AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.5.1.3 GRAVITY (PACK 1)

SCORE	PERCENTAGE
/78	%

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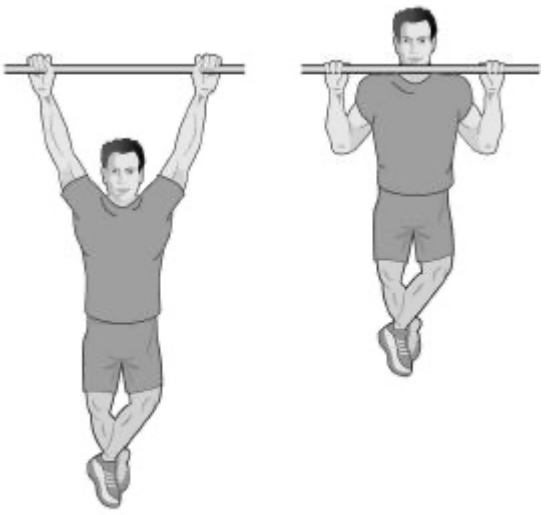
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Q1.

The diagram below shows a man doing two stages of a pull up. In both diagrams the man is stationary.



Stage 1 Stage 2

(a) Complete the sentence.

Choose the answers from the box.

equal to	**less than**	**more than**

In stage 1 the downwards force of the man on the bar is _____

the upwards force of the bar on the man.

(1)

(b) The man has a mass of 85 kg

Gravitational field strength = 9.8 N/kg

Calculate the weight of the man.

Use the equation:

weight = mass × gravitational field strength

_____

_____

Weight = _____ N

(2)

(c) The man raises his body a vertical distance of 0.63 m to go from stage 1 to stage 2

Calculate the work done by the man.

Use your answer to part **(b)**

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Use the equation:

work done = force × distance

_____

_____

Work done = _____ J

(2)

(d) The man was **not** moving at stage 2

How much work is done by the man at stage 2?

Work done = _____ J

(1)

(e) A woman uses the bar to do a pull up.

The woman has a mass of 62 kg

She accelerates at 11 m/s^2

Calculate the resultant force on the woman.

Use the equation:

force = mass × acceleration

_____

_____

Force = _____ N

(2)

(Total 8 marks)

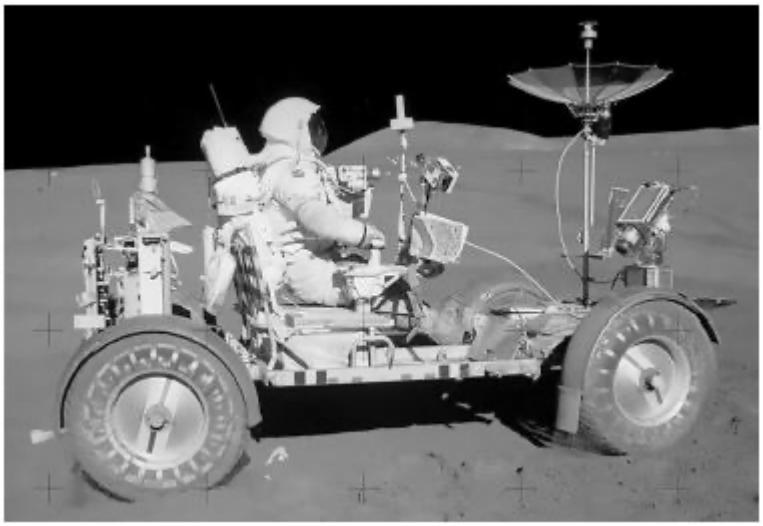
Q2.

Astronauts have been to the Moon.

(a) Astronauts moved around the surface of the Moon in a lunar rover.

The photograph below shows a lunar rover.

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The batteries on the lunar rover provided a potential difference of 36 V

The total charge stored in the batteries was 870 000 C

Calculate the maximum energy that could have been transferred from the batteries.

Use the equation:

energy transferred = charge flow × potential difference

Maximum energy transferred = _____ J

(2)

(b) Not all of the energy from the batteries was usefully transferred to the kinetic energy of the lunar rover.

Explain why.

(2)

The astronauts collected rock samples from the Moon.

Scientists analysed the percentages of elements in Moon rock and Earth rock.

The table below shows the results.

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Element	Percentage in Moon rock	Percentage in Earth rock
Aluminium	8	8
Iron	13	5
Oxygen	42	47
Silicon	**X**	28
Other elements	10	12

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

X = _____ %

(1)

(d) Give **one** similarity and **one** difference between Moon rock and Earth rock.

Use the table above.

Similarity _____

_____

Difference _____

_____

(2)

(e) Scientists used to think the Earth and Moon formed separately.

Scientists now believe that the Moon formed after a collision between the Earth and a small planet.

