AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.5.1.1 SCALAR AND VECTOR QUANTITIES (PACK 1)

SCORE	PERCENTAGE
/66	%

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Q1.

(a) Which of these is a scalar quantity?

Tick **one** box.

displacement ☐

distance ☐

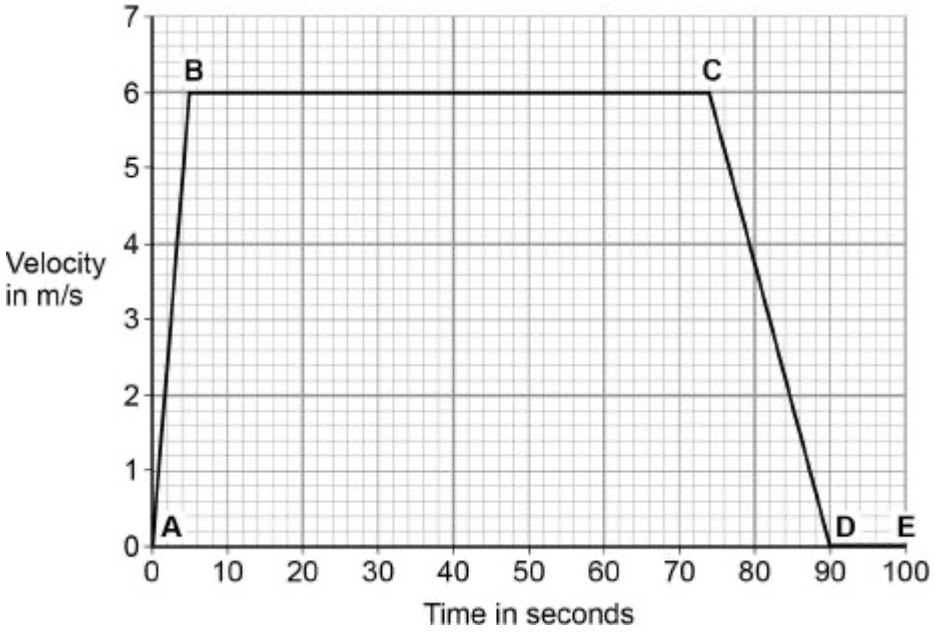
force ☐

velocity ☐

(1)

(b) A woman cycled along a straight flat road.

The graph below shows how the woman's velocity changed with time.



Which part of the graph shows the woman moving at constant velocity?

Tick **one** box.

BC ☐ **CD** ☐ **DE** ☐

(1)

(c) Which part of the graph shows the woman stationary?

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BC ☐ **CD** ☐ **DE** ☐

(1)

Between points **A** and **B** the woman was accelerating.

(d) Use the graph above to determine the total time for which she was accelerating.

_____

Time = _____ s

(1)

(e) Use the graph above to determine her increase in velocity between points **A** and **B**.

_____

Increase in velocity = _____ m/s

(1)

(f) Calculate her acceleration between points **A** and **B**.

Use the equation:

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

_____

_____

Acceleration = _____ m/s^2

(2)

(g) Estimate how a typical cycling speed of 6 m/s compares with a typical walking speed.

Tick **one** box.

about twice as fast ☐

about four times faster ☐

about eight times faster ☐

(1)

(Total 8 marks)

Q2.

A student investigated the frictional force between an object and a surface.

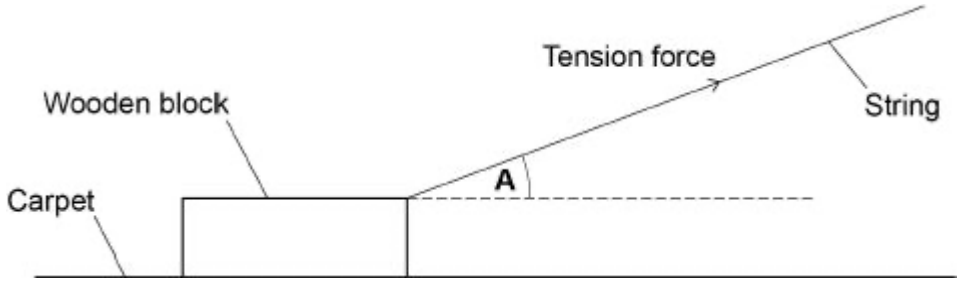
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The student used a string to pull a small wooden block across different surfaces.
The block was pulled at a constant speed in a straight line.

