AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.1.3

Gravity

Past-paper questions

Tier	**Foundation**
Question groups	**33**
Available paper years	**2003–2025**

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.

4.5.1.3 Gravity

Question 01

June 2003 | 3451F | Original Q15 | Legacy

15 (a) The table gives information about some planets.

Name of planet	Gravitational field strength in N/kg	Diameter of planet in thousands of km	Time for 1 orbit around the sun in years
Mercury	4	4.9	0.2
Venus	9	12.0	0.6
Earth	10	12.8	1.0
Jupiter	26	143.0	12.0

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

.....

(1 mark)

(ii) An astronaut has a mass of 75 kg. Calculate the weight of the astronaut on Venus. Show clearly how you work out your answer.

.....

.....

Weight of astronaut = ...newtons

(2 marks)

(iii) Why would the astronaut weigh more on the Earth than on Venus?

.....

.....

(1 mark)

(iv) The radius of the orbit of Jupiter is greater than the radius of the orbit of Mercury, Venus or the Earth. What evidence is given in the table to show this?

.....

.....

(1 mark)

4.5.1.3 Gravity

Question 01 · continued

MARGIN BLANK

(b) *To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Explain briefly how stars like the Sun are thought to have been formed.

.....

.....

.....

.....

(2 marks)

7

4.5.1.3 Gravity

Question 02

June 2003 | 3451F | Original Q17 | Legacy

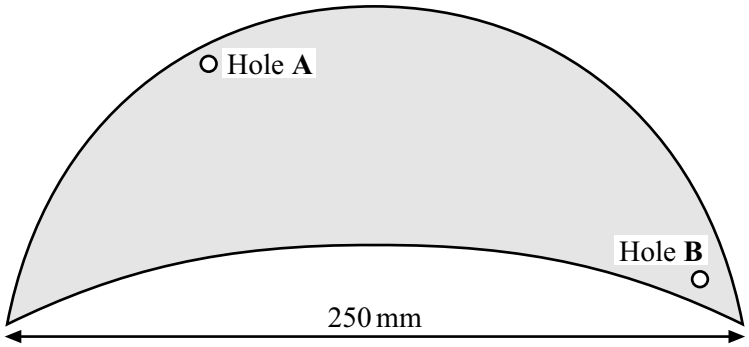
17 (a) Every object has a *centre of mass*. What is meant by the *centre of mass*?

.....

.....

(1 mark)

(b) The drawing shows a thin sheet of plastic. The sheet is 250 mm wide. Two holes, each with a radius of 2 mm, have been drilled through the sheet.



Describe how you could use:

- a clamp and stand
- a steel rod 100 mm long and with a radius of 1 mm
- a weight on a thin piece of string (= a plumb line)
- a ruler
- a pen which will write on the plastic sheet

to find the centre of mass of the plastic sheet.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(5 marks)

4.5.1.3 Gravity

Question 02 · continued

MARGIN
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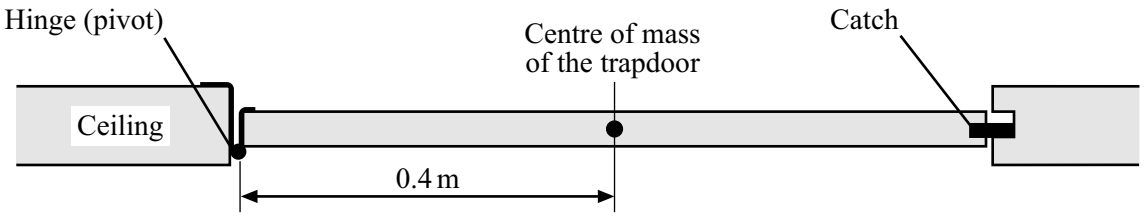
(c) There is a trapdoor in the ceiling of a house.
The trapdoor weighs 44 N.
The drawing shows a side view of the trapdoor.



(i) Complete the **three** spaces to give the equation which is used to calculate the turning effect of a force.

..... = ... × perpendicular.....
between line of action and pivot

(1 mark)

(ii) Calculate the turning effect, about the hinge, due to the weight of the trapdoor.

Show clearly how you work out your final answer and give the unit.

.....

.....

Turning effect = ...

(3 marks)

10

4.5.1.3 Gravity

Question 03

June 2003 | 3462F3 | Original Q13 | Legacy

13 (a) The table gives information about some planets.

Name of planet	Gravitational field strength in N/kg	Diameter of planet in thousands of km	Time for 1 orbit around the sun in years
Mercury	4	4.9	0.2
Venus	9	12.0	0.6
Earth	10	12.8	1.0
Jupiter	26	143.0	12.0

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

.....

(1 mark)

(ii) An astronaut has a mass of 75 kg. Calculate the weight of the astronaut on Venus. Show clearly how you work out your answer.

.....

.....

Weight of astronaut = ...newtons

(2 marks)

(iii) Why would the astronaut weigh more on the Earth than on Venus?

.....

.....

(1 mark)

(iv) The radius of the orbit of Jupiter is greater than the radius of the orbit of Mercury, Venus or the Earth. What evidence is given in the table to show this?

.....

.....

(1 mark)

4.5.1.3 Gravity

Question 03 · continued

MARGIN
BLANK

(b) *To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Explain briefly how stars like the Sun are thought to have been formed.

.....

.....

.....

.....

(2 marks)

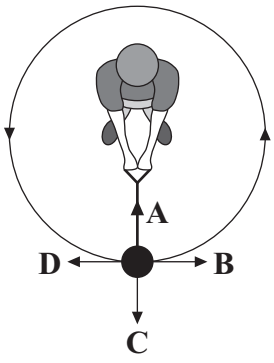
7

4.5.1.3 Gravity

Question 04

June 2006 | 3451 | Original Q11 | Legacy

11 (a) The diagram shows an overhead view of an athlete who is about to throw a hammer.
The hammer is a metal mass joined to a strong wire.
The athlete swings the mass round in a circular path.