This new idea came from the study of Moon rocks.

Why do scientific theories sometimes change?

Tick **one** box.

- Scientists agree that the existing theory is old-fashioned ☐
- Scientists change their theories to make the theories more popular ☐
- Scientists decide that the new theory is more exciting ☐
- Scientists discover new evidence which the existing theory cannot explain ☐

(1)

(f) Write down the equation which links gravitational field strength, gravitational

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potential energy, height and mass.

_____

_____

(1)

(g) When the astronauts left the Moon, they used a spacecraft with a mass of 2150 kg

Calculate the height reached by the spacecraft at the point where it had a gravitational potential energy of 86 000 000 J

The gravitational field strength of the Moon is 1.6 N/kg

_____

_____

_____

_____

_____

_____

Height = _____ m

(3)

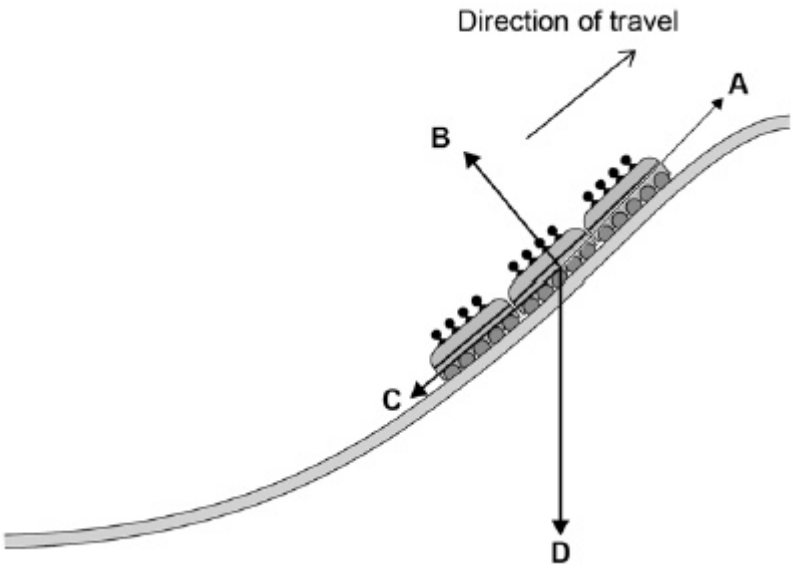
(Total 12 marks)

Q3.

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.

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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?

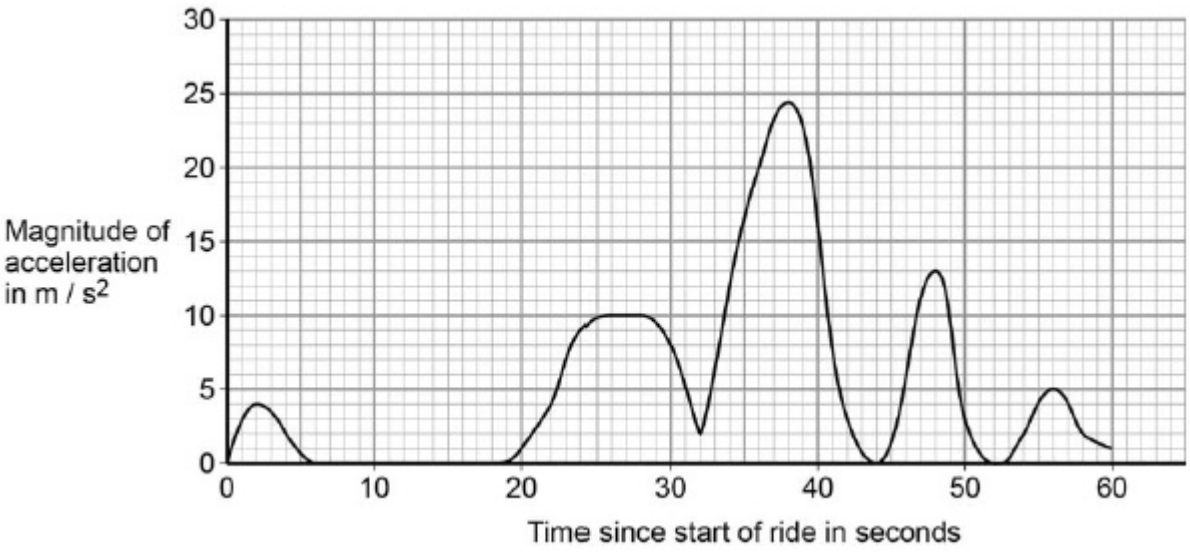
Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

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

Figure 2



(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. ☐

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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.

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.