Pulling the block causes a tension force in the string.

The student kept the angle of the string the same each time.

The diagram below represents the block being pulled across a piece of carpet.



(a) Measure angle **A** on the diagram above.

Angle **A** = _____ degrees

(1)

(b) Complete the sentences.

Choose answers from the box.

controlled	**dependent**	**scalar**	**valid**	**vector**

Force has both magnitude and direction, so is a _____ quantity.

A quantity with magnitude only is a _____ quantity.

(2)

(c) Two forces acting on the block are tension and friction.

Name **one** other force acting on the block.

_____

(1)

(d) When the student pulled the block with a constant force, the velocity of the block did not change.

What is the best explanation for this?

Tick **one** box.

Force is directly proportional to velocity ☐

No work is done by the pulling force ☐

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The block is moving in a straight line ☐

The resultant force on the block is zero ☐

(1)

The student pulled the block along four different surfaces:

- cardboard
- carpet
- glass
- sandpaper.

(e) Give **two** control variables for this investigation.

1. _____

2. _____

(2)

The table below shows the results.

Surface	**Force to pull the block in newtons**			**Mean force in newtons**
	Trial 1	**Trial 2**	**Trial 3**	
cardboard	1.4	1.6	1.5	1.5
carpet	2.5	3.0	3.9	3.2
glass	0.7	0.8	0.6	0.7
sandpaper	5.2	5.6	5.4	**X**

(f) Calculate value **X** in the table above.

_____

_____

X = _____ N

(1)

(g) Which surface produced the lowest friction force?

_____

(1)

(Total 9 marks)

Q3.

Forces are vector quantities.

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(a) What is the difference between a vector quantity and a scalar quantity?

_____

_____

_____

_____

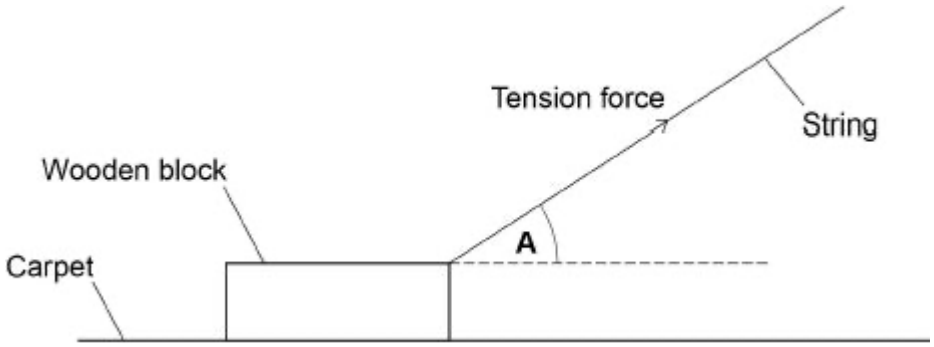
(2)

Figure 1 represents a wooden block being pulled across a surface at a constant speed in a straight line.

The block is in contact with the surface.

The arrow in **Figure 1** represents the tension force in the string pulling the block.

Figure 1

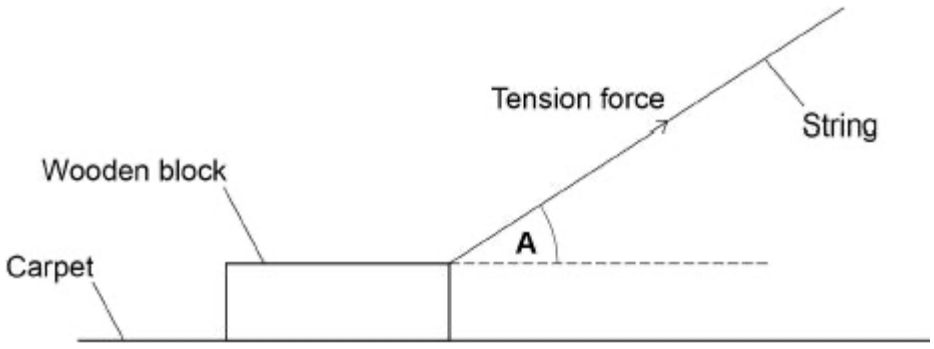


(b) Complete **Figure 1** to show the other three forces acting on the block.

(3)

Figure 2 is a copy of **Figure 1** to help you answer the following question.

