

GCSE Physics

Worksheet: Acceleration and velocity–time graphs

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Acceleration and velocity–time graphs

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 small toy parachute as it falls through the air from rest. Table 1 shows its speed at different times.

Table 1

Time in s	0.0	0.4	0.8	1.2	1.6	2.0	2.4	2.8
Speed in m/s	0.0	3.2	4.2	4.5	4.5	4.5	4.5	4.5

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

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Terminal velocity = m/s

[1 mark]

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

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[3 marks]

0 2 . 3

Describe the shape of the velocity–time graph for the toy parachute from 0.0 s to 2.8 s.

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[2 marks]

0 3

A sprinter accelerates uniformly from rest at 4 m/s^2 over a distance of 14 m.

0 3 . 1

Calculate the final speed of the sprinter.
Use the Physics Equations Sheet.

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Final speed = m/s

[3 marks]

0 4

0 4 . 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/s²

[3 marks]

0 4 . 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/s²
Calculate the speed of the stone when it reaches the water.
Use the Physics Equations Sheet.

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Speed = m/s

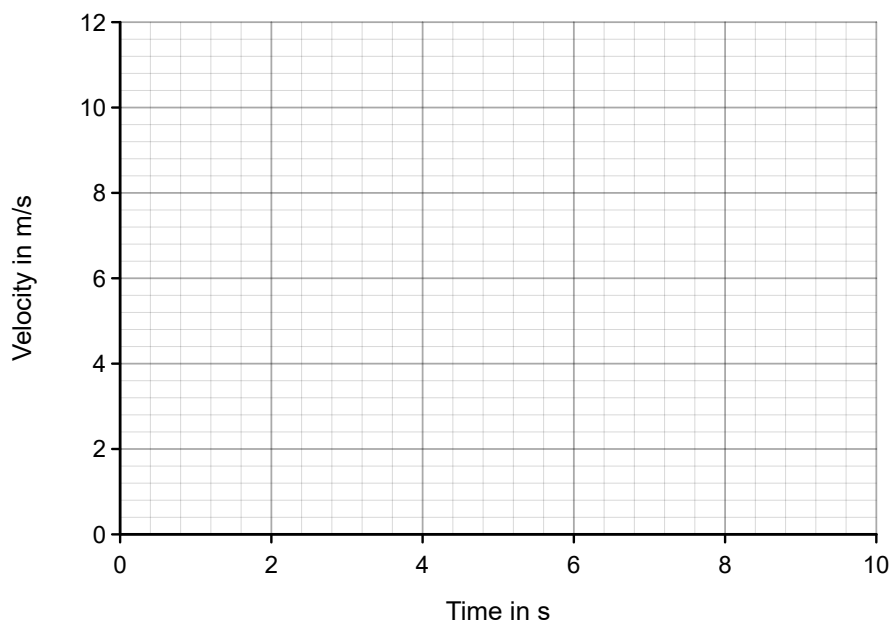
[3 marks]

.....

0 5

A table-tennis ball is dropped from the top of a tall tower. After a few seconds it reaches a terminal velocity of 9 m/s. It is still falling at this velocity when it reaches the ground, 8 s after it was released. Figure 1 shows axes for a velocity–time graph.

Figure 1



0 5 . 1

State the acceleration of the ball at the moment it is released.

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.....

Acceleration = m/s²

[1 mark]

0 5 . 2

Sketch a graph on Figure 1 to show how the velocity of the ball changes from the moment it is released until it reaches the ground.

[3 marks]

0 5 . 3

Explain, in terms of the forces acting on the ball, why the gradient of your graph decreases before it becomes horizontal.

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[2 marks]

0 6

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

0 6 . 1

Calculate the acceleration of the trolley.

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Acceleration = m/s²

[2 marks]

0 6 . 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 6 . 3

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

[1 mark]

END OF QUESTIONS

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

Mark scheme

GCSE Physics · Worksheet: Acceleration and velocity–time graphs · 30 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)
-

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: 4.5 m/s

- 4.5 (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 toy parachute 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 toy parachute 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 4.5 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, 4.5 m/s (1)

Question 3 (3 marks)

03.1 [3 marks]

Answer: 10.6 m/s

- $v^2 - 0^2 = 2 \times 4 \times 14$ (1)
 - $v^2 = 112$ (1)
 - 10.6 (m/s) (1)
-

Question 4 (6 marks)

04.1 [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)

04.2 [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 5 (6 marks)

05.1 [1 mark]

Answer: 9.8 m/s^2

- $9.8 \text{ (m/s}^2\text{)}$ (1)

Notes: Allow 10 m/s^2 .

05.2 [3 marks]

Answer: A curve starting steeply from the origin, with a gradient that decreases, becoming horizontal at 9 m/s and staying horizontal until 8 s .

- the line starts at the origin ($v = 0$ at $t = 0$) with a steep gradient (1)
- the line curves, with a gradient that decreases (the velocity increases more and more slowly) (1)
- the line becomes horizontal at 9 m/s and stays horizontal until 8 s (1)

Notes: Do not accept a straight line rising to 9 m/s for the second mark.

05.3 [2 marks]

Answer: As the ball's speed increases, the air resistance (drag) on it increases; its weight stays the same, so the resultant force and the acceleration decrease, until the air resistance equals the weight and the resultant force is zero.

- as the ball's speed increases, the air resistance (drag) acting on it increases (1)
 - so the resultant force (weight – air resistance), and therefore the acceleration, decreases — until air resistance equals weight, when the resultant force is zero and the ball falls at a constant (terminal) velocity (1)
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Question 6 (5 marks)

06.1 [2 marks]

Answer: 0.75 m/s^2

- $a = 3.0 \div 4.0$ (1)
 - $0.75 \text{ (m/s}^2\text{)}$ (1)
-

06.2 [2 marks]

Answer: 1.5 N

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

Notes: Allow ECF from the previous part.

06.3 [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)
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