



Name	
Date	
Score	/ 50

GCSE PHYSICS · QUESTION PACK

Forces and motion

Higher tier · scalars and vectors, motion graphs, Newton's laws, stopping distances, momentum, springs

Suggested time: 1 hour · Total: 50 marks

You will need

- a black pen, a pencil and a ruler
- a scientific calculator
- the Physics Equations Sheet (at the back of this pack)

Instructions

- Answer **all** questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for each question are shown in brackets.
- Try to complete the pack in the suggested time, without your notes.

Marking your work

The mark scheme is at the back of this pack. Mark your answers in a different coloured pen, then go back over any questions where you lost marks.

Your marks	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	/ 50

Exam-style questions written by Oakleaf Learning in the style of AQA GCSE Physics (8463), Higher tier. Not an official AQA resource.

This question is about forces.

0 1 . 1 Which **two** quantities are vectors?

Tick (✓) **two** boxes.

Distance	☐
Force	☐
Mass	☐
Speed	☐
Velocity	☐

[2 marks]

0 1 . 2 Two horizontal forces act on a box. A force of 12 N acts to the right and a force of 5 N acts to the left.

Determine the size and direction of the resultant force on the box.

Size

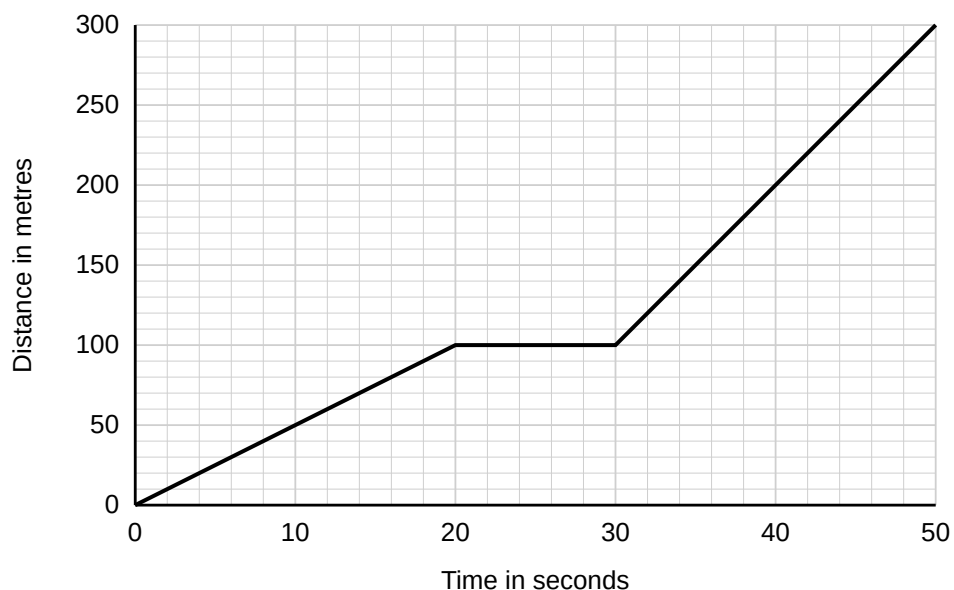
Answer N

Direction

.....
[2 marks]

A cyclist rides along a straight road.
Figure 1 shows a distance–time graph for the journey.

Figure 1



0 2 . 1 Describe the motion of the cyclist between 20 s and 30 s.

[1 mark]

0 2 . 2 Calculate the speed of the cyclist between 0 s and 20 s.

Answer _____ m/s

[2 marks]

0 2 . 3 Calculate the speed of the cyclist between 30 s and 50 s.

Answer _____ m/s

[2 marks]

0 2 . 4

Calculate the average speed of the cyclist for the whole journey.

.....

.....

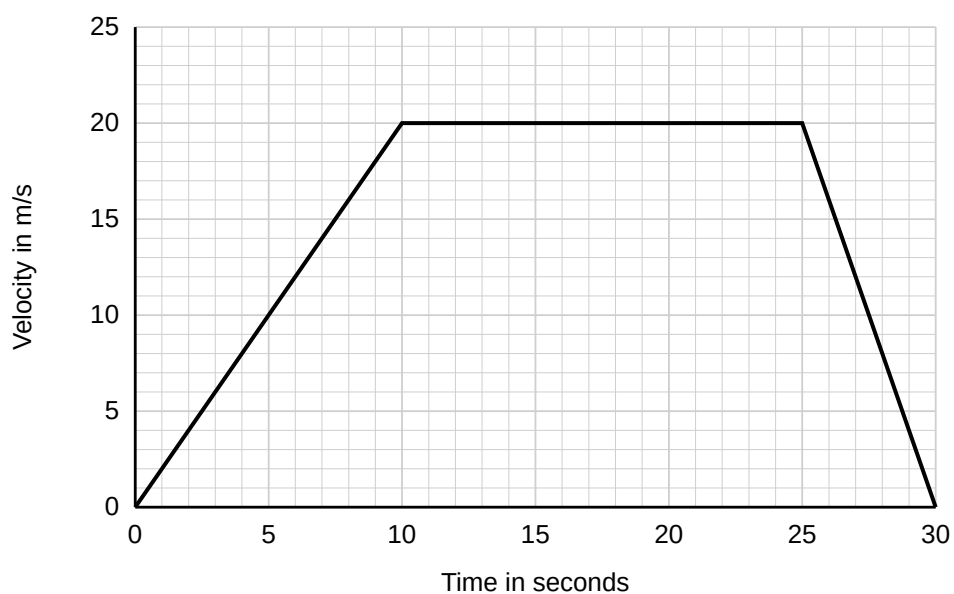
.....

