AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.1.3

Gravity

Past-paper questions

Tier	**Foundation**
Question groups	**17**
Available paper years	**2018–2025**

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.

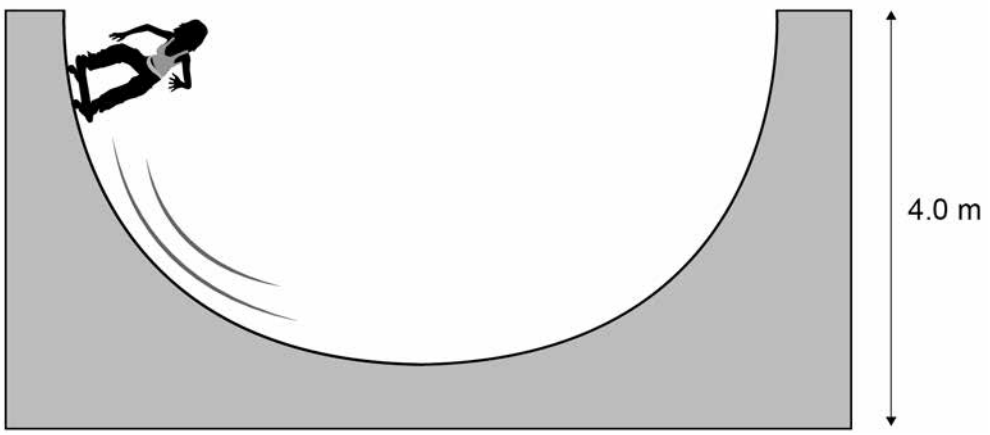
6.5.1.3 Gravity

Question 01

June 2018 | 8464/P/1F | Original Q3

0 3 **Figure 5** shows a girl skateboarding on a semi-circular ramp.

Figure 5



The girl has a mass of 50 kg

0 3 . 1 Calculate the gravitational potential energy (g.p.e.) of the girl at the top of the ramp.

Use the equation:

g.p.e. = mass × gravitational field strength × height

gravitational field strength = 9.8 N/kg

[2 marks]

g.p.e. = _____ J

0 3 . 2 The girl has a speed of 7 m/s at the bottom of the ramp.

Calculate the kinetic energy of the girl at the bottom of the ramp.

Use the equation:

kinetic energy = 0.5 × mass × $(\text{speed})^2$

[2 marks]

Kinetic energy = _____ J

6.5.1.3 Gravity

Question 01 · continued

June 2018 | 8464/P/1F | Original Q3

0 3 . 3 Not all of the g.p.e. has been transferred to kinetic energy.

Which **two** statements explain why?

[2 marks]

Tick **two** boxes.

- Some energy is wasted. ☐
- The mass of the girl is too low. ☐
- The ramp is not high enough. ☐
- The g.p.e. of the girl is not zero. ☐
- The speed of the girl is too great. ☐

0 3 . 4 Explain how lubricating the wheels of the skateboard can increase the speed of the girl.

Use ideas about energy in your explanation.

[3 marks]

9

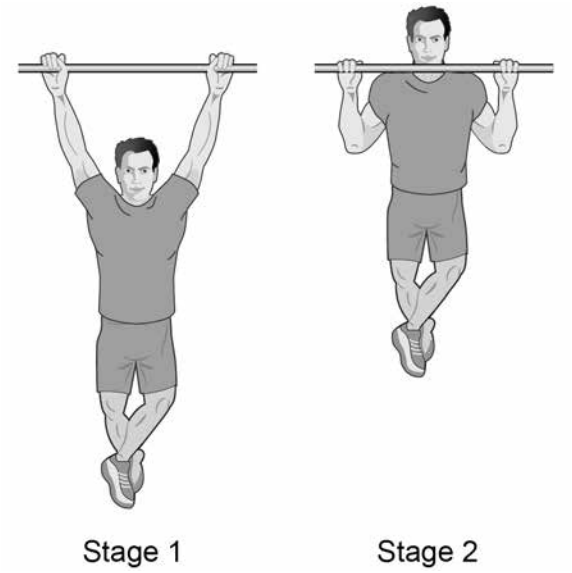
6.5.1.3 Gravity

Question 02

June 2018 | 8464/P/2F | Original Q3

0 3 **Figure 4** shows a man doing two stages of a pull up. In both diagrams the man is stationary.

Figure 4



0 3 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

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.

0 3 . 2 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

[2 marks]

_____

_____

Weight = _____ N

6.5.1.3 Gravity

Question 02 · continued

0 3 . 3 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 question **03.2**

Use the equation:

work done = force × distance

[2 marks]

Work done = _____ J

0 3 . 4 The man was **not** moving at stage 2

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

[1 mark]

Work done = _____ J

0 3 . 5 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

[2 marks]

Force = _____ N

8

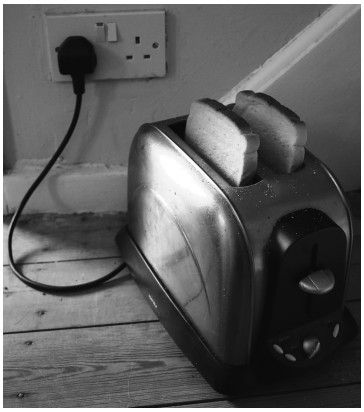
6.5.1.3 Gravity

Question 03

June 2019 | 8464/P/1F | Original Q5

0 5 **Figure 7** shows a toaster.

Figure 7



The toaster is connected to the mains supply using a three-core cable.

0 5 . 1 What is the function of the earth wire inside the cable?

[1 mark]

Tick (✓) **one** box.

To carry the current from the supply to the toaster ☐

To complete the circuit in the toaster ☐

To melt if a fault occurs inside the toaster ☐

To stop the metal case of the toaster becoming live if a fault occurs ☐

0 5 . 2 Complete the sentences.

Choose answers from the box.

[3 marks]

blue	**brown**	**orange**	**white**	**yellow**

The insulation around the earth wire is green and _____ .

The insulation around the live wire is _____ .

The insulation around the neutral wire is _____ .

6.5.1.3 Gravity

Question 03 · continued

0 5 . 3 The toaster is switched on for 120 seconds.

The power of the toaster is 850 watts.

Calculate the energy transferred by the toaster.

Use the equation:

energy transferred = power × time

[2 marks]

Energy transferred = _____ J

0 5 . 4 Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	**elastic potential**	**kinetic**	**thermal**

When bread is lowered into the toaster, a spring is stretched. The stretched spring stores _____ energy.

After the bread is toasted, the spring makes the toast move upwards. As the speed of the toast increases, the _____ energy of the toast increases.

6.5.1.3 Gravity

Question 03 · continued

0 5 . 5 Write the equation which links gravitational field strength, gravitational potential energy, height and mass.

[1 mark]

0 5 . 6 The toast was moved upwards by the spring.

The change in gravitational potential energy of the toast was 0.049 J

The mass of the toast was 0.050 kg

gravitational field strength = 9.8 N/kg

Calculate the change in height of the toast.

[3 marks]

Change in height = _____ m

12

6.5.1.3 Gravity

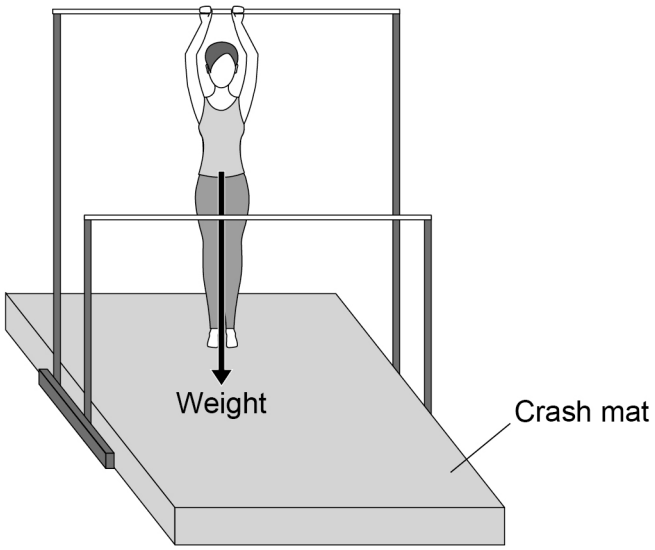
Question 04

June 2019 | 8464/P/2F | Original Q2

0 2 **Figure 3** shows a gymnast on a piece of gymnastic equipment.

