

Gravity

Question Paper

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.5 Forces
Sub-Topic	Gravity
Difficulty Level	Gold Level
Booklet	Question Paper

Time Allowed: 43 minutes

Score: /40

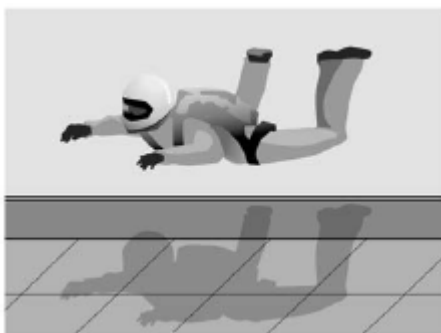
Percentage: /100

Grade Boundaries:

Q1.Figure 1 shows a skydiver training in an indoor wind tunnel.

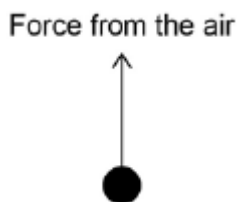
Large fans below the skydiver blow air upwards.

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.

This causes the skydiver to accelerate upwards.

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

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(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)

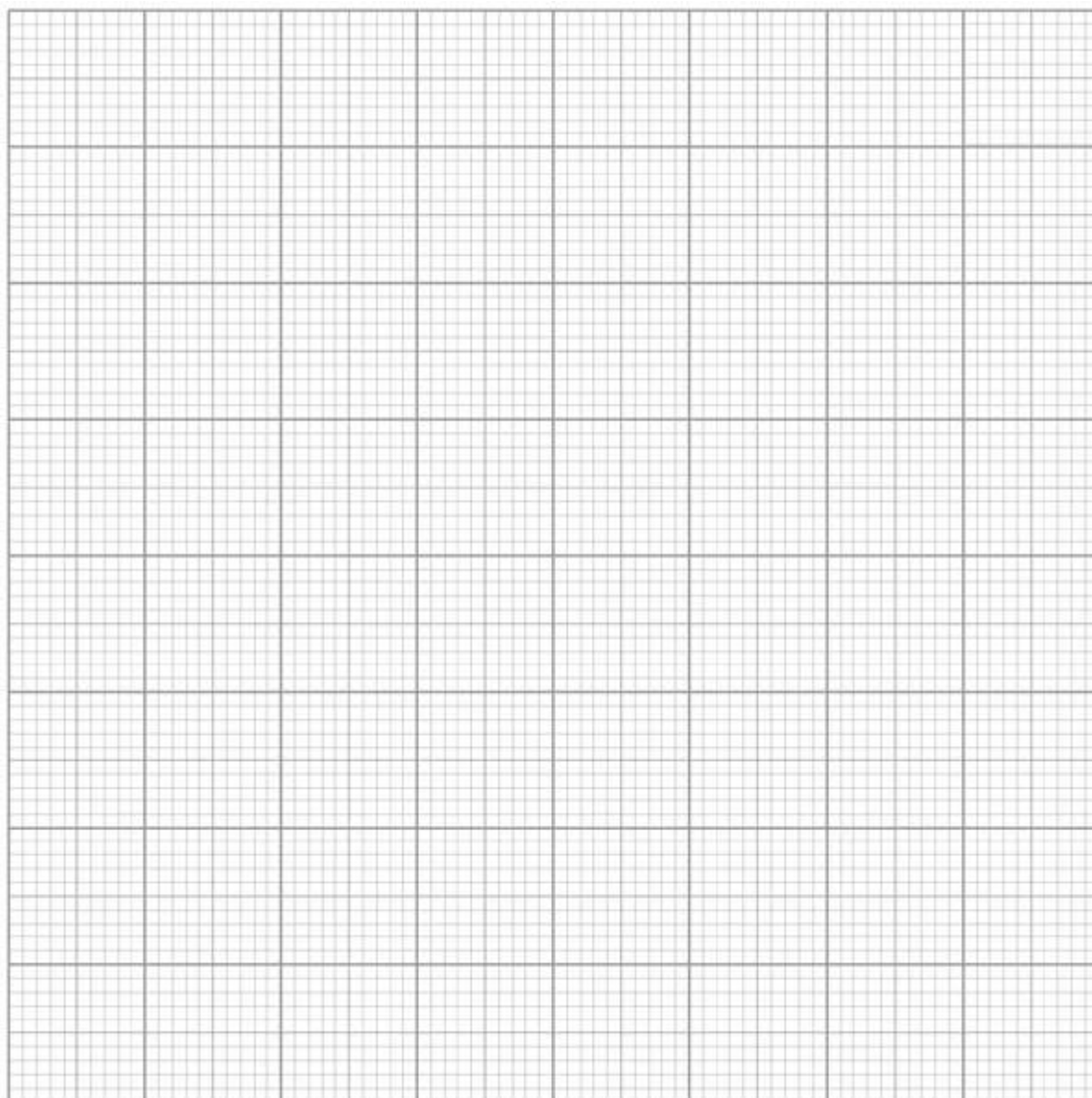
- (d) A skydiver jumps from an aeroplane.

