AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.1.3

Gravity

Past-paper questions

Tier	**Higher**
Question groups	**6**
Available paper years	**2019–2024**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

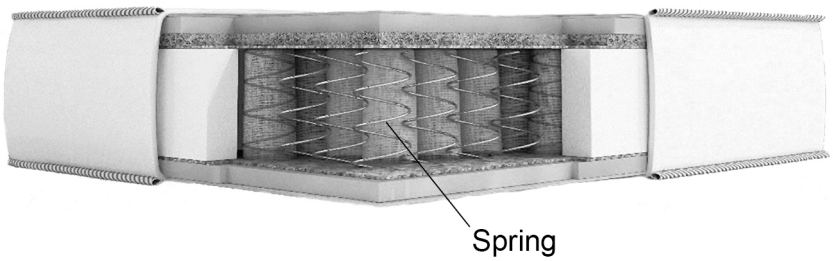
6.5.1.3 Gravity

Question 01

June 2019 | 8464/P/2H | Original Q5

0 5 **Figure 8** shows some springs inside a mattress.

Figure 8



0 5 . 1 Which proportionality is true when a force is applied to a spring?

[1 mark]

Tick (✓) **one** box.

- Force ∝ energy stored ☐
- Force ∝ extension ☐
- Force ∝ length ☐
- Force ∝ spring constant ☐

6.5.1.3 Gravity

Question 01 · continued

A mattress contains 1200 identical springs.

A person lies on the mattress and the springs compress.

The mean force on each spring in the mattress is 0.49 N

0 5 . 2 Calculate the mass of the person.

gravitational field strength = 9.8 N/kg

[4 marks]

Mass = _____ kg

Question 5 continues on the next page

6.5.1.3 Gravity

Question 01 · continued

0 5 . 3 The mean compression of each spring is 3.5×10^{-3} m

Calculate the spring constant of each spring in the mattress.

Give the unit.

[4 marks]

Spring constant = _____

Unit = _____

0 5 . 4 For a given force, different springs compress by different amounts.

Explain what property of the springs would make the mattress soft.

[2 marks]

11

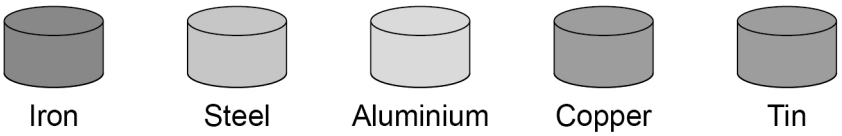
6.5.1.3 Gravity

Question 02

November 2020 | 8464/P/2H | Original Q1

0 1 **Figure 1** shows five different metal samples.

Figure 1



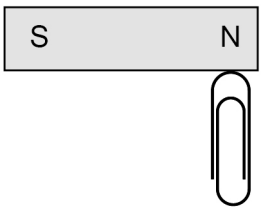
0 1 . 1 A student placed a magnet close to each metal sample.

Describe what happened.

[2 marks]

Figure 2 shows a paper clip being attracted to a permanent magnet.

Figure 2



0 1 . 2 The paper clip in **Figure 2** is not a permanent magnet.

Explain what would happen if the paper clip was removed and brought close to the south pole of the permanent magnet.

[2 marks]

6.5.1.3 Gravity

Question 02 · continued

0 1 . 3 Write down the equation that links gravitational field strength (*g*), mass (*m*) and weight (*W*).

[1 mark]

0 1 . 4 The student added more paperclips to one end of the magnet.

The maximum number of paperclips the magnet could hold was 20

Each paper clip had a mass of 1.0 g

gravitational field strength = 9.8 N/kg

Calculate the maximum force the magnet can exert.

[3 marks]

Force = _____ N

8

6.5.1.3 Gravity

Question 03

November 2021 | 8464/P/1H | Original Q3

0 3 **Figure 4** shows a sailing boat crossing an ocean.