_____

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Maximum force = _____ Unit _____

(3)

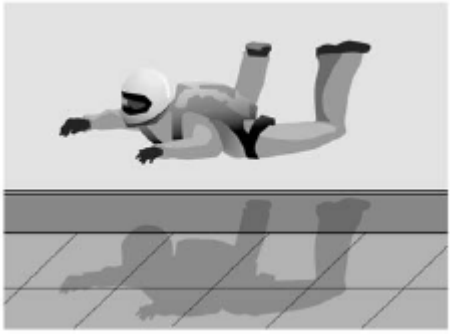
(Total 13 marks)

Q4.

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

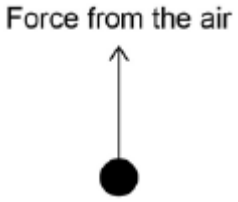
Large fans below the skydiver blow air upwards.

Figure 1



(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.

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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.

_____

_____

_____

Take-off velocity = _____ m / s

(3)

(d) A skydiver jumps from an aeroplane.

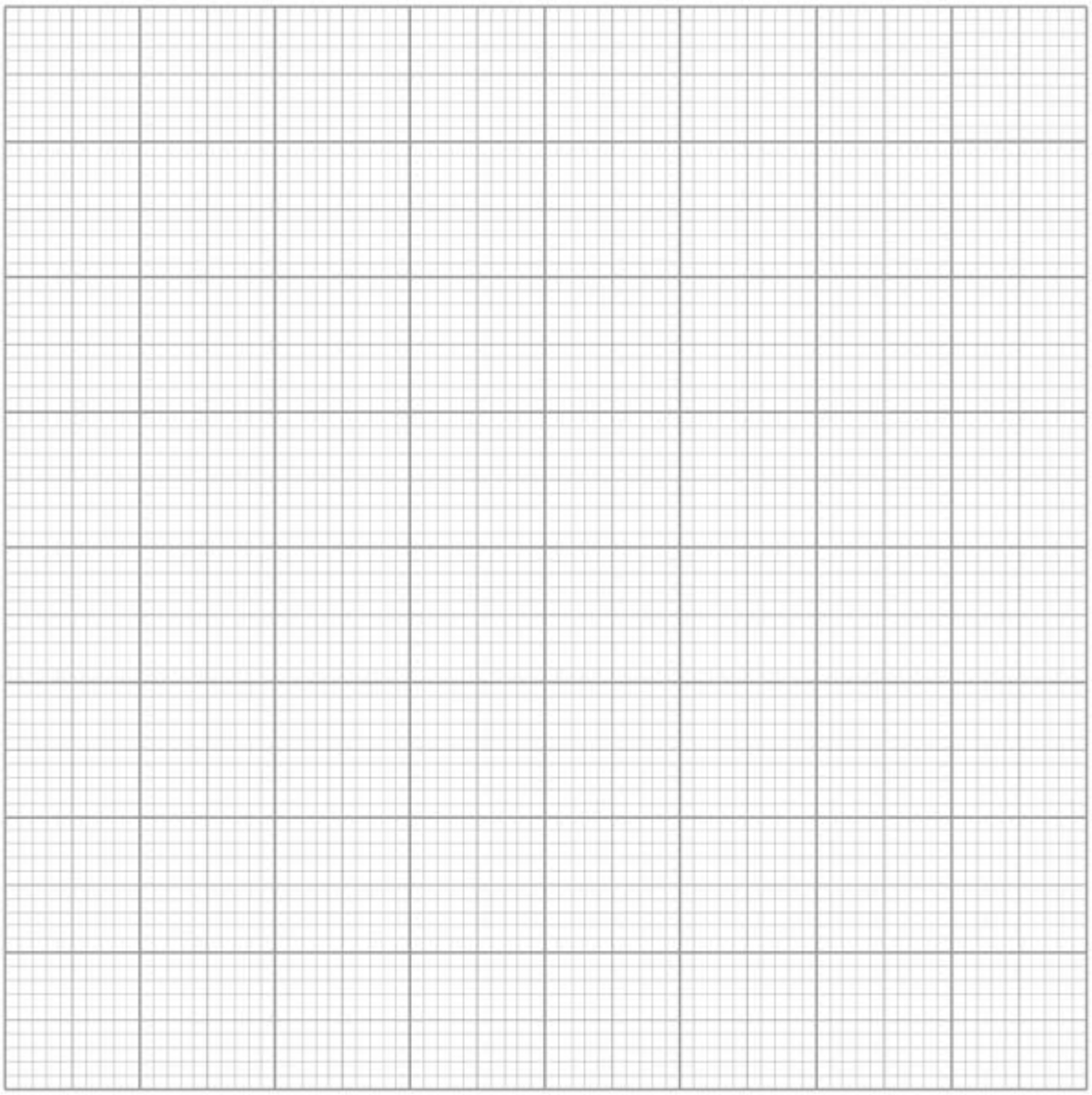
There is a resultant vertical force of 300 N on the skydiver.