(i) In which direction, **A**, **B**, **C** or **D**, does the centripetal force act? .....
(1 mark)

(ii) The athlete lets go of the wire.
In which direction, **A**, **B**, **C** or **D**, does the mass move? .....
(1 mark)

(iii) Complete the sentences by ticking (✓) the correct ending.

When the mass moves in a circle at a steady speed the centripetal force is larger

if the

mass is larger	
mass is smaller	
speed decreases	
weight is smaller	

.

(1 mark)

When the mass moves in a circle at a steady speed the centripetal force is larger

if the

speed decreases	
weight is smaller	
wire is longer	
wire is shorter	

.

(1 mark)

(b) The following equation is used to calculate the turning effect of a force.

Choose **two** words from the box to complete the equation.

distance	**energy**	**mass**	**moment**	**weight**

..... = force × perpendicular ..... between line of action and pivot.
(2 marks)

Question 04 · continued

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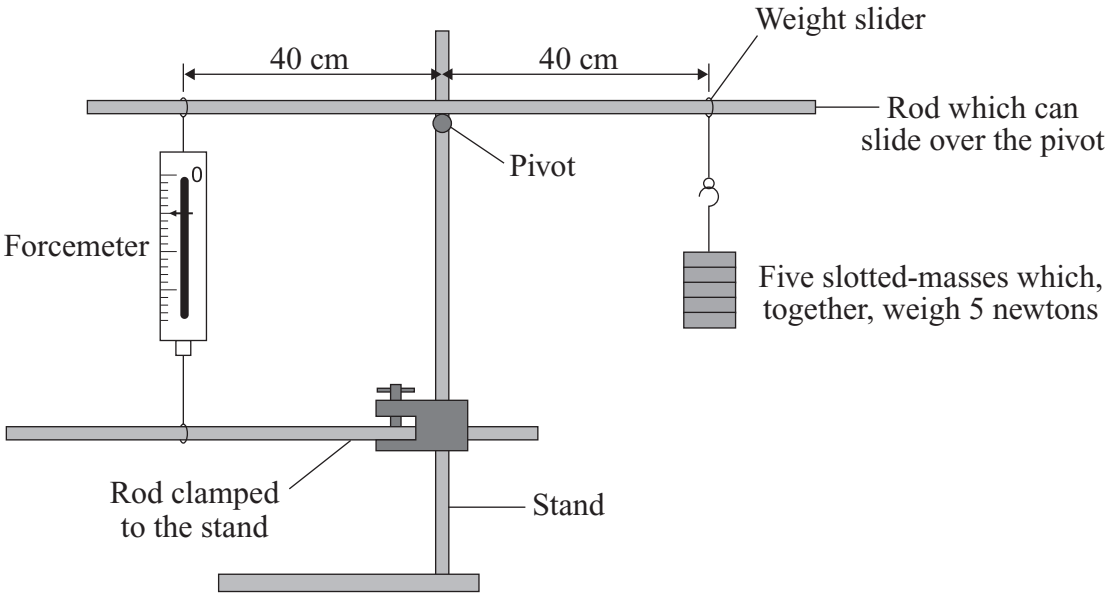
(c) A student investigates turning effects.
The equipment she uses is shown below.



(i) What is the weight, in newtons, of each of the slotted masses? ..... N
(1 mark)

(ii) What will the reading be, in newtons, on the forcemeter? ..... N
(1 mark)

(iii) Briefly describe **two** different ways to adjust the apparatus so that the reading on the forcemeter is **less** than the weight of the slotted masses.

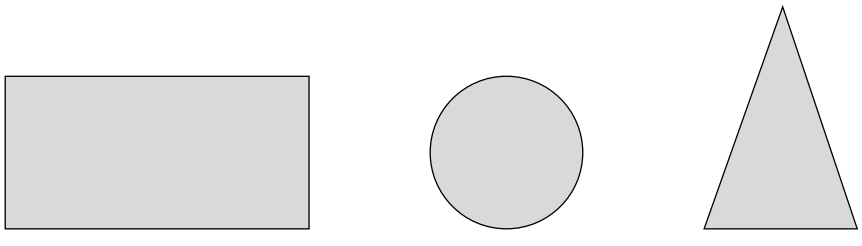
1.....

.....

2.....

.....
(2 marks)

(d) The diagrams show three thin sheets of plastic.
Label the centre of mass of each sheet with an **X**.



(3 marks)

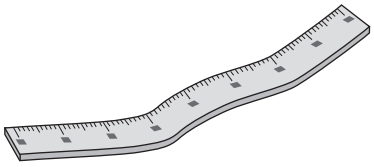
13

4.5.1.3 Gravity

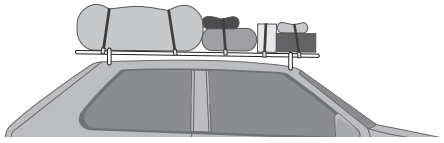
Question 05

January 2008 | PHY2F | Original Q1 | Legacy

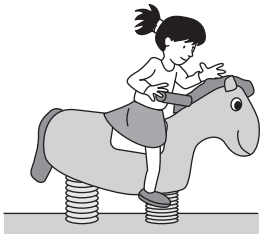
1 (a) The pictures show four objects. Each object has had its shape changed.



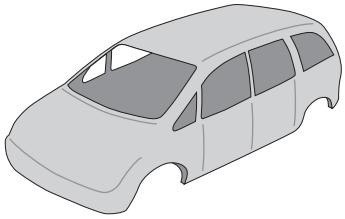
Bent metal ruler
A



Stretched bungee cords
B



Springs on a playground ride
C



Moulded plastic model car body
D

Which of the objects are storing elastic potential energy?

.....

Explain the reason for your choice or choices.

.....

.....

.....

.....

.....

.....