Figure 4



There is a wind turbine on the boat.

0 3 . 1 The wind turbine generates electricity to charge a battery on the boat.

Name one **other** renewable energy resource that could be used on the boat to generate electricity.

[1 mark]

_____

0 3 . 2 The boat also has a generator that burns a fossil fuel.

The battery can be charged by either the wind turbine **or** the generator.

Give **two** reasons why this is useful.

[2 marks]

1 _____

_____

2 _____

_____

6.5.1.3 Gravity

Question 03 · continued

0 3 . 3 Explain **one** environmental impact of using fossil fuels to generate electricity.

[2 marks]

0 3 . 4 The kinetic energy of the boat is 81 kJ.

mass of boat = 8000 kg

Calculate the speed of the boat.

[4 marks]

Speed = _____ m/s

Question 3 continues on the next page

6.5.1.3 Gravity

Question 03 · continued

0 3 . 5 As the boat passes over a wave, the gravitational potential energy of the boat increases by 19 600 J.

mass of boat = 8000 kg

gravitational field strength = 9.8 N/kg

Calculate the change in height of the centre of mass of the boat as it passes over the wave.

[3 marks]

Change in height = _____ m

12

6.5.1.3 Gravity

Question 04

0 2 Professional rugby players wear a tracking device that measures their velocity and acceleration.

Figure 2 shows a player wearing a tracking device.

The player is tackling another player who is running with the ball.

Figure 2



0 2 . 1 Velocity and acceleration are both vector quantities.

What is a vector quantity?

[1 mark]

Tick (✓) **one** box.

- A quantity with both magnitude and direction ☐
- A quantity with direction only ☐
- A quantity with magnitude only ☐

6.5.1.3 Gravity

Question 04 · continued

0 2 . 2 Which of the following is a vector quantity?

[1 mark]

Tick (✓) **one** box.