The equipment consists of two bars at different heights.

Figure 3



0 2 . 1 The gymnast exerts a downward force on the bar.

What is the size of the upward force acting on the gymnast from the bar?

[1 mark]

Tick (✓) **one** box.

It is greater than the downward force. ☐

It is less than the downward force. ☐

It is the same size as the downward force. ☐

Question 04 · continued

0 2 . 2 Why is the weight of the gymnast represented by an arrow?

[1 mark]

Tick (✓) **one** box.

Weight is a constant. ☐

Weight is a scalar. ☐

Weight is a unit. ☐

Weight is a vector. ☐

0 2 . 3 **Figure 3** shows the weight of the gymnast acting from a point.

What name is given to this point?

[1 mark]

Tick (✓) **one** box.

Centre of force ☐

Centre of mass ☐

Centre of tension ☐

Centre of weight ☐

Question 2 continues on the next page

6.5.1.3 Gravity

Question 04 · continued

0 2 . 4 The gymnast has a mass of 45 kg

gravitational field strength = 9.8 N/kg

Calculate the weight of the gymnast.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

Weight = _____ N

0 2 . 5 The gymnast swings from one bar to the other bar several times.

Describe how the gravitational potential energy store and the kinetic energy store of the gymnast change as she moves between the bars.

[4 marks]

6.5.1.3 Gravity

Question 04 · continued

0 2 . 6 Falling on the crash mat reduces the average deceleration of the gymnast compared with falling on a hard surface.

Explain why reducing the deceleration is important to the gymnast.

[2 marks]

11

Turn over for the next question

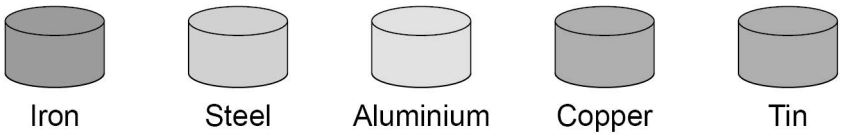
6.5.1.3 Gravity

Question 05

November 2020 | 8464/P/2F | Original Q6

0 6 **Figure 9** shows five different metal samples.

Figure 9



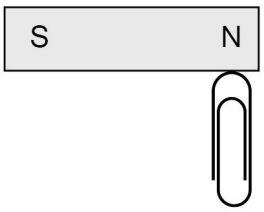
0 6 . 1 A student placed a magnet close to each metal sample.

Describe what happened.

[2 marks]

Figure 10 shows a paper clip being attracted to a permanent magnet.

Figure 10



0 6 . 2 The paper clip in **Figure 10** 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 05 · continued

0 6 . 3 Write down the equation that links gravitational field strength (*g*), mass (*m*) and weight (*W*).

[1 mark]

0 6 . 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 06

0 2 In a sport called far-leaping, an athlete uses a long pole to cross a river.

Figure 4 shows an athlete far-leaping.

Figure 4

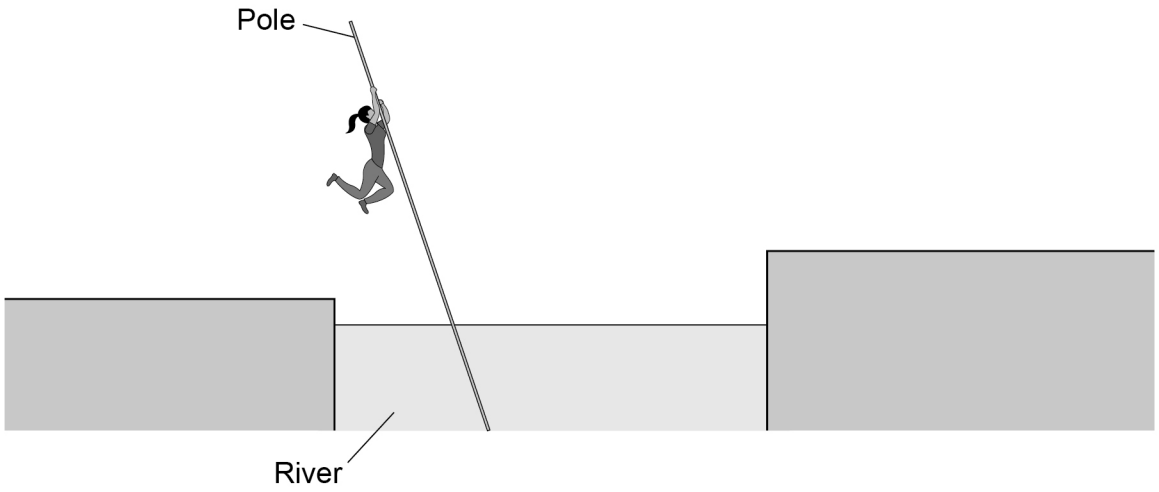
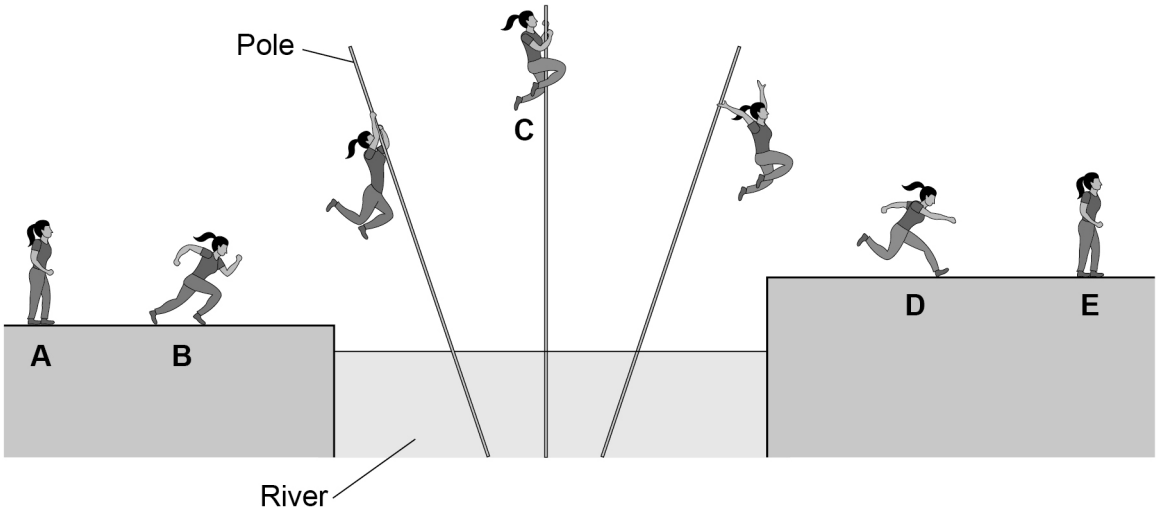


Figure 5 shows the athlete in different stages of far-leaping.

Figure 5



Question 06 · continued

0 2 . 1 Complete the sentence.

Choose answers from the box.

[2 marks]

chemical	**nuclear**	**kinetic**
elastic potential		**gravitational potential**

Between positions **A** and **B** the athlete speeds up. There is

an increase in the athlete's _____ energy and

a decrease in the athlete's _____ store of energy.

0 2 . 2 Between positions **B** and **C** the athlete jumps to the pole and climbs up it.

Which statement describes a change in the athlete's energy between positions **B** and **C**?

[1 mark]

Tick (✓) **one** box.

- Elastic potential energy decreases. ☐
- Elastic potential energy increases. ☐
- Gravitational potential energy decreases. ☐
- Gravitational potential energy increases. ☐

Question 2 continues on the next page

6.5.1.3 Gravity

Question 06 · continued

0 2 . 3 The pole falls over from position **C**. The athlete lets go of the pole and lands at position **D**.

The change in height of the athlete between positions **C** and **D** is 3.0 m.

mass of athlete = 50 kg

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the athlete between positions **C** and **D**.