Figure 2



(c) **Figure 2** is drawn to scale. The scale is 1 cm : 0.5 N

Determine the horizontal and vertical components of the tension in the string.

Show these components on **Figure 2**.

_____

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Horizontal component = _____ N

Vertical component = _____ N

(3)

A student collects data on the size of the force required to pull the block across different surfaces at a constant speed.

The table below shows the results.

Type of surface	Force in N			Mean force in N
	Trial 1	Trial 2	Trial 3	
Cardboard	1.4	1.6	1.5	1.5
Carpet	2.6	3.1	3.9	3.2
Glass	0.7	0.8	0.6	0.7
Sandpaper	5.2	**X**	5.3	5.4

(d) Calculate value **X** in the table above.

X = _____ N

(2)

(e) Give **three** control variables for this investigation.

1. _____

2. _____

3. _____

(3)

(Total 13 marks)

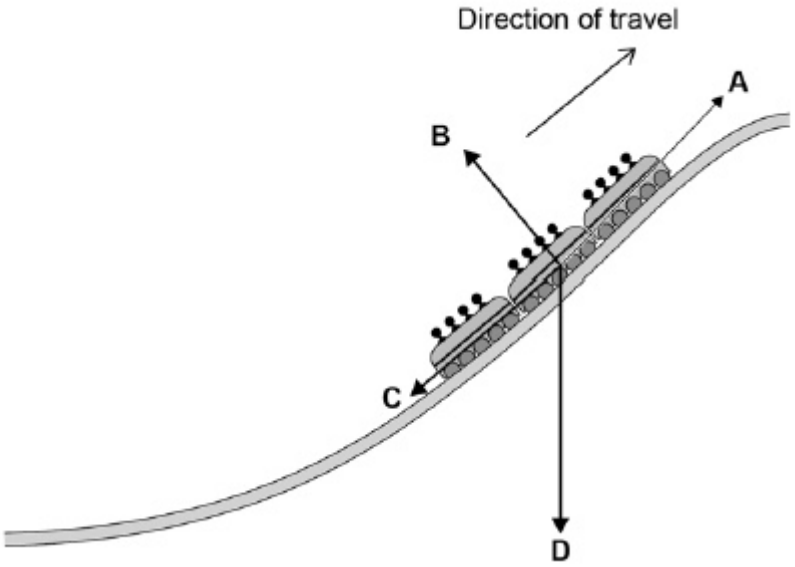
Q4.

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Figure 1 shows a rollercoaster train as it is pulled up a slope on the track.

The arrows, **A**, **B**, **C** and **D**, represent the forces acting on the rollercoaster train.

Figure 1



(a) Give **two** ways that the force arrows show that forces are vector quantities.

1. _____

2. _____

(2)

(b) Which arrow shows the weight of the rollercoaster train?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(c) Which arrow shows the normal contact force?

Tick **one** box.

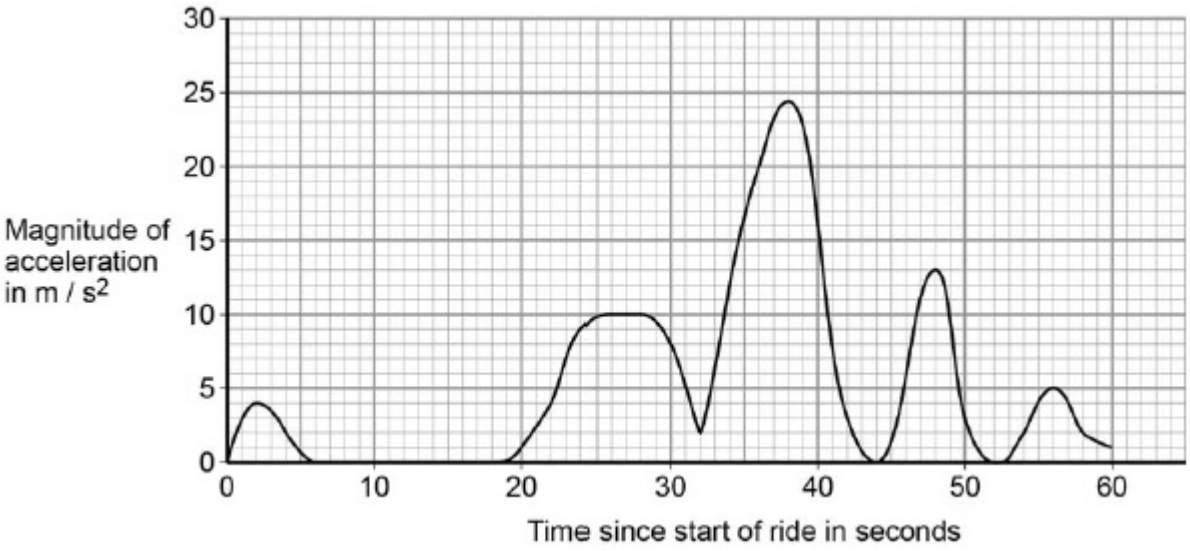
A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