(3 marks)

Question 1 continues on the next page

Question 05 · continued

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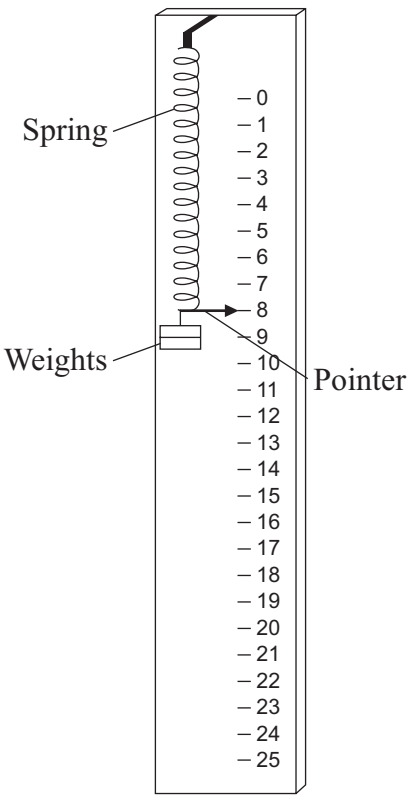
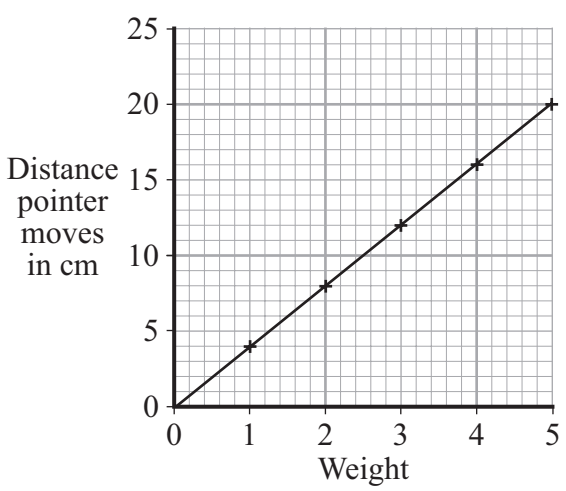
(b) A student makes a simple spring balance. To make a scale, the student uses a range of weights. Each weight is put onto the spring and the position of the pointer marked.



The graph below shows how increasing the weight made the pointer move further.



4.5.1.3 Gravity

Question 05 · continued

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(i) Which **one** of the following is the unit of weight?

Draw a ring around your answer.

joule **kilogram** **newton** **watt**

(1 mark)

(ii) What range of weights did the student use?

.....

(1 mark)

(iii) How far does the pointer move when 4 units of weight are on the spring?

.....

(1 mark)

(iv) The student ties a stone to the spring. The spring stretches 10 cm.

What is the weight of the stone?

.....

(1 mark)

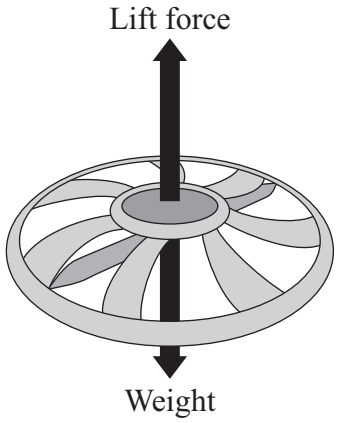
7

4.5.1.3 Gravity

Question 06

June 2008 | PHY2F | Original Q4 | Legacy

4 The diagram shows the forces on a small, radio-controlled, flying toy.



4 (a) (i) The mass of the toy is 0.06 kg.
Gravitational field strength = 10 N/kg

Use the equation in the box to calculate the weight of the toy.

weight = mass × gravitational field strength

Show clearly how you work out your answer and give the unit.

.....

.....

Weight = ...

(3 marks)

4 (a) (ii) Complete the following sentence by drawing a ring around the correct line in the box.

When the toy is hovering stationary in mid-air, the lift force is

bigger than
the same as
smaller than

the weight of the toy.

(1 mark)

4.5.1.3 Gravity

Question 06 · continued

for mark

4 (b) When the motor inside the toy is switched off, the toy starts to *accelerate* downwards.

4 (b) (i) What does the word *accelerate* mean?

.....

(1 mark)

4 (b) (ii) What is the direction of the resultant force on the falling toy?

.....

(1 mark)

4 (b) (iii) Does the momentum of the toy increase, decrease or stay the same?

.....

Give a reason for your answer.

.....

(2 marks)

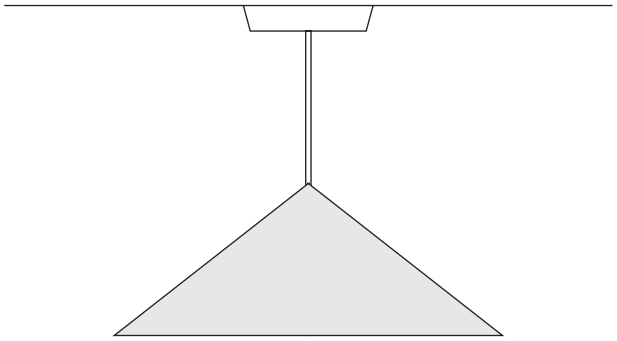
8

4.5.1.3 Gravity

Question 07

June 2008 | PHY3F | Original Q1 | Legacy

1 (a) The diagram shows a lampshade hanging from the ceiling. Draw an **X** on the diagram so that the centre of the **X** marks the centre of the mass of the lampshade.



(1 mark)

1 (b) Complete the sentence using the correct word or phrase from the box.

above	**below**	**to the left of**	**to the right of**

A suspended object will come to rest with its centre of mass directly

..... the point of suspension.