Use the equation:

change in gravitational potential energy = mass × gravitational field strength × change in height

[2 marks]

Change in gravitational potential energy = _____ J

Question 06 · continued

0 2 . 4 The kinetic energy of the athlete at position **D** is 1600 J.

mass of athlete = 50 kg

Calculate the speed of the athlete at position **D**.

Use the equation:

$$\text{speed} = \sqrt{\frac{2 \times \text{kinetic energy}}{\text{mass}}}$$

Choose the unit from the box.

[3 marks]

m/s	J/kg	J/s

Speed = _____ Unit _____

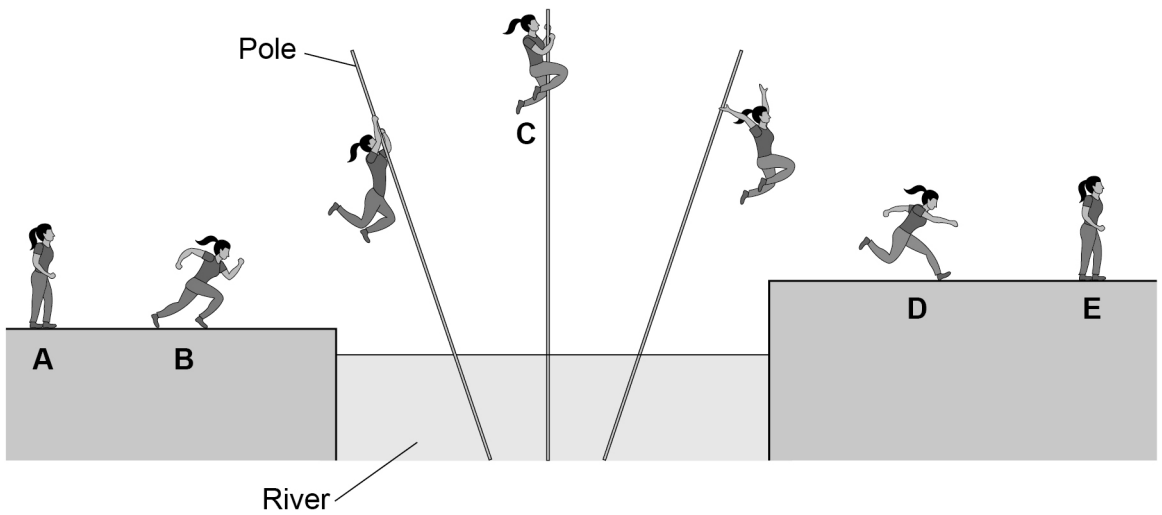
Question 2 continues on the next page

6.5.1.3 Gravity

Question 06 · continued

Figure 5 is repeated below.

Figure 5



0 2 . 5 At positions **A** and **E**, the athlete is standing still.

Why does the athlete have less energy in position **E** than in position **A**?

[1 mark]

Tick (✓) **one** box.

Energy has been transferred from the athlete to the air. ☐

The air temperature has decreased. ☐

The height of the athlete above the water has increased. ☐

Question 06 · continued

0 2 . 6 Athletes have a large power output when they are far-leaping.

What is meant by the power of an athlete?

[1 mark]

Tick (✓) **one** box.

The rate at which the athlete transfers energy. ☐

The size of the maximum force exerted by the athlete. ☐

The total energy transferred by the athlete. ☐

0 2 . 7 A second athlete crossed the same river by far-leaping.

The second athlete had less power than the first athlete when running between position **A** and position **B**.

Complete the sentences.

Choose answers from the box.

Each answer may be used once, more than once or not at all.

[2 marks]

less than	**the same as**	**more than**

Two factors that could explain why the second athlete had less power than the first athlete are:

1. The time taken by the second athlete to run between position **A** and position **B** was _____ the first athlete.

2. The work done by the second athlete was _____ the first athlete.

12

6.5.1.3 Gravity

Question 07

November 2021 | 8464/P/2F | Original Q1

0 1 Forces are either contact forces or non-contact forces.

0 1 . 1 Which of the following is a non-contact force?

[1 mark]

Tick (✓) **one** box.

Electrostatic force ☐

Friction force ☐

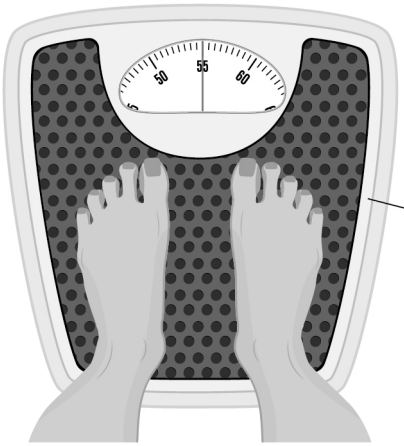
Tension force ☐

6.5.1.3 Gravity

Question 07 · continued

Figure 1 shows a person standing on some bathroom scales.

Figure 1



The person exerts a downward force on the scales and the scales exert an upward force on the person.

0 1 . 2 Which sentence about the forces is true?

[1 mark]

Tick (✓) **one** box.

The downward force is less than the upward force. ☐

The downward force is the same size as the upward force. ☐

The downward force is greater than the upward force. ☐

0 1 . 3 What is the name of the upward force on the person?

[1 mark]

Tick (✓) **one** box.

Air resistance ☐

Normal contact force ☐

Weight ☐

6.5.1.3 Gravity

Question 07 · continued

0 1 . 4 The person on the scales has a mass of 55 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the person.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

Weight = _____ N

0 1 . 5 The gravitational field strength is **not** the same at all points on the surface of the Earth.

The gravitational field strength is weakest at the equator.

A person travelled from the UK to the equator.

What happened to the weight of the person?

[1 mark]

Tick (✓) **one** box.

- The weight decreased. ☐
- The weight remained the same. ☐
- The weight increased. ☐

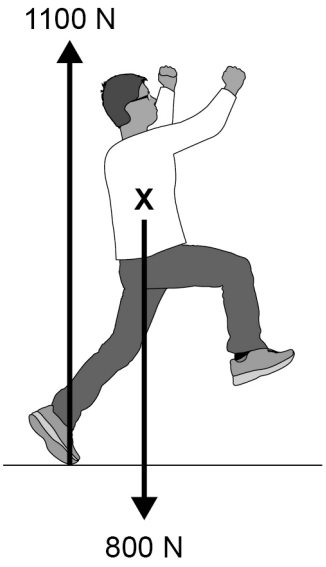
6.5.1.3 Gravity

Question 07 · continued

Figure 2 shows the forces acting on a person.

The person is about to jump.

Figure 2



0 1 . 6 The arrow representing the weight of the person is drawn from point **X**.

What is the name given to point **X**?

[1 mark]

Tick (✓) **one** box.

Centre of force ☐

Centre of mass ☐

Centre of weight ☐

0 1 . 7 Determine the size of the resultant force on the person in **Figure 2**.

[1 mark]

Resultant force = _____ N

8

6.5.1.3 Gravity

Question 08

November 2021 | 8464/P/2F | Original Q7

0 7 Professional rugby players wear a tracking device that measures their velocity and acceleration.

Figure 9 shows a player wearing a tracking device.

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

Figure 9



0 7 . 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 08 · continued

0 7 . 2 Which of the following is a vector quantity?

[1 mark]

Tick (✓) **one** box.