- Displacement ☐
- Distance ☐
- Time ☐
- Work done ☐

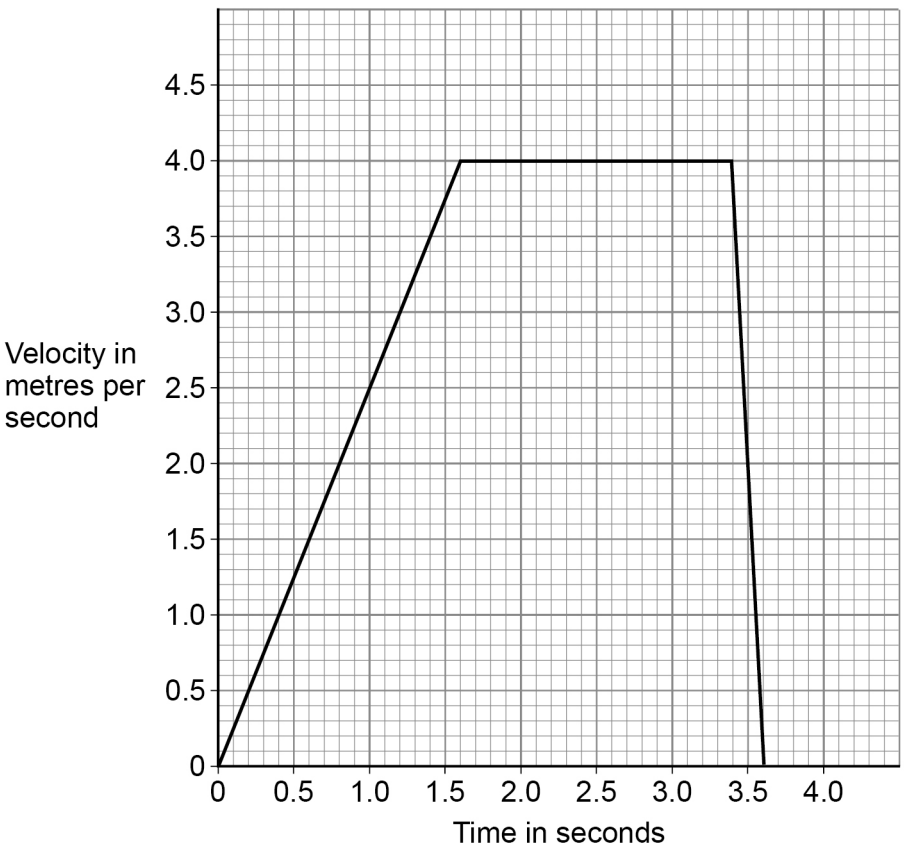
Question 2 continues on the next page

6.5.1.3 Gravity

Question 04 · continued

Figure 3 shows a velocity–time graph for the player running with the ball.

Figure 3



0 2 . 3 Determine the acceleration of the player between 0 and 1.6 s.

[2 marks]

Acceleration = _____ m/s^2

0 2 . 4 Describe the motion of the player between 3.4 s and 3.6 s.

[1 mark]

6.5.1.3 Gravity

Question 04 · continued

The force exerted on the player when she is tackled causes her to accelerate.

0 2 . 5 Write down the equation which links acceleration (*a*), mass (*m*) and resultant force (*F*).

[1 mark]

0 2 . 6 The player accelerates at 25 m/s^2 when a resultant force of 1800 N acts on her.

Calculate the mass of the player.

[3 marks]

Mass = _____ kg

0 2 . 7 The tracking device sends data to a computer during the game.

Suggest **one** advantage of the data being sent during the game.

[1 mark]

10

6.5.1.3 Gravity

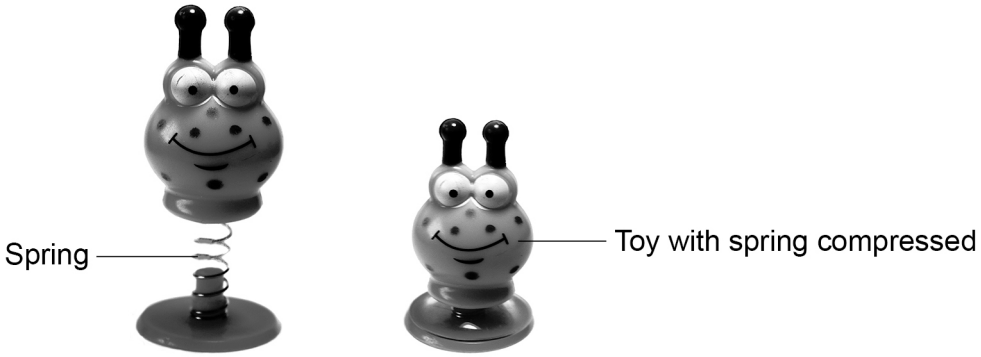
Question 05

June 2023 | 8464/P/1H | Original Q5

0 5 **Figure 10** shows a child's toy.

A child pushes down on the toy to compress the spring. The spring then launches the toy into the air.