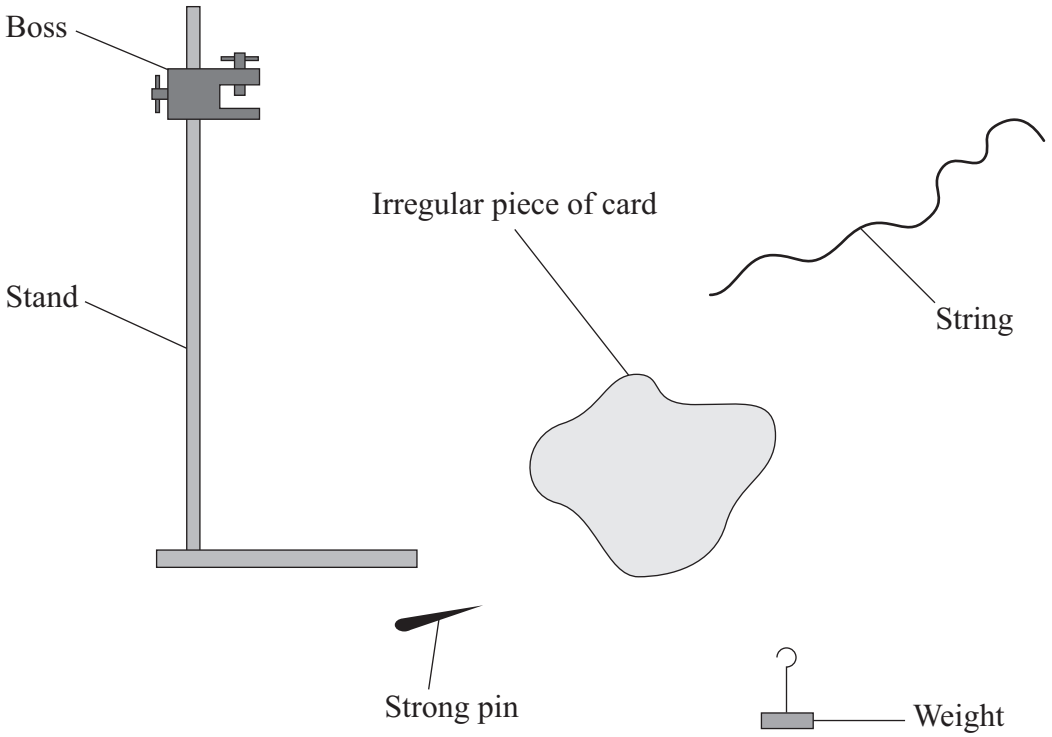
(1 mark)

4.5.1.3 Gravity

Question 07 · continued

for mark

1 (c) The diagrams show equipment that a student uses to find the centre of mass of a thin sheet of card.



Arrange these sentences in the correct order to describe how the student can find the centre of mass of the card.

The sequence starts with sentence **D** and finishes with sentence **E**.

A A line is drawn on the card marking the position of the string.

B The pin is put through one of the holes in the card and held in the boss.

C This is repeated using the other hole.

D Two holes are made in the card with each hole near to the edge of the card.

E The centre of mass is where the lines cross on the card.

F The weight is tied to the string and then the string is hung from the pin.

D					**E**

(3 marks)

5

4.5.1.3 Gravity

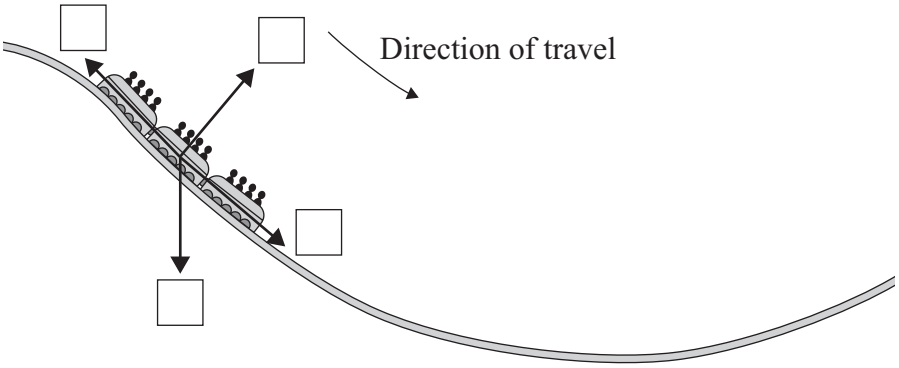
Question 08

January 2009 | PHY2F | Original Q7 | Legacy

7 The diagram shows the passenger train on part of a rollercoaster ride.

7 (a) Which arrow shows the direction of the resultant force acting on the passenger train?

Put a tick (✓) in the box next to your choice.



(1 mark)

7 (b) At the bottom of the slope, the passengers in the train all have the same speed but they each have a different kinetic energy.

Why is the kinetic energy of each passenger different?

.....

.....

(1 mark)

7 (c) For part of the ride, the maximum gravitational field strength acting on the passengers seems 3 times bigger than normal.

Normal gravitational field strength = 10 N/kg

7 (c) (i) Calculate the maximum gravitational field strength that seems to act on the passengers during the ride.

.....

.....

Maximum gravitational field strength = ... N/kg

(1 mark)

4.5.1.3 Gravity

Question 08 · continued

for mark

7 (c) (ii) One of the passengers has a mass of 80 kg.

Use the equation in the box to calculate the maximum weight this passenger seems to have during the ride.

weight = mass × gravitational field strength

Show clearly how you work out your answer.

.....

.....

Maximum weight = ... N
(2 marks)

5

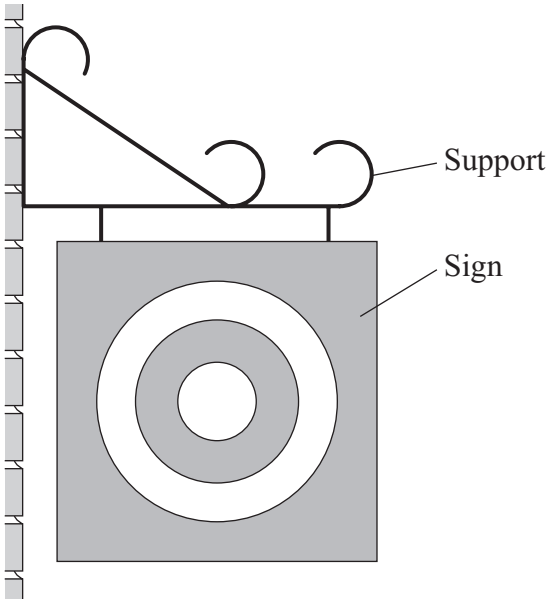
Turn over for the next question

4.5.1.3 Gravity

Question 09

June 2009 | PHY3F | Original Q1 | Legacy

1 The drawing shows a sign which hangs outside a shop.



1 (a) Draw an **X** on the sign so that the centre of your **X** is at the centre of mass of the sign.