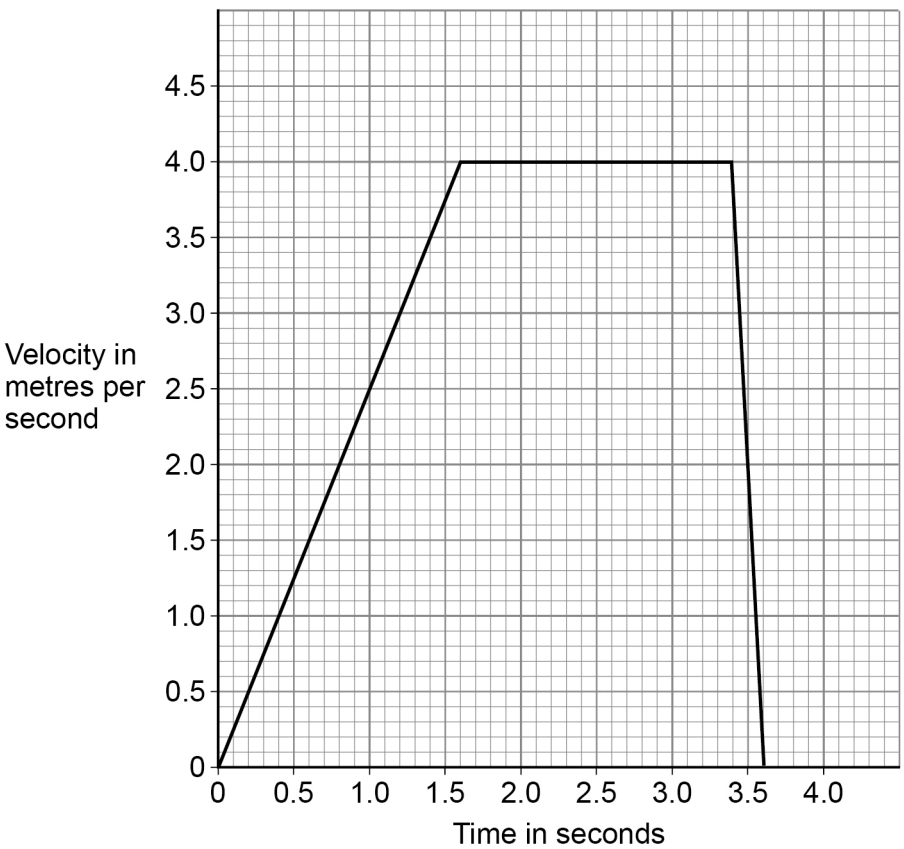
- Displacement ☐
- Distance ☐
- Time ☐
- Work done ☐

Question 7 continues on the next page

Question 08 · continued

Figure 10 shows a velocity–time graph for the player running with the ball.

Figure 10



0 7 . 3 Determine the acceleration of the player between 0 and 1.6 s.

[2 marks]

Acceleration = _____ m/s^2

0 7 . 4 Describe the motion of the player between 3.4 s and 3.6 s.

[1 mark]

6.5.1.3 Gravity

Question 08 · continued

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

0 7 . 5 Write down the equation which links acceleration (*a*), mass (*m*) and resultant force (*F*).

[1 mark]

0 7 . 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 7 . 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 09

June 2022 | 8464/P/1F | Original Q2

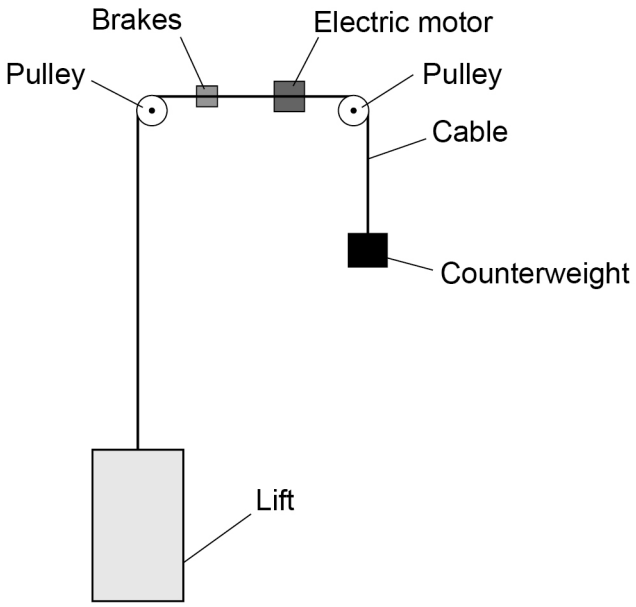
0 2 **Figure 3** shows a lift near the bottom of a building.

The lift is attached by a cable to a counterweight.

An electric motor moves the lift.

The lift is moving up.

Figure 3



0 2 . 1 As the lift moves up, how far does the counterweight move down?

[1 mark]

Tick (✓) **one** box.

A shorter distance than the lift. ☐

The same distance as the lift. ☐

A longer distance than the lift. ☐

6.5.1.3 Gravity

Question 09 · continued

0 2 . 2 What happens to the gravitational potential energy of the counterweight as it moves down?

[1 mark]

Tick (✓) **one** box.

It decreases ☐

It stays the same ☐

It increases ☐

0 2 . 3 Calculate the change in gravitational potential energy of the lift when it moves up 4.0 m

The mass of the lift is 1300 kg

gravitational field strength = 9.8 N/kg

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Change in gravitational potential energy = _____ J

Question 2 continues on the next page

Question 09 · continued

0 2 . 4 Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	**elastic potential**	**gravitational potential**
internal		**kinetic**

Friction between the brakes and the cable causes the speed of the lift to decrease.

As the speed decreases, there is a decrease in the _____ energy of the lift.

As the speed decreases, there is an increase in the _____ energy of the brakes.

0 2 . 5 The motor transfers different amounts of energy each time people use the lift.

Which factors affect the amount of energy transferred by the motor as the lift moves?

[2 marks]

Tick (✓) **two** boxes.

- The distance moved by the lift ☐
- The height of the building ☐
- The length of the steel cable ☐
- The maximum power of the motor ☐
- The weight of the people in the lift ☐

6.5.1.3 Gravity

Question 09 · continued

0 2 . 6 The weight of the lift and the counterweight stretch the cable by 0.015 m

The cable acts like a spring with a spring constant of 880 000 N/m

Calculate the elastic potential energy of the stretched cable.

Use the equation:

$$\text{elastic potential energy} = 0.5 \times \text{spring constant} \times (\text{extension})^2$$

[2 marks]

Elastic potential energy = _____ J

0 2 . 7 A lift system using a counterweight is more efficient than a lift system that does not use a counterweight.

How does having a more efficient system affect the energy transferred by the motor?

[1 mark]

Tick (✓) **one** box.

- Less energy is transferred. ☐
- The same amount of energy is transferred. ☐
- More energy is transferred. ☐

11

6.5.1.3 Gravity

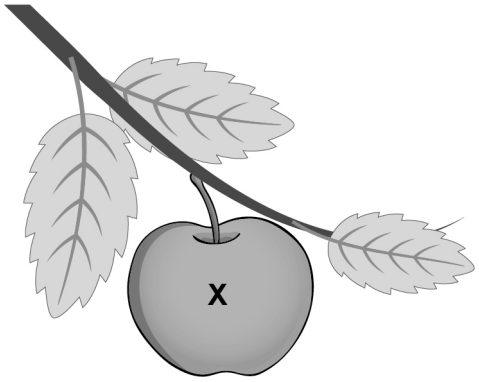
Question 10

June 2022 | 8464/P/2F | Original Q3

0 3 **Figure 4** shows an apple hanging from a tree.

The **X** marks the centre of mass of the apple.

Figure 4



0 3 . 1 Draw an arrow on **Figure 4** to represent the weight of the apple.

[1 mark]

0 3 . 2 The apple has a mass of 0.150 kg

gravitational field strength = 9.8 N/kg

Calculate the weight of the apple.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

Weight = _____ N

6.5.1.3 Gravity

Question 10 · continued

0 3 . 3 The apple in **Figure 4** is stationary.

Why is the apple stationary?

[1 mark]

Tick (✓) **one** box.

The resultant force on the apple is downwards. ☐

The resultant force on the apple is upwards. ☐

The resultant force on the apple is zero. ☐

Question 3 continues on the next page

6.5.1.3 Gravity

Question 10 · continued

When the apple is ripe it falls from the tree and accelerates towards the ground.

0 3 . 4 Why does the apple accelerate?

[1 mark]

Tick (✓) **one** box.

The resultant force on the apple is downwards. ☐

The resultant force on the apple is upwards. ☐

The resultant force on the apple is zero. ☐

0 3 . 5 The acceleration of the apple is 9.8 m/s^2

The velocity of the apple changes from 0 to 4.9 m/s

Calculate the time taken for the apple to fall to the ground.