Figure 2 shows the magnitude of the acceleration of the rollercoaster train during the ride.

Figure 2

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(d) Why has a line graph been drawn instead of a bar chart?

Tick **one** box.

Acceleration is a control variable. ☐

Both variables are continuous. ☐

Line graphs are easier to read. ☐

Time is a categoric variable. ☐

(1)

(e) What conclusion can be made from **Figure 2** about the motion of the rollercoaster train between 10 and 15 seconds?

Tick **one** box.

It is moving at a constant velocity. ☐

Its velocity is decreasing. ☐

Its velocity is increasing. ☐

(1)

(f) What is the maximum acceleration of the rollercoaster train?

Use **Figure 2**.

Acceleration = _____ m/s^2

(1)

(g) The maximum safe acceleration for most people is 5 times the acceleration due to gravity.

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Acceleration due to gravity = 9.8 m/s^2

Explain whether the acceleration of this rollercoaster train is safe for most people

_____

_____

_____

_____

_____

_____

(3)

(h) One of the passengers on the rollercoaster train has a mass of 58 kg

Calculate the maximum force experienced by the passenger during the ride.

Use the equation:

force = mass × acceleration

Give the unit.

_____

_____

_____

_____

_____

_____

Maximum force = _____ Unit _____

(3)

(Total 13 marks)

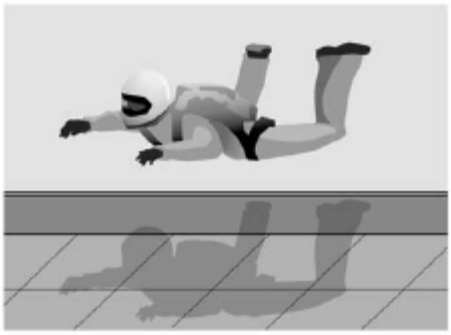
Q5.

Figure 1 shows a skydiver training in an indoor wind tunnel.

Large fans below the skydiver blow air upwards.

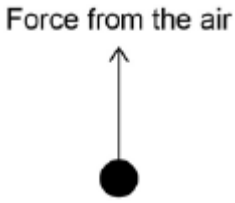
Figure 1

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(a) The skydiver is in a stationary position.

Complete the free body diagram for the skydiver.



(2)

(b) The skydiver now straightens his legs to increase his surface area.

This causes the skydiver to accelerate upwards.

Explain why straightening his legs cause the skydiver to accelerate upwards.

_____

_____

_____

_____

(2)

(c) A small aeroplane used for skydiving moves along a runway.

The aeroplane accelerates at 2 m / s^2 from a velocity of 8 m / s.

After a distance of 209 m it reaches its take-off velocity.

Calculate the take-off velocity of the aeroplane.

_____

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Take-off velocity = _____ m / s

(3)