(1 mark)

1 (b) Use a ruler to draw **one** axis of symmetry on the sign.

(1 mark)

1 (c) One force which acts on the sign is its weight.

Complete the following sentence by drawing a ring around the correct line in the box.

The moment of the weight produces

an accelerating
a balancing
a turning

effect.

(1 mark)

3

4.5.1.3 Gravity

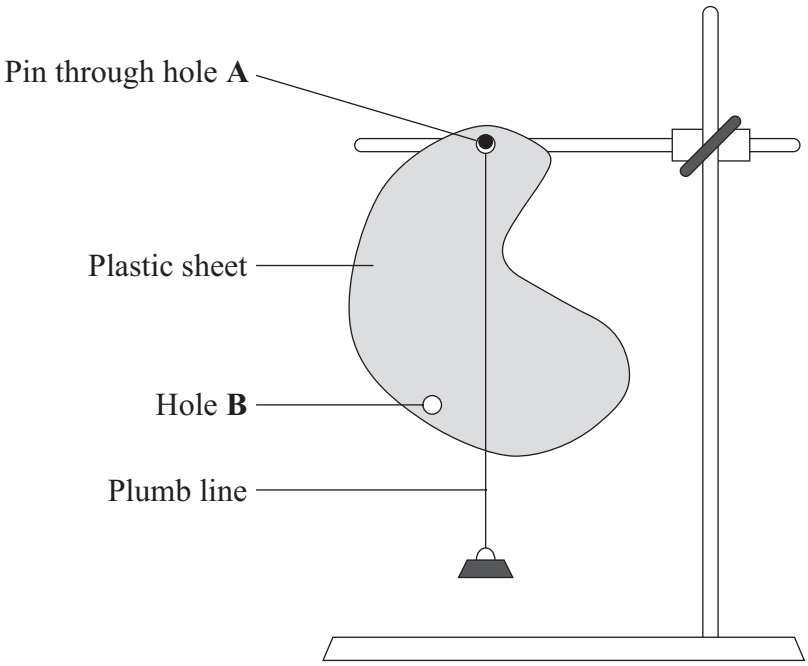
Question 10

2 The diagram shows how a student can find the centre of mass of a thin flat sheet of plastic.

Part of his equipment is a plumb line. This is a weight fastened to one end of a piece of string.

He hangs the sheet and the plumb line from a pin through hole **A**.

2 (a) Mark an **X** on the diagram so that the centre of the **X** marks the likely position of the centre of mass of the plastic sheet.



(1 mark)

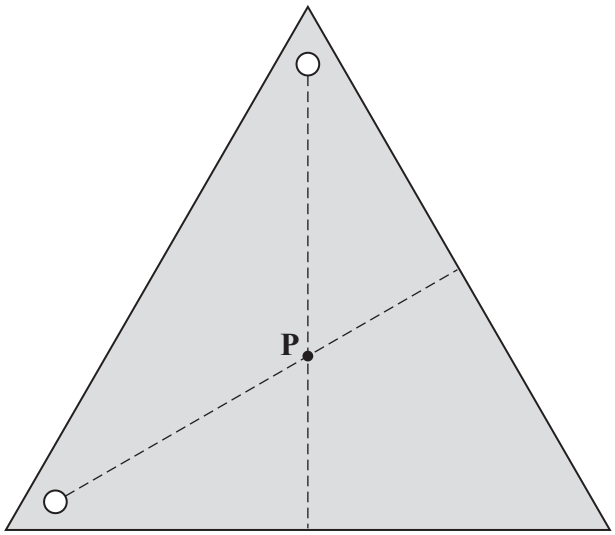
4.5.1.3 Gravity

Question 10 · continued

for mark

2 (b) The dashed lines on the diagram below show the position of the plumb line from each hole when the student uses a different plastic sheet.

Point **P** is on both the dashed lines.



Complete the following sentence by drawing a ring around the correct line in the box.

Point **P** shows the

axis
centre of mass
moment
symmetry

of the plastic sheet.

(1 mark)

2 (c) Complete the following sentence by drawing a ring around the correct word in the box.

A plumb line always hangs so that it is

curved
horizontal
parallel
vertical

.

(1 mark)

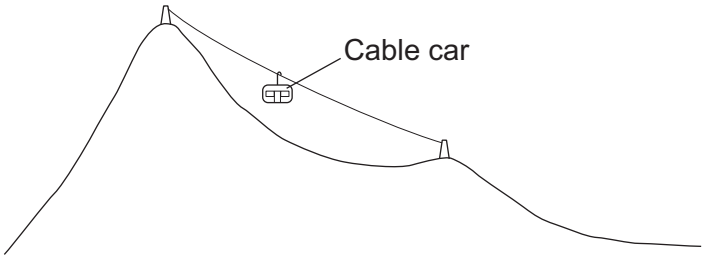
3

4.5.1.3 Gravity

Question 11

June 2010 | PHY2F | Original Q6 | Legacy

6 (a) The diagram shows a cable car used to take skiers to the top of a mountain.



6 (a) (i) The total mass of the cable car and skiers is 7500 kg.

Use the equation in the box to calculate the weight of the cable car and skiers.

weight = mass × gravitational field strength

gravitational field strength = 10 N/kg

Show clearly how you work out your answer and give the unit.

.....

.....

Weight = ...

(3 marks)

4.5.1.3 Gravity

Question 11 · continued

6 (a) (ii) The cable car moves at a constant speed. It lifts skiers through a vertical height of 800 metres in 7 minutes.

Use the following equation to calculate the work done to lift the cable car and skiers.

work done = force applied × distance moved in the direction of force

Show clearly how you work out your answer.