Use the equation:

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

[2 marks]

Time taken = _____ s

7

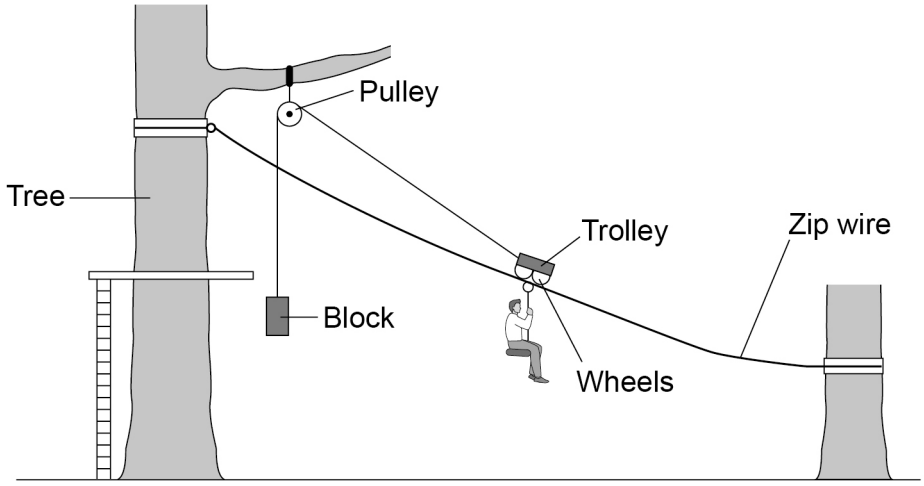
6.5.1.3 Gravity

Question 11

June 2023 | 8464/P/1F | Original Q2

0 2 **Figure 3** shows a person using a zip wire to move from a tree to the ground.

Figure 3



As the person moves down the zip wire, the block moves upwards.

0 2 . 1 What happens to the gravitational potential energy of the person as the person accelerates down the zip wire?

[1 mark]

Tick (✓) **one** box.

Decreases ☐

Stays the same ☐

Increases ☐

6.5.1.3 Gravity

Question 11 · continued

0 2 . 2 What happens to the kinetic energy of the person as the person accelerates down the zip wire?

[1 mark]

Tick (✓) **one** box.

Decreases ☐

Stays the same ☐

Increases ☐

0 2 . 3 The block is 3.4 m above the ground when the person is at the bottom of the zip wire.

mass of block = 2.5 kg

gravitational field strength = 9.8 N/kg

Calculate the gravitational potential energy of the block.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Gravitational potential energy = _____ J

Question 2 continues on the next page

Question 11 · continued

The trolley is a seat suspended from wheels which can roll along the zip wire.

0 2 . 4 When the person reaches the end of the zip wire, the person gets off the trolley.

The block falls downwards pulling the trolley back to the top of the zip wire.

maximum speed of block = 4.8 m/s

mass of block = 2.5 kg

Calculate the maximum kinetic energy of the block.

Use the equation:

$$\text{kinetic energy} = 0.5 \times \text{mass} \times (\text{speed})^2$$

[2 marks]

Maximum kinetic energy = _____ J

0 2 . 5 As the trolley moves, work is done against friction.

What is the effect of this?

[1 mark]

Tick (✓) **one** box.

- Some energy is destroyed. ☐
- Some energy is transferred to the surroundings. ☐
- The total energy of the block and trolley increases. ☐

6.5.1.3 Gravity

Question 11 · continued

0 2 . 6 The person oils the wheels on the trolley.

Explain how this will affect the speed of the person down the zip wire.

[2 marks]

9

Turn over for the next question

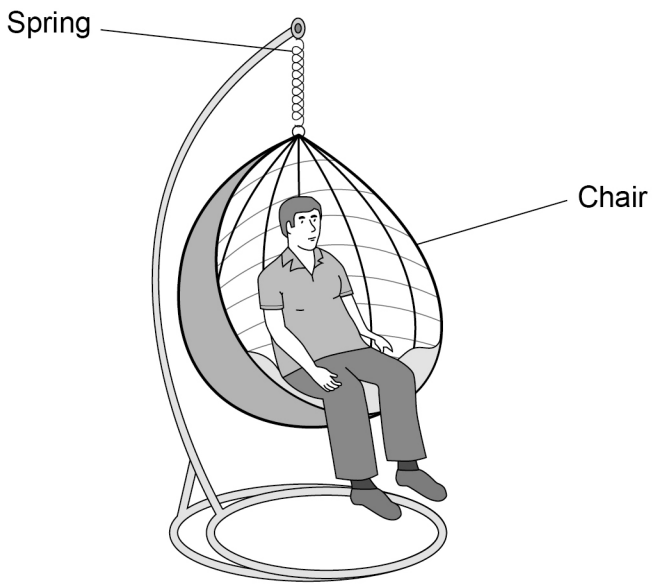
6.5.1.3 Gravity

Question 12

June 2023 | 8464/P/2F | Original Q1

0 1 **Figure 1** shows a garden chair hanging from a spring.

Figure 1



The weight of the person causes the spring to extend.

0 1 . 1 Why does the weight of the person cause the spring to extend?

[1 mark]

Tick (✓) **one** box.

- Weight acts downwards ☐
- Weight acts in all directions ☐
- Weight acts upwards ☐

6.5.1.3 Gravity

Question 12 · continued

0 1 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

a gravitational	**a frictional**	**an electrostatic**

The weight of the person in **Figure 1** is _____ force.

Question 1 continues on the next page

Question 12 · continued

The weight of the person causes an extension in the spring of 0.070 m.

The spring constant of the spring is 12 000 N/m.

0 1 . 3 Calculate the weight of the person.

Use the equation:

weight = spring constant × extension

[2 marks]

Weight = _____ N

0 1 . 4 Calculate the elastic potential energy stored in the extended spring.

Use the equation:

elastic potential energy = 0.5 × spring constant × (extension)^2

[2 marks]

Elastic potential energy = _____ J

6.5.1.3 Gravity

Question 12 · continued

0 1 . 5 If there is more than one person on the chair, the spring could become inelastically deformed.

What is meant by 'inelastically deformed'?

[1 mark]

Tick (✓) **one** box.

- The spring extends more when two or more forces act on it. ☐
- The spring will not go back to its original length when the force is removed. ☐
- The spring extends so that it is twice as long as its original length. ☐

Question 1 continues on the next page

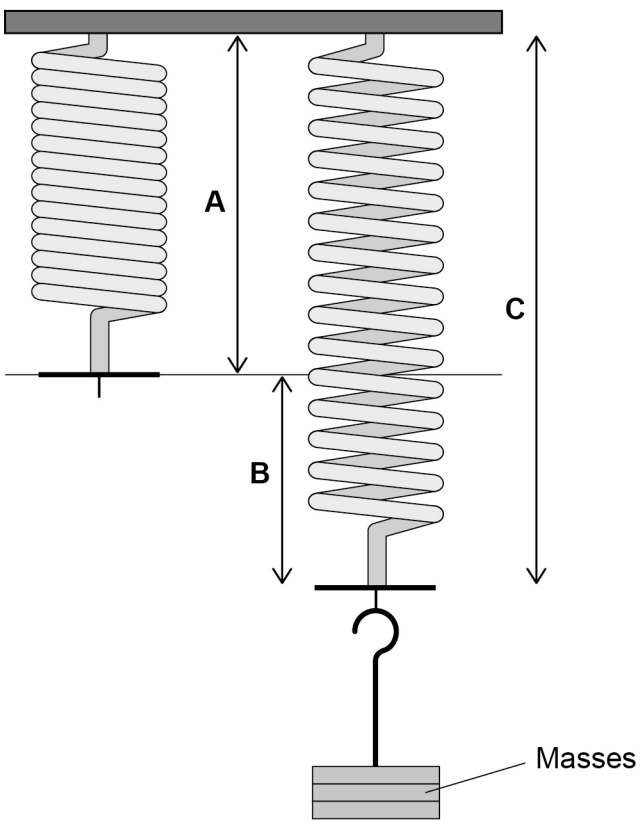
Question 12 · continued

The manufacturer of the chair investigated the extension of a new spring.

0 1 . 6 **Figure 2** shows slotted masses hanging from the spring.

The weight of the masses extends the spring.