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)
(Total 12 marks)

Q2. This question is about forces, quantities and vectors.

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

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(1)

- (b) A small ball weighs 1.4 N.

gravitational field strength, $g = 9.8 \text{ N / kg}$

Calculate the mass of the ball.

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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.

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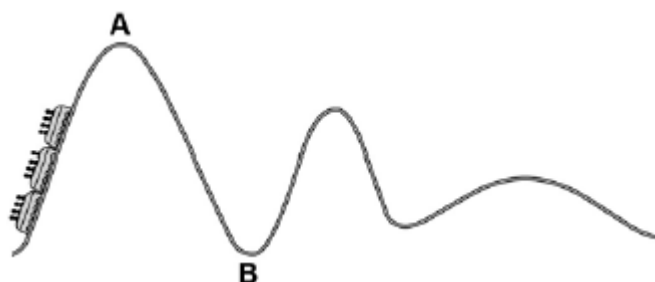
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(4)
(Total 12 marks)

Q3. The figure below shows a rollercoaster.



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 .

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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

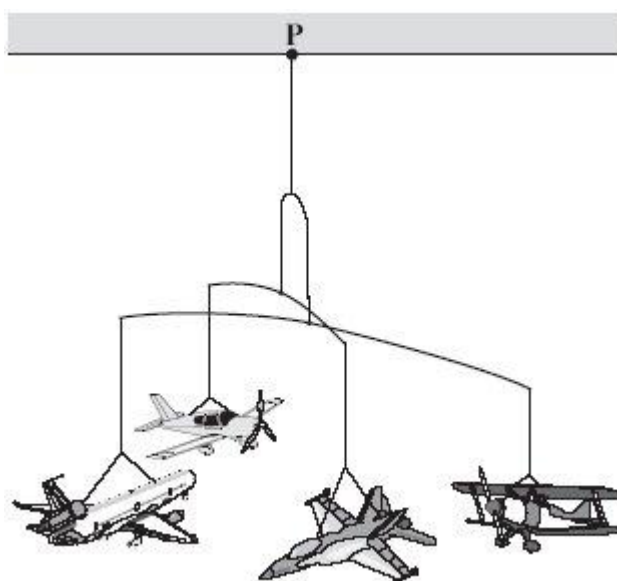
(6)

(Total 11 marks)

- Q4.** (a) The diagram shows a child's mobile. The mobile hangs from point **P** on the ceiling of the child's bedroom.

- (i) Mark the position of the centre of mass of the mobile by drawing a letter **X** on

the diagram. Do this so that the centre of the **X** marks the centre of mass of the mobile.



(1)

(ii) Explain why you have chosen this position for your letter **X**.

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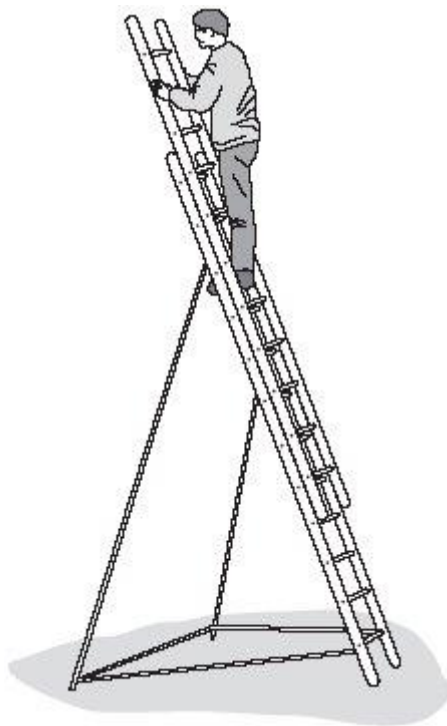
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(2)

(b) The diagram shows a device which helps to prevent a ladder from falling over.



Use the term *centre of mass* to explain why the ladder, in the situation shown, is unlikely to topple over.
You may add to the diagram to illustrate your explanation.

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(3)
(Total 6 marks)