Figure 10



Question 05 · continued

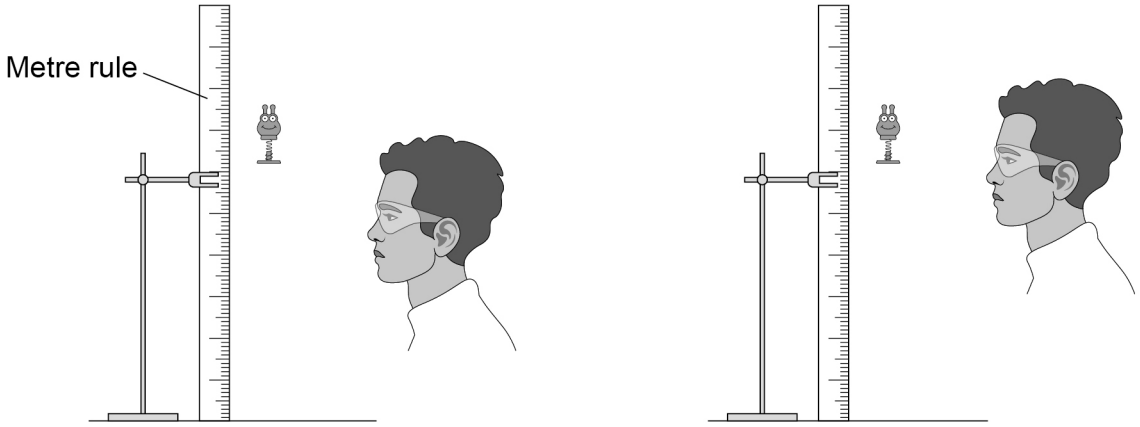
0 5 . 1 A student measured the maximum height reached by the toy.

The student placed a vertical metre rule near the toy, and observed the height reached by the toy.

The student repeated the experiment, observing from a different position.

Figure 11 shows the toy at its maximum height and the two positions of the student.

Figure 11



Observing the toy from **position B** instead of **position A** affected the measurement of the maximum height reached by the toy.

Explain how.

[2 marks]

Question 5 continues on the next page

6.5.1.3 Gravity

Question 05 · continued

0 5 . 2 The greatest height reached by the toy was 64 cm.

The gravitational potential energy of the toy at this height was 0.049 J.

gravitational field strength = 9.8 N/kg

Calculate the mass of the toy.

Use the Physics Equations Sheet.

Give your answer to 2 significant figures.

[5 marks]

Mass of toy (2 significant figures) = _____ kg

0 5 . 3 When the spring launches the toy into the air, the temperature of the air increases.

Explain why the child's toy on its own is **not** a closed system.

[2 marks]

9

6.5.1.3 Gravity

Question 06

June 2024 | 8464/P/1H | Original Q4

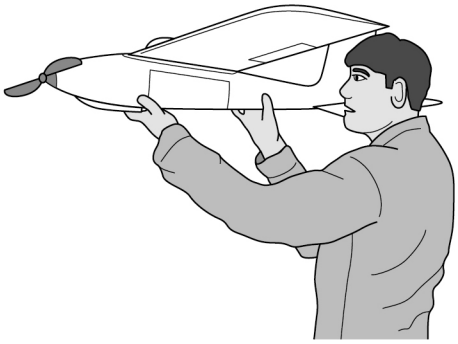
0 4 A drone is a miniature aircraft that has a remote control.

An inventor designed a battery powered drone.

The inventor tested what would happen if the battery runs out of charge during a flight.

Figure 5 shows the inventor about to launch the drone.

Figure 5



0 4 . 1 After the drone was launched, it moved at a constant speed and gained height.

The thermal stores of energy of the drone increased.

Describe **two** other changes to the energy stores of the drone as it moved at a constant speed and gained height.

[2 marks]

1 _____

_____

2 _____

_____

Question 4 continues on the next page

6.5.1.3 Gravity

Question 06 · continued

When the drone reached a height of 840 m the motor was switched off.

The motor was switched back on after a short time, when the drone had fallen to a lower height above the ground.

The change in gravitational potential energy of the drone during the fall to this lower height was 3920 J.

The mass of the drone is 2.5 kg.

gravitational field strength = 9.8 N/kg

0 4 . 2 Calculate the height above the ground of the drone when the motor was switched back on.

Use the Physics Equations Sheet.

[4 marks]

Height above ground = _____ m

6.5.1.3 Gravity

Question 06 · continued

0 4 . 3 When the motor was switched off, the kinetic energy of the drone was 150 J.

Calculate the maximum possible speed of the drone when the motor was switched back on.

Use the Physics Equations Sheet.

Give your answer in km/s.

[5 marks]

Maximum possible speed of drone = _____ km/s

11