Figure 2



Which length in **Figure 2** represents the extension of the spring?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐

6.5.1.3 Gravity

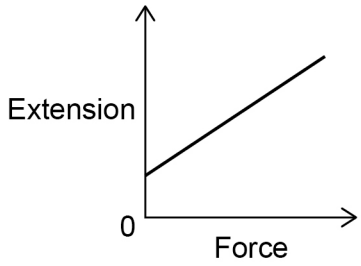
Question 12 · continued

0 1 . 7 Which graph shows that the extension of the spring is directly proportional to the force applied to the spring?

[1 mark]

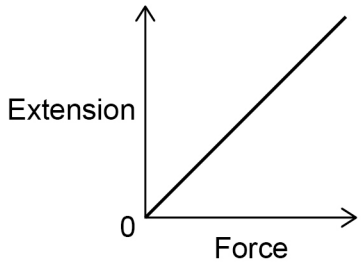
Tick (✓) **one** box.

A



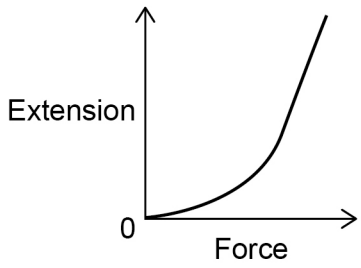
☐

B



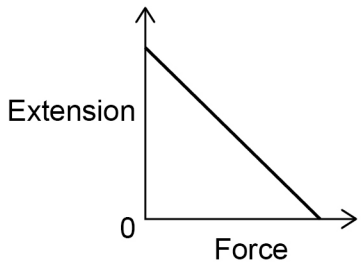
☐

C



☐

D



☐

Question 1 continues on the next page

6.5.1.3 Gravity

Question 12 · continued

0 1 . 8 **Table 1** shows the results of the manufacturer's investigation.

Table 1

Force in newtons	Extension in metres
100	0.008
200	0.016

Suggest **two** improvements to the investigation.

[2 marks]

1 _____

_____

2 _____

_____

11

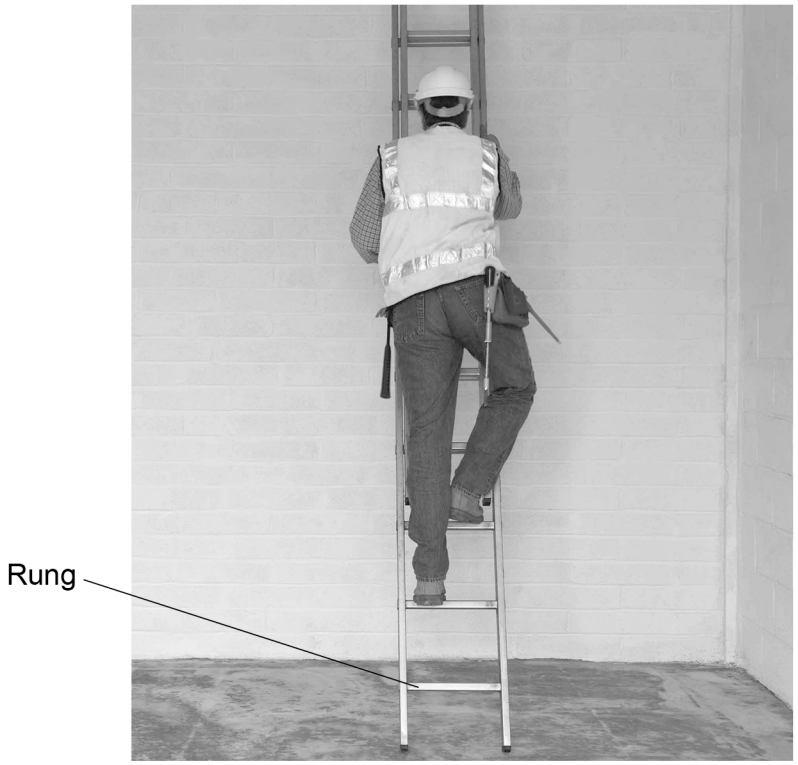
6.5.1.3 Gravity

Question 13

June 2023 | 8464/P/2F | Original Q5

0 5 **Figure 13** shows an engineer climbing up a ladder.

Figure 13



The distance between each rung on the ladder is 30 cm.

0 5 . 1 What is 30 cm in metres?

[1 mark]

Tick (✓) **one** box.

0.030 m ☐ 0.30 m ☐ 3.0 m ☐ 30 m ☐

6.5.1.3 Gravity

Question 13 · continued

0 5 . 2 The engineer has a weight of 710 N.

Calculate the work done when climbing up one rung of the ladder.

Use your answer to Question **05.1** and the equation:

work done = force × distance

[2 marks]

Work done = _____ Nm

0 5 . 3 The engineer climbs the ladder carrying some equipment.

Give the reason why carrying equipment increases the work done by the engineer when climbing the ladder.

[1 mark]

Question 5 continues on the next page

6.5.1.3 Gravity

Question 13 · continued

0 5 . 4 The engineer is stationary at the top of the ladder.

Which energy stores of the engineer increase due to the engineer climbing the ladder?

[2 marks]

Tick (✓) **two** boxes.

- Chemical ☐
- Elastic potential ☐
- Gravitational potential ☐
- Kinetic ☐
- Thermal ☐

6.5.1.3 Gravity

Question 13 · continued

Use the Physics Equations Sheet to answer questions **05.5** and **05.6**.

0 5 . 5 Write down the equation that links gravitational field strength (*g*), mass (*m*) and weight (*W*).

[1 mark]

0 5 . 6 The engineer has a weight of 710 N.

gravitational field strength = 9.8 N/kg

Calculate the mass of the engineer.

Give your answer to 2 significant figures.

[4 marks]

Mass (2 significant figures) = _____ kg

11

6.5.1.3 Gravity

Question 14

June 2024 | 8464/P/1F | Original Q2

0 2 **Figure 2** shows an outdoor swimming pool.

The water in the swimming pool comes from the sea.

Figure 2



The water in the pool is heated using a geothermal energy resource.

0 2 . 1 Which of the following describes a geothermal energy resource?

[1 mark]

Tick (✓) **one** box.

A non-renewable energy resource with high carbon emissions. ☐

A non-renewable energy resource with low running costs. ☐

A renewable energy resource that uses hot rocks underground. ☐

A renewable energy resource that uses the tides. ☐

Question 14 · continued

0 2 . 2 15 kg of seawater is heated before it is added to the pool.

specific heat capacity of seawater = 3800 J/kg °C

Calculate the change in thermal energy of 15 kg of seawater when its temperature is increased by 9.0 °C.

Use the equation:

change in thermal energy = mass × specific heat capacity × temperature change

[2 marks]

Change in thermal energy = _____ J

0 2 . 3 The energy transferred from 1.0 m^2 of the surface of the pool to the air is 80 J each second.

The surface area of the pool is 120 m^2.

Calculate the energy transferred from the whole surface of the pool to the air each second.

[1 mark]

Energy transferred each second = _____ J

Question 2 continues on the next page

Question 14 · continued

0 2 . 4 Which of the following units is the same as 1 J/s?

[1 mark]

Tick (✓) **one** box.

1 N ☐

1 Pa ☐

1 W ☐

0 2 . 5 The pool is above sea level.

5.0 kg of water is pumped from sea level into the pool.

The water gains 196 J of gravitational potential energy.

gravitational field strength = 9.8 N/kg

Calculate the height of the pool above sea level.

Use the equation:

$$\text{height} = \frac{\text{gravitational potential energy}}{\text{mass} \times \text{gravitational field strength}}$$

[2 marks]

Height = _____ m

6.5.1.3 Gravity

Question 14 · continued

0 2 . 6 The water in some swimming pools is heated by burning fossil fuels.

Explain **one** environmental **disadvantage** of burning fossil fuels.