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

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Magnitude of resultant force = _____ N

(5)

(Total 12 marks)

Q5.

This question is about forces.

(a) Force is a vector quantity.

Which is a correct statement about a vector quantity?

Tick **one** box.

Has direction only ☐

Has direction and magnitude ☐

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Has magnitude only ☐

Has neither magnitude nor direction ☐

(1)

(b) A newtonmeter measures the weight of an object.

Look at the figure below.



What is the weight of the object in the figure above?

Weight = _____ N

(1)

(c) An object has a weight of 6.4 N.

Calculate the mass of the object.

Use the equation

mass = weight ÷ gravitational field strength (*g*)

gravitational field strength = 9.8 N / kg

_____

_____

Mass = _____ kg

(1)

(d) The mass of a bag of sugar is 1 kg.

- On Earth the weight of this bag of sugar is 10 N.
- On Mars the weight of this bag of sugar is 4 N.

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Suggest why the weight of the bag of sugar is different on Earth and on Mars.

_____

_____

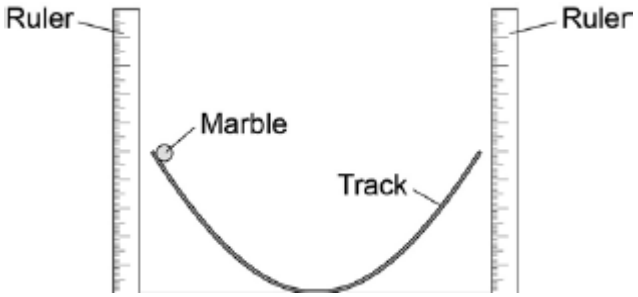
(1)

(Total 4 marks)

Q6.

A student investigates rolling a marble down a track.

The figure below shows how he sets up the investigation.



The student lets go of the marble from different heights.

He records:

- the height from which he drops the marble (the drop height)
- the height the marble rolls up the other side (the roll height).

(a) What force causes the marble to fall down the track?

Tick **one** box.

Air resistance ☐

Friction ☐

Gravity ☐

Magnetism ☐

(1)

(b) What is one variable the student should control in the investigation?

Tick **one** box.

Length of ruler ☐

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Length of track ☐

Mass of marble ☐

Roll height ☐

(1)

(c) The table below shows the student's results.

Drop height in cm	Roll height in cm			
	Test 1	**Test 2**	**Test 3**	**Mean**
20	15	14	14	14
40	29	33	32	
60	47	19	46	46
80	65	61	63	63

What is the **independent** variable in the investigation?

Tick **one** box.

Drop height ☐

Length of track ☐

Mass of marble ☐

Roll height ☐

(1)

(d) Calculate the mean roll height of the marble when it is dropped from 40 cm.

_____

Mean roll height = _____ cm

(1)

(e) The student calculated the mean roll height for a drop height of 60 cm.

He did not include the result for Test 2 in his calculation.

Why did the student leave out the result for Test 2?

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_____

_____

(1)

(f) Describe how the drop height of the marble affects the roll height.

_____

_____

(1)

(g) Why does the marble never roll up to the same height the student drops it from?

_____

_____

(1)

(Total 7 marks)

Q7.

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.

_____

_____

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Velocity of red ball = _____ m / s

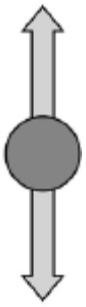
(4)

(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.

The force arrows are drawn to scale.



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

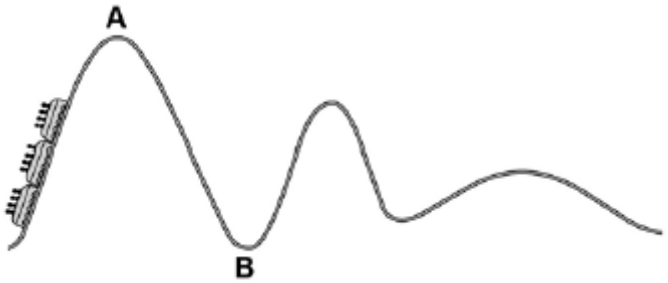
(4)

(Total 12 marks)

Q8.

The figure below shows a rollercoaster.

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The rollercoaster car is raised a vertical distance of 35 m to point **A** by a motor in 45 seconds.

The mass of the rollercoaster is 600 kg.

The motor has a power rating of 8 000 W.

(a) Calculate the percentage efficiency of the motor.

Gravitational field strength = 9.8 N / kg.

Efficiency = _____ %

(5)

(b) The rollercoaster rolls from point **A** to point **B**, a drop of 35 m.

Calculate the speed of the roller coaster at point **B**.

Assume that the decrease in potential energy store is equal to the increase in kinetic energy store.

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Speed at point **B** = _____ m / s

(6)

(Total 11 marks)

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