.....

.....

Work done = ... J

(2 marks)

6 (b) The diagram shows a skier who is accelerating down a steep ski slope.



6 (b) (i) Draw an arrow on the diagram to show the direction of the resultant force acting on the skier.

(1 mark)

6 (b) (ii) How and why does the kinetic energy of the skier change?

.....

.....

.....

.....

(2 marks)

Question 6 continues on the next page

4.5.1.3 Gravity

Question 11 · continued

6 (c) Last year, 18 000 skiers suffered a head injury. It is thought that nearly 8000 of these injuries could have been avoided if the skier had been wearing a helmet. However, at present, there are no laws to make skiers wear helmets.

Suggest why skiers should be made aware of the benefits of wearing a helmet.

.....

.....

(1 mark)

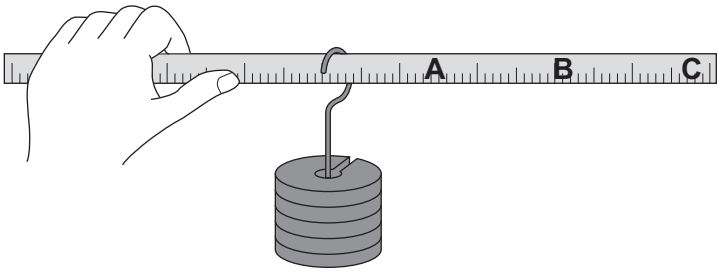
9

4.5.1.3 Gravity

Question 12

January 2011 | PHY3F | Original Q3 | Legacy

3 (a) A student holds a ruler at one end and slides a weight along the ruler.



At which point, **A**, **B** or **C**, will the turning effect of the weight feel greatest?

Write your answer, **A**, **B** or **C**, in the box. Point ☐

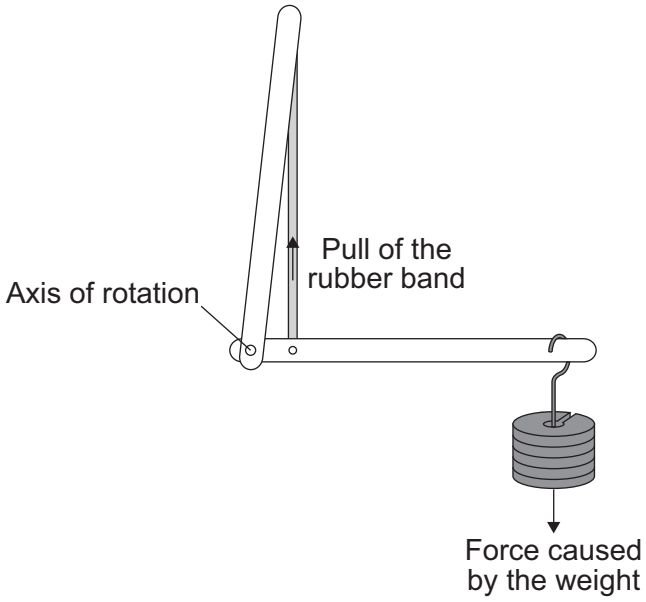
(1 mark)

3 (b) Complete the following sentence by drawing a ring around the correct word in the box.

The turning effect of a force is called the | axis | equilibrium | moment | of the force.

(1 mark)

3 (c) In a human arm, the biceps muscle provides the force needed to hold the arm horizontal. A student uses a model in which a rubber band represents the biceps muscle.



4.5.1.3 Gravity

Question 12 · continued

Complete the following sentence by drawing a ring around the correct line in the box.

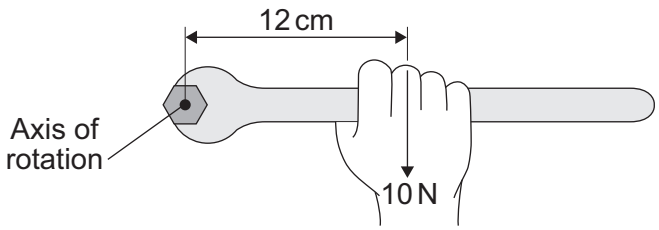
To hold the model arm horizontal, the pull from the rubber band will be

bigger than
smaller than
the same as

the force caused by the weight.

(1 mark)

3 (d) The diagram shows a long spanner.



Use the equation in the box to calculate the moment, in N cm, being produced.

moment	=	force	×	perpendicular distance from the line of action of the force to the axis of rotation

Show clearly how you work out your answer.

.....

.....

Moment = ... N cm

(2 marks)

5

4.5.1.3 Gravity

Question 13

June 2011 | PHY3F | Original Q2 | Legacy

2 The centre of mass of an object is where the mass of the object may be thought to be concentrated.

2 (a) Use a word or phrase from the box to complete the sentence below.

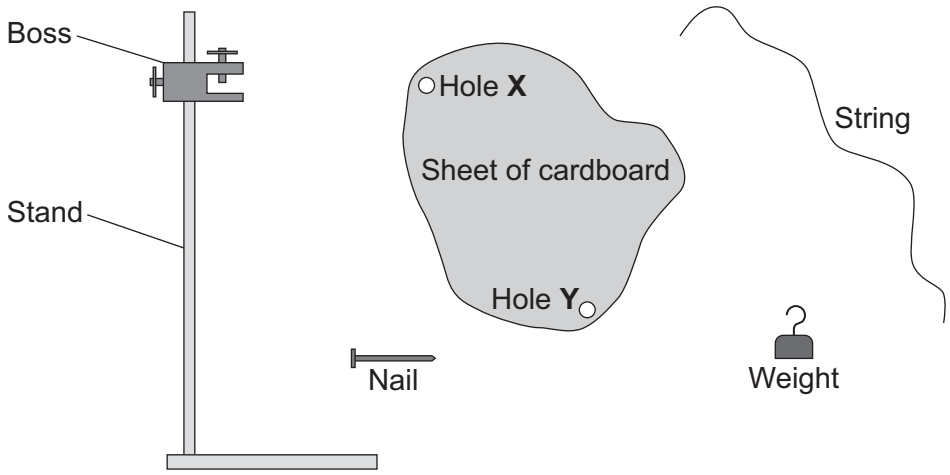
above	below	to the side of

A hanging object will come to rest with its centre of mass directly

..... the point from which it hangs.