[2 marks]

9

Turn over for the next question

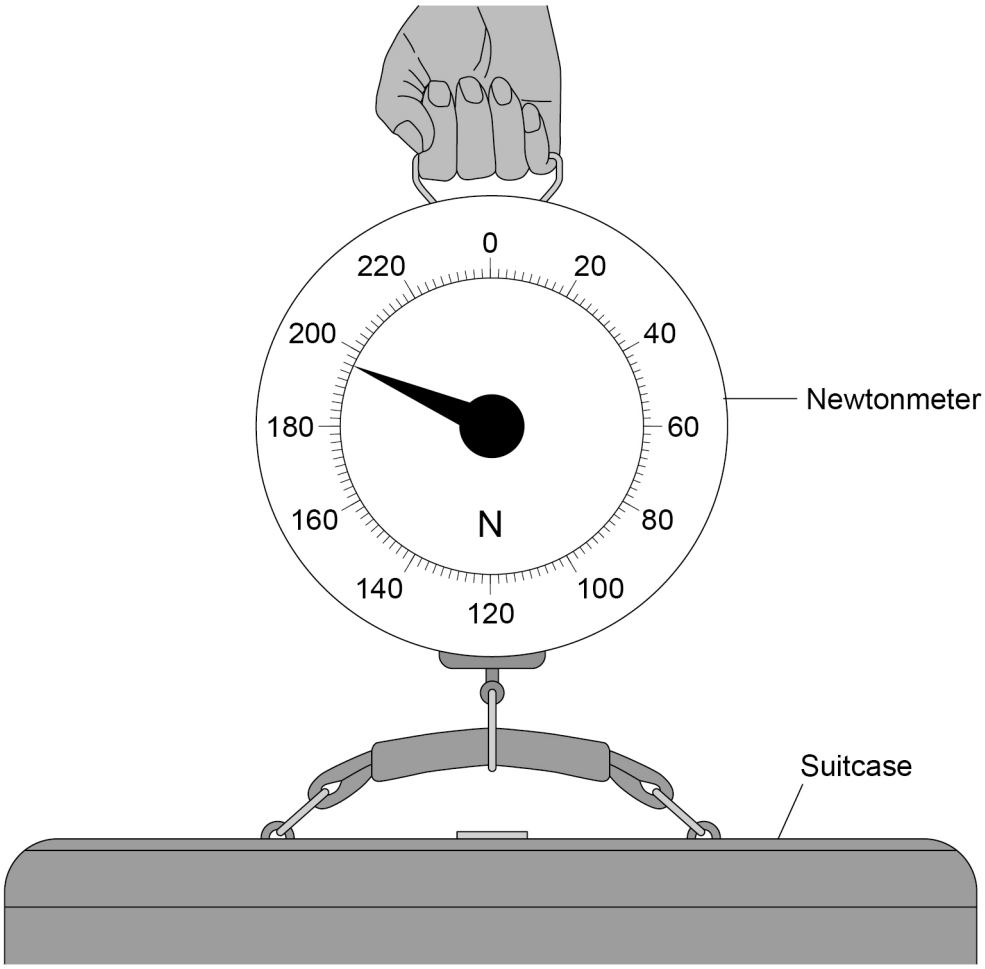
6.5.1.3 Gravity

Question 15

June 2024 | 8464/P/2F | Original Q2

0 2 **Figure 4** shows a person using a newtonmeter to measure the weight of a suitcase.

Figure 4



There is a pair of forces acting between the suitcase and the newtonmeter.

0 2 . 1 How does the force on the suitcase compare with the force on the newtonmeter?

[1 mark]

Tick (✓) **one** box.

The force on the suitcase is smaller. ☐

The forces are the same size. ☐

The force on the suitcase is bigger. ☐

Question 15 · continued

0 2 . 2 Which sentence describes the directions in which the pair of forces act?

[1 mark]

Tick (✓) **one** box.

They act in opposite directions. ☐

They act in the same direction. ☐

They act in perpendicular directions. ☐

0 2 . 3 What is the weight of the suitcase shown on the newtonmeter in **Figure 4**?

[1 mark]

Weight = _____ N

0 2 . 4 Calculate the mass of the suitcase.

gravitational field strength = 9.8 N/kg

Use your answer from Question **02.3** and the equation:

$$\text{mass} = \frac{\text{weight}}{\text{gravitational field strength}}$$

[2 marks]

_____

_____

_____

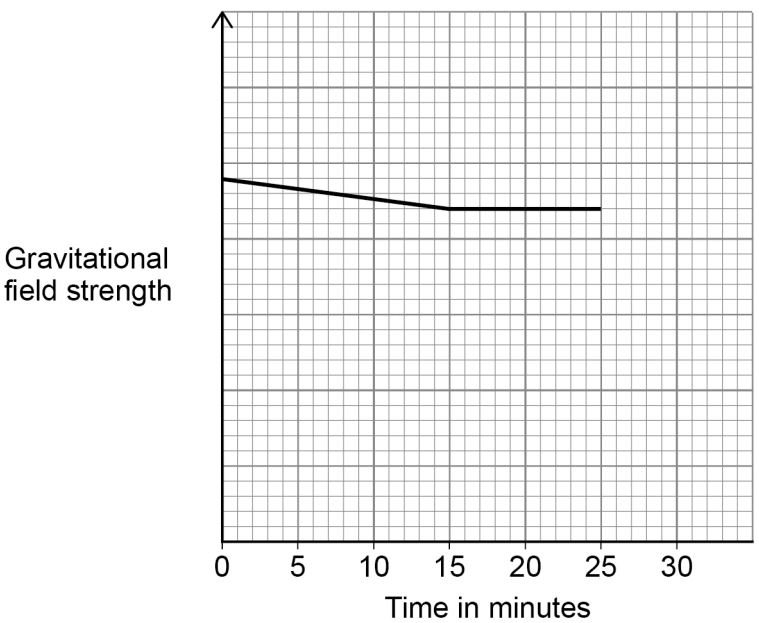
Mass = _____ kg

Question 2 continues on the next page

0 2 . 5 The suitcase is loaded into an aeroplane. The aeroplane takes off and its height above the ground increases. The aeroplane then flies at a constant height.

Figure 5 shows how the gravitational field strength in the aeroplane varies for the first 25 minutes of the flight.

Figure 5



Describe how the weight of the suitcase will change during the first 25 minutes of the flight.

Use **Figure 5**.

[3 marks]

8

6.5.1.3 Gravity

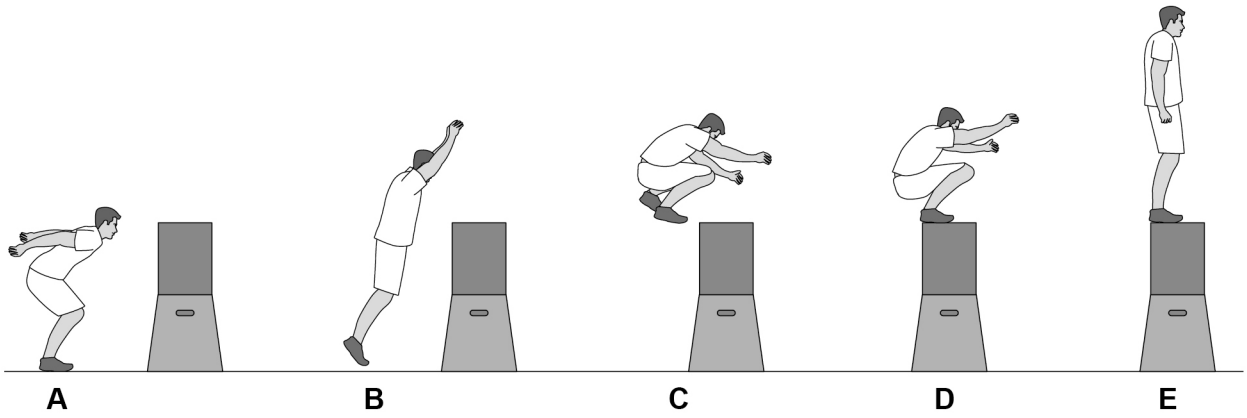
Question 16

June 2025 | 8464/P/1F | Original Q3

0 3 A person performs a 'vertical box jump'.

Figure 4 shows five different stages, **A**, **B**, **C**, **D** and **E**, of the jump.

Figure 4



0 3 . 1 Complete the sentences.

Choose answers from the box.

[2 marks]

A	**B**	**C**	**D**	**E**

The person has the least gravitational potential energy at stage _____.

The person has the greatest kinetic energy at stage _____.

6.5.1.3 Gravity

Question 16 · continued

0 3 . 2 The person in **Figure 4** has a mass of 60 kg.