Answer m/s

[2 marks]

Figure 2 shows a velocity–time graph for a car.

Figure 2



0 3 . 1

Calculate the acceleration of the car between 0 s and 10 s.

.....

.....

.....

Answer m/s²

[2 marks]

03 . 2

Determine the total distance travelled by the car in 30 s.

Answer m

[3 marks]

03 . 3

The mass of the car is 1200 kg.

Calculate the braking force on the car between 25 s and 30 s.

Answer N

[3 marks]

A skydiver jumps from a stationary aircraft.
After some time, the skydiver opens a parachute.

0	4
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1

 Describe and explain the motion of the skydiver from the moment they jump until they are falling at a steady speed with the parachute open.

Your answer should refer to the forces acting on the skydiver.

This image shows a full page of blank primary-ruled paper. It features ten sets of horizontal lines across the page. Each set consists of three lines: a solid top line, a dashed middle line, and a solid bottom line. The lines are evenly spaced and extend from the left margin to the right edge of the page. There are no margins or other markings present.

[6 marks]

This question is about stopping distances.

0	5
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 .

1

 The stopping distance of a car is the sum of two distances.
Name the **two** distances.

[1 mark]

05 . 2

Give **two** factors that increase the reaction time of a driver.

1

.....

2

.....

[2 marks]

05 . 3

A car is travelling at 15 m/s. The driver has a reaction time of 0.70 s.
Calculate the thinking distance.

.....

.....

.....

Answer m

[2 marks]

05 . 4

The brakes are then applied. The car decelerates at 7.5 m/s^2 until it stops.
Calculate the braking distance.
Use the Physics Equations Sheet.

.....

.....

.....

.....

.....

Answer m

[3 marks]

This question is about momentum.

06 . 1

A ball of mass 0.16 kg is moving at 25 m/s.

Calculate the momentum of the ball.

Answer kg m/s

[2 marks]

06 . 2

Trolley X has a mass of 2.0 kg and is moving at 3.0 m/s. It collides with a stationary trolley Y of mass 1.0 kg.

The two trolleys stick together and move off in the same direction.

Calculate the velocity of the two trolleys just after the collision.

Answer m/s

[3 marks]

06 . 3

Cars are fitted with airbags.

Explain how an airbag reduces the force on a driver in a collision.

[3 marks]

This question is about weight, work and springs.

gravitational field strength = 9.8 N/kg

07 . 1 Calculate the weight of a person of mass 65 kg .

Answer N

[2 marks]

07 . 2 A person pushes a box with a constant force of 150 N . The box moves 4.0 m in the direction of the force.

Calculate the work done on the box.

Answer J

[2 marks]

07 . 3 A force of 6.0 N stretches a spring by 0.15 m . The spring has not exceeded its limit of proportionality.

Calculate the spring constant of the spring.

Answer N/m

[2 marks]

07 . 4

Calculate the elastic potential energy stored in the spring.

Use the Physics Equations Sheet.

Answer _____ J

[2 marks]

07 . 5

What is meant by the **limit of proportionality** of a spring?

[1 mark]

END OF QUESTIONS

Physics Equations Sheet

These are the equations given in the examination for the topics in this pack. Any other equation you need must be recalled.

1	(final velocity) ² – (initial velocity) ² = 2 × acceleration × distance	$v^2 - u^2 = 2 a s$
2	force = change in momentum ÷ time taken	$F = m \Delta v / \Delta t$
3	elastic potential energy = 0.5 × spring constant × (extension) ²	$E_e = \frac{1}{2} k e^2$

Mark scheme

GCSE Physics question pack · Forces and motion



How to use this mark scheme

- Mark in a different coloured pen to the one you wrote your answers in.
- For calculations, a correct final answer scores full marks even if no working is shown. If the final answer is wrong, award marks for each correct step of working.
- **ecf** (error carried forward): if you got an earlier part wrong, you can still get full marks for a later part that correctly uses your earlier answer.
- **allow** means the answer is also acceptable. **ignore** means the words do not gain or lose marks. **do not accept** means the answer scores no marks.
- For 6-mark questions, decide which level your answer fits best, then award the higher mark in that level if your answer is at the top of it.