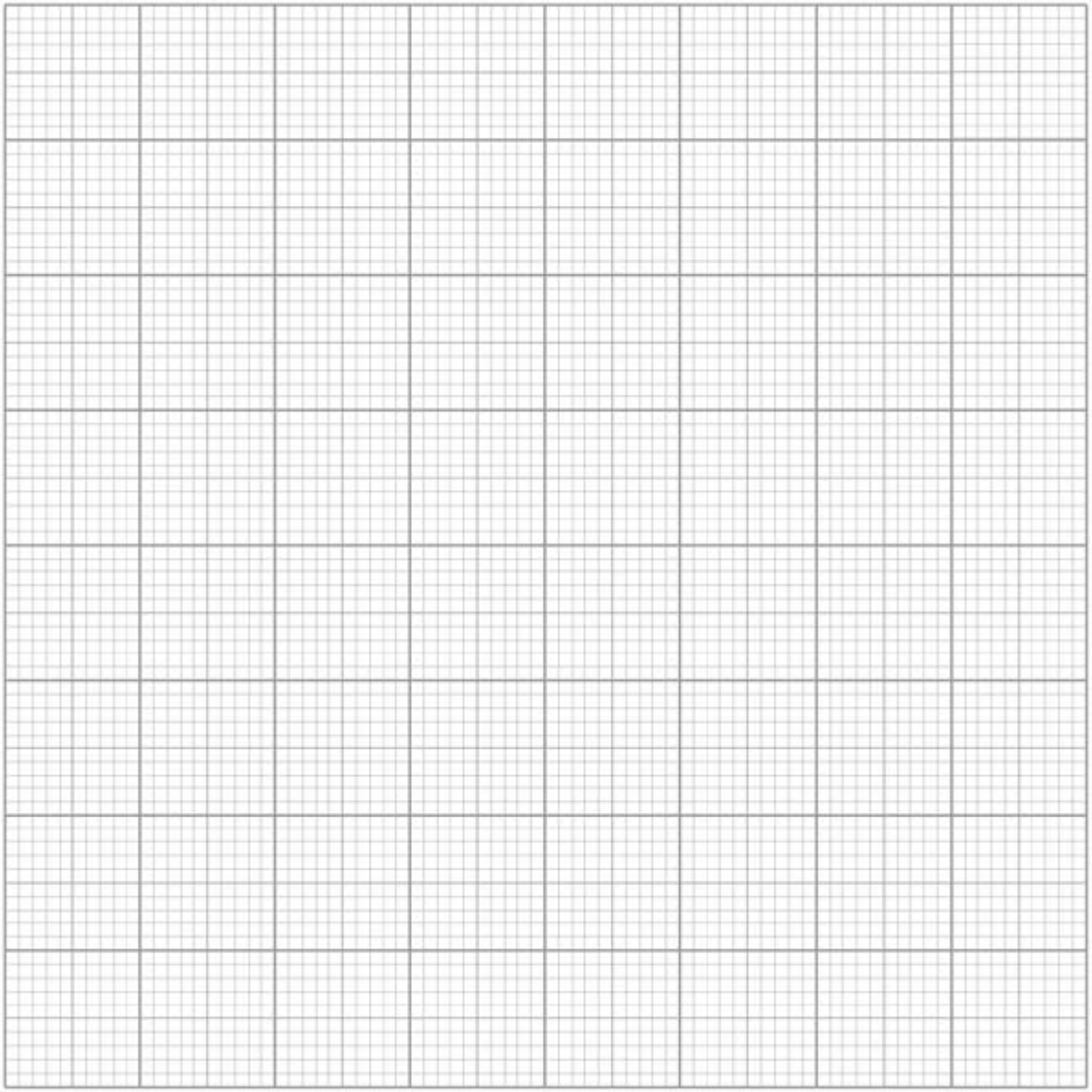
(d) A skydiver jumps from an aeroplane.

There is a resultant vertical force of 300 N on the skydiver.

There is a horizontal force from the wind of 60 N.

Draw a vector diagram on **Figure 2** to determine the magnitude and direction of the resultant force on the skydiver.

Figure 2



Magnitude of resultant force = _____ N

(5)

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(Total 12 marks)

Q6.

This question is about forces, quantities and vectors.

(a) Write down the equation that links gravitational field strength, mass and weight.

_____

(1)

(b) A small ball weighs 1.4 N.

gravitational field strength, g = 9.8 N / kg

Calculate the mass of the ball.

_____

_____

_____

Mass = _____ kg

(3)

(c) A white ball with mass 143 g is moving at a velocity of 7.9 m / s.

It collides with a red ball with mass of 150 g.

The red ball is stationary before the collision. The white ball stops after the collision.

Calculate the velocity of the red ball after the collision.

Give your answer to two significant figures.

_____

_____

_____

_____

_____

_____

Velocity of red ball = _____ m / s

(4)

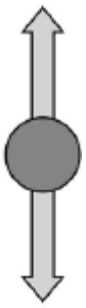
(d) The white ball is thrown high into the air.

After it is released the ball moves up and then back down in a vertical line.

The free body force diagram in the figure below shows the forces on the ball at one point in its flight.

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The force arrows are drawn to scale.



Explain what is happening to the ball at this point in its flight.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 12 marks)

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