The person leaves the ground with a speed of 5.5 m/s.

Calculate the kinetic energy of the person.

Use the equation:

$$\text{kinetic energy} = 0.5 \times \text{mass} \times (\text{speed})^2$$

[2 marks]

Kinetic energy = _____ J

0 3 . 3 The person has a mass of 60 kg.

The height of the jump is 1.5 m.

gravitational field strength = 9.8 N/kg

Calculate the gravitational potential energy of the person at a height of 1.5 m.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Gravitational potential energy = _____ J

Question 3 continues on the next page

6.5.1.3 Gravity

Question 16 · continued

0 3 . 4 The person jumps onto a box higher than the one in **Figure 4**, on page 12.

To jump onto a higher box, the person's speed when leaving the ground is different.

Explain how the speed is different when jumping onto a higher box.

You should answer in terms of gravitational potential energy and kinetic energy.

[3 marks]

0 3 . 5 Suggest **one** reason why a person is more likely to be injured when falling off a higher box.

[1 mark]

10

6.5.1.3 Gravity

Question 17

0 3 A student went on a cycling journey that lasted for three days.

The student recorded information about the journey using a cycling app on a mobile phone.

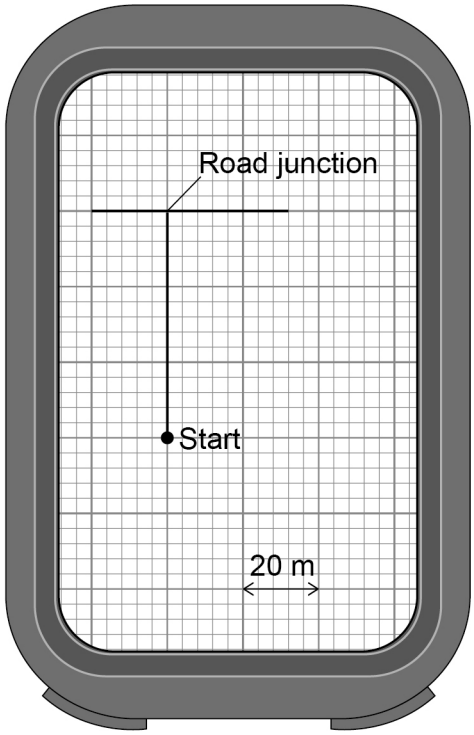
0 3 . 1 At the start of the journey, the student travelled along a straight road to a road junction.

A map on the cycling app showed the road.

Figure 5 shows the map.

The scale of the map is 1 cm **:** 20 m

Figure 5



6.5.1.3 Gravity

Question 17 · continued

Calculate the distance travelled by the student between the start and the road junction.

Use **Figure 5**.

[2 marks]

Distance travelled = _____ m

0 3 . 2 The bicycle had a mass of 15 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the bicycle.

Use the equation:

weight = mass × gravitational field strength

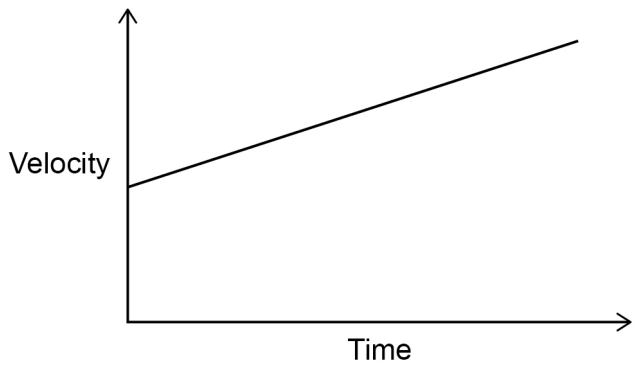
[2 marks]

Weight = _____ N

Question 3 continues on the next page

0 3 . 3 **Figure 6** shows a velocity–time graph for a downhill part of the journey.

Figure 6



The gradient of the graph represents acceleration.

How does **Figure 6** show that the acceleration was constant?

[1 mark]

0 3 . 4 As the student accelerated downhill, the forward force on the student was 250 N.

The work done by the forward force was 4500 J.

Calculate the distance travelled as the student accelerated downhill.

Use the equation:

$$\text{distance travelled} = \frac{\text{work done}}{\text{force}}$$

[2 marks]

Distance travelled = _____ m

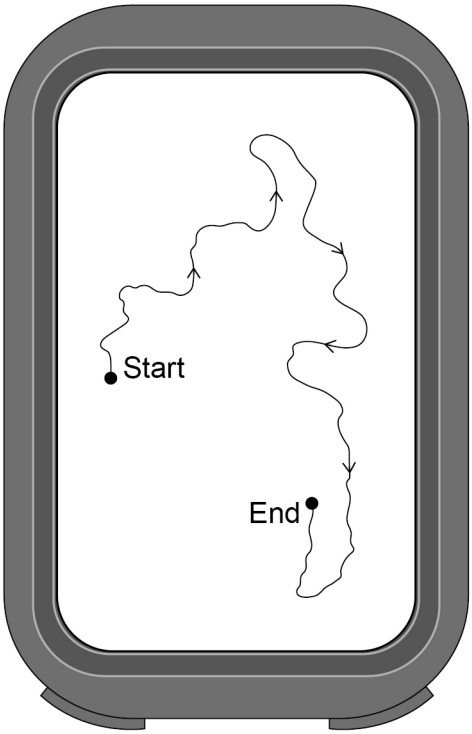
6.5.1.3 Gravity

Question 17 · continued

0 3 . 5 Most of the roads on the journey were not straight.

Figure 7 shows a map of the route taken for the whole journey.

Figure 7



The line in **Figure 7** represents the total distance travelled when the student reached the end of the journey.

How does the total distance travelled compare with the magnitude of the displacement of the student from the start?

[1 mark]

Tick (✓) **one** box.

Total distance travelled is less than the displacement. ☐

Total distance travelled is equal to the displacement. ☐

Total distance travelled is greater than the displacement. ☐

6.5.1.3 Gravity

Question 17 · continued

0 3 . 6 Why is distance a scalar quantity?

[1 mark]

Tick (✓) **one** box.

Distance has direction only. ☐

Distance has magnitude only. ☐

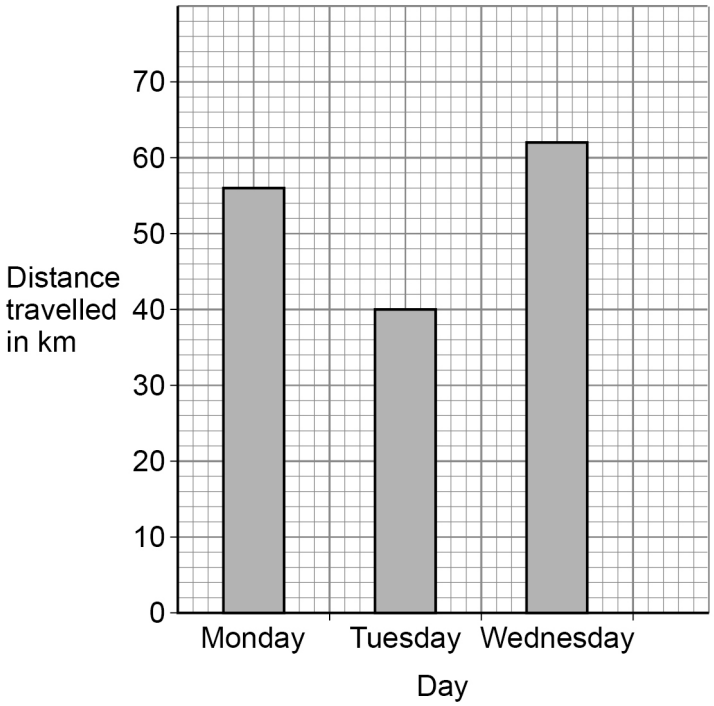
Distance has direction and magnitude. ☐

6.5.1.3 Gravity

Question 17 · continued

0 3 . 7 **Figure 8** shows the distance travelled by the student each day.

Figure 8



Calculate the total distance travelled by the student.

Use **Figure 8**.

[2 marks]

Total distance travelled = _____ km

11