 (m/s²) (1)

03.2 [2 marks]

Answer: 1.5 N

- $F = 2.0 \times 0.75$ (1)
- 1.5 (N) (1)

Notes: Allow ECF from the previous part.

03.3 [1 mark]

Answer: A straight line from the origin with a constant, positive gradient.

- a straight line, starting from the origin, with a positive, constant gradient (1)

Question 4 (4 marks)

04.1 [1 mark]

Answer: 8.5 m/s

- 8.5 (m/s) (1)

04.2 [3 marks]

Answer: Weight exceeds air resistance at first (accelerating); as speed rises, air resistance grows until it equals weight, giving zero resultant force and constant (terminal) velocity.

- at first the shuttlecock's weight is much bigger than air resistance, so there is a large resultant force and it accelerates quickly (1)
- as its speed increases, air resistance increases, so the resultant force (and the acceleration) decreases (1)
- eventually air resistance becomes equal to weight; the resultant force is then zero, so (by Newton's First Law) the shuttlecock continues at this constant, terminal velocity (1)

Question 5 (3 marks)

05.1 [3 marks]

Answer: 155 m/s

- $v^2 - 0^2 = 2 \times 30 \times 400$ (1)
- $v^2 = 24\,000$ (1)
- 155 (m/s) (1)

Question 6 (6 marks)

06.1 [3 marks]

Answer: 0.75 m/s^2

- $8.0^2 - 2.0^2 = 2 \times a \times 40$ (1)
- $60 = 80 a$ (1)
- $a = 0.75 \text{ (m/s}^2\text{)}$ (1)

06.2 [3 marks]

Answer: 19.8 m/s

- $v^2 - 0 = 2 \times 9.8 \times 20$ (1)
 - $v^2 = 392$ (1)
 - $v = 19.8 \text{ (m/s)}$ (1)
-

Question 7 (3 marks)

07.1 [3 marks]

Answer: 40 m/s

- $v^2 - 0^2 = 2 \times 1 \times 800$ (1)
 - $v^2 = 1600$ (1)
 - 40 (m/s) (1)
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