(1 mark)

2 (b) The diagram shows the equipment that a student uses to find the centre of mass of a sheet of cardboard.
She intends to draw two lines on the sheet. The centre of mass of the sheet will be where these lines cross.



Use words from the box to complete the sentences below.

boss	cardboard	nail	stand	string	weight

The nail is put through hole **X** in the cardboard sheet. The nail is held in the ..... . The string is tied to the weight and then the other end of the string is hung from the ..... . A line is drawn on the cardboard sheet to mark the position of the ..... . This is repeated using hole **Y**.

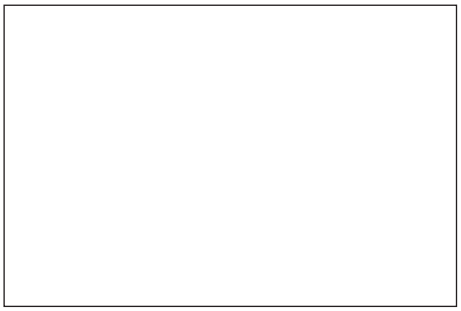
(3 marks)

4.5.1.3 Gravity

Question 13 · continued

2 (c) The diagram below shows a plastic rectangle.

2 (c) (i) Use a ruler to draw an axis of symmetry on the rectangle.



(1 mark)

2 (c) (ii) Draw an **X** on the diagram so that the centre of the **X** marks the centre of mass of the rectangle.

(1 mark)

6

Turn over for the next question

4.5.1.3 Gravity

Question 14

June 2011 | PHY3F | Original Q8 | Legacy

8 (a) A student investigates the moment of a force.

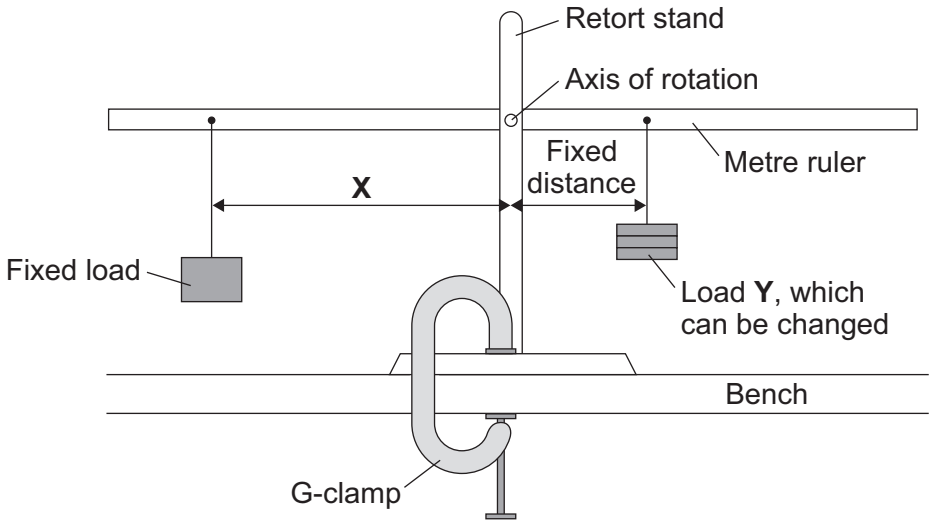
8 (a) (i) What does the word *moment* mean in this sentence?

.....

.....

(1 mark)

8 (a) (ii) The diagram shows how she sets up her apparatus.



Suggest the purpose of the G-clamp.

.....

.....

(1 mark)

4.5.1.3 Gravity

Question 14 · continued

8 (a) (iii) A horizontal rod fits into a hole at the centre of the metre ruler. This is the axis of rotation. The student changes the load **Y** and adjusts the distance **X** until the metre ruler is horizontal. She takes six pairs of measurements which are shown in the table.

Load Y in newtons	Distance X in centimetres
1	7
2	14
3	21
4	28
5	35
6	42

Explain fully how distance **X** varies with load **Y**.

.....

.....

.....

.....

.....

(2 marks)

8 (a) (iv) The weight of the ruler can be ignored in this experiment.

Which statement gives the reason why?

Put a tick (✓) in the box next to your answer.

The weight of the ruler is so small it is negligible. ☐

The centre of mass of the ruler is at the axis of rotation. ☐

The ruler is a symmetrical object. ☐

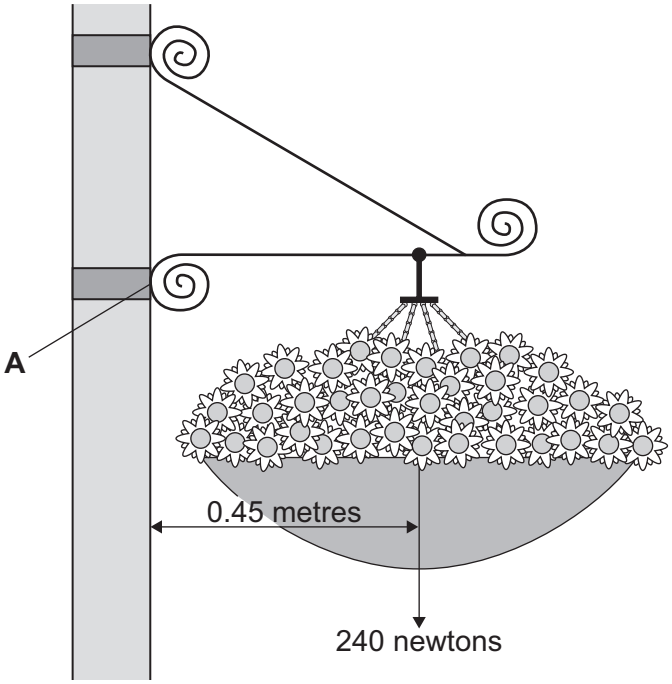
(1 mark)

Question 8 continues on the next page

4.5.1.3 Gravity

Question 14 · continued

8 (b) In the summer, a town council fits hanging baskets to some of its lamp posts.