Question	Answers	Extra information	Mark	AO
01.1	force velocity		1 1	AO1
01.2	7 (N) to the right		1 1	AO2
02.1	stationary / not moving	allow at rest	1	AO2
02.2	speed = 100 / 20 speed = 5.0 (m/s)	an answer of 5 (m/s) scores 2 marks	1 1	AO2
02.3	speed = 200 / 20 speed = 10 (m/s)	an answer of 10 (m/s) scores 2 marks	1 1	AO2
02.4	average speed = 300 / 50 average speed = 6.0 (m/s)	an answer of 6 (m/s) scores 2 marks	1 1	AO2
03.1	a = 20 / 10 a = 2.0 (m/s ²)		1 1	AO2
03.2	distance = area under the graph (0.5 × 10 × 20) + (15 × 20) + (0.5 × 5 × 20) = 100 + 300 + 50 distance = 450 (m)	an answer of 450 (m) scores 3 marks allow 2 marks for two of the three areas correct	1 1 1	AO2
03.3	deceleration = 20 / 5 = 4.0 (m/s ²) F = 1200 × 4.0 F = 4800 (N)	an answer of 4800 (N) scores 3 marks	1 1 1	AO2

Question	Answers	Extra information	Mark	AO															
04.1	Level of response question. Indicative content: - at the start, weight is the only (main) force, so there is a large resultant force downwards - so the skydiver accelerates (at about 9.8 m/s²) - as speed increases, air resistance increases - so the resultant force decreases and the acceleration decreases - air resistance becomes equal to weight; resultant force is zero - the skydiver reaches terminal velocity (constant speed) - opening the parachute increases the surface area, so air resistance increases - air resistance is now greater than weight, so the resultant force is upwards and the skydiver decelerates - as speed decreases, air resistance decreases until it equals weight again - the skydiver falls at a new, lower terminal velocity <table><tr><th>Level</th><th>Descriptor</th><th>Marks</th></tr><tr><td>Level 3</td><td>A detailed and coherent explanation of the motion of the skydiver in terms of the forces acting, with clear links between causes and effects. The response is logically structured.</td><td>5–6</td></tr><tr><td>Level 2</td><td>A partial explanation of the motion of the skydiver in terms of the forces acting, with at least one clear link between a cause and its effect. Some detail may be missing.</td><td>3–4</td></tr><tr><td>Level 1</td><td>Simple relevant statements about the motion of the skydiver in terms of the forces acting, with little or no explanation.</td><td>1–2</td></tr><tr><td></td><td>No relevant content.</td><td>0</td></tr></table>	Level	Descriptor	Marks	Level 3	A detailed and coherent explanation of the motion of the skydiver in terms of the forces acting, with clear links between causes and effects. The response is logically structured.	5–6	Level 2	A partial explanation of the motion of the skydiver in terms of the forces acting, with at least one clear link between a cause and its effect. Some detail may be missing.	3–4	Level 1	Simple relevant statements about the motion of the skydiver in terms of the forces acting, with little or no explanation.	1–2		No relevant content.	0		6	AO1
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	No relevant content.	0																	
05.1	thinking distance and braking distance	both needed for the mark	1	AO1															
05.2	any two from: - tiredness - alcohol - drugs - distractions (e.g. using a mobile phone)	ignore age ignore speed (this affects thinking distance, not reaction time)	1 1	AO1															
05.3	s = 15 × 0.70 s = 10.5 (m)	allow 11 (m)	1 1	AO2															
05.4	0 ² – 15 ² = 2 × (–7.5) × s s = 225 / 15 s = 15 (m)	an answer of 15 (m) scores 3 marks	1 1 1	AO2															
06.1	p = 0.16 × 25 p = 4.0 (kg m/s)		1 1	AO2															
06.2	momentum before = 2.0 × 3.0 = 6.0 (kg m/s) 6.0 = (2.0 + 1.0) × v v = 2.0 (m/s)	an answer of 2.0 (m/s) scores 3 marks	1 1 1	AO2															

Question	Answers	Extra information	Mark	AO
06.3	the airbag increases the time taken for the driver to stop so the rate of change of momentum is reduced force is equal to the rate of change of momentum, so the force on the driver is smaller	allow the change in momentum is the same but happens over a longer time	1 1 1	AO1
07.1	$W = 65 \times 9.8$ $W = 637 \text{ (N)}$	allow 640 (N)	1 1	AO2
07.2	$W = 150 \times 4.0$ $W = 600 \text{ (J)}$	allow 600 N m	1 1	AO2
07.3	$k = 6.0 / 0.15$ $k = 40 \text{ (N/m)}$		1 1	AO2
07.4	$E = 0.5 \times 40 \times 0.15^2$ $E = 0.45 \text{ (J)}$	allow ecf from 07.3	1 1	AO2
07.5	the point beyond which the extension is no longer directly proportional to the force	allow the spring no longer obeys Hooke's law	1	AO1

Total: 50 marks