Use the information in the diagram and the equation in the box to calculate the moment produced by the weight of the hanging basket about an axis through point **A**.

moment = force × perpendicular distance from the line of action of the force to the axis of rotation

Show clearly how you work out your answer **and** give the unit.

.....

.....

.....

.....

Moment =.....

(3 marks)

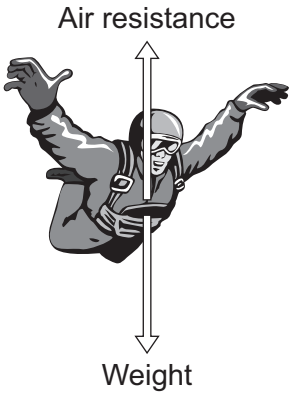
8

4.5.1.3 Gravity

Question 15

June 2012 | PH2FP | Original Q8 | Legacy

8 (a) The diagram shows the forces acting on a parachutist in free fall.



The parachutist has a mass of 75 kg.

Calculate the weight of the parachutist.

gravitational field strength = 10 N/kg

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer and give the unit.

.....

.....

Weight = ...

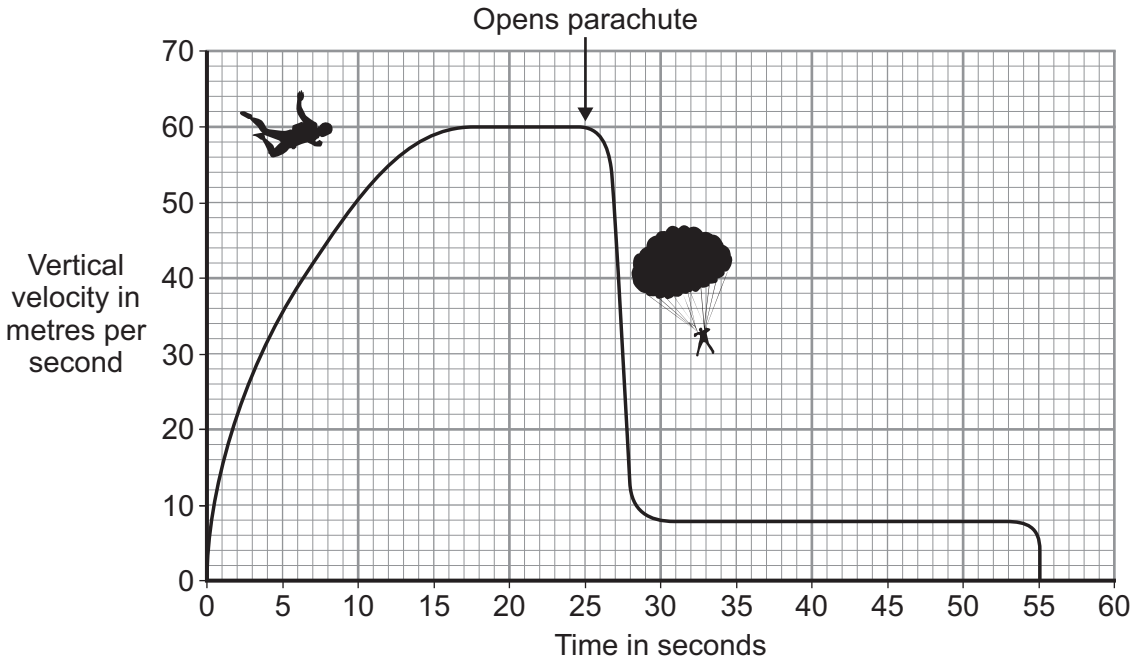
(3 marks)

4.5.1.3 Gravity

Question 15 · continued

8 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The graph shows how the vertical velocity of a parachutist changes from the moment the parachutist jumps from the aircraft until landing on the ground.



Using the idea of forces, explain why the parachutist reaches a terminal velocity and why opening the parachute reduces the terminal velocity.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6 marks)

Question 8 continues on the next page

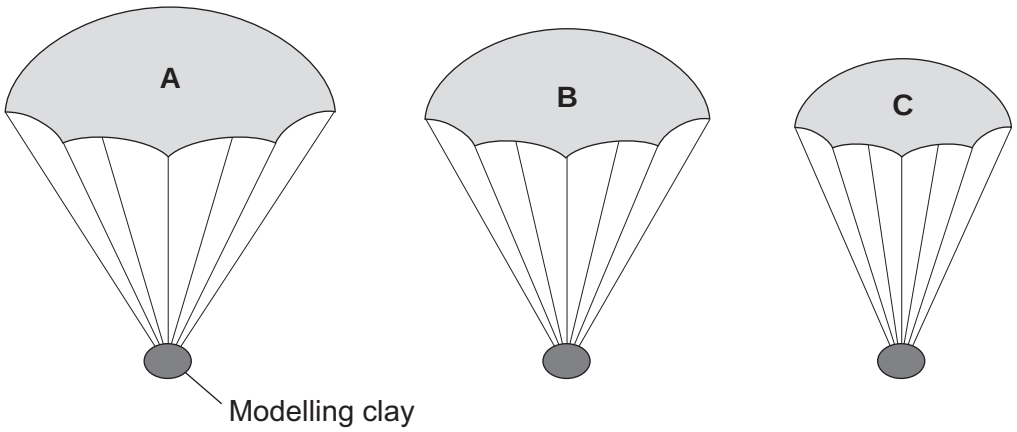
4.5.1.3 Gravity

Question 15 · continued

8 (c) A student wrote the following hypothesis.

'The larger the area of a parachute, the slower a parachutist falls.'

To test this hypothesis the student made three model parachutes, **A**, **B** and **C**, from one large plastic bag. The student dropped each parachute from the same height and timed how long each parachute took to fall to the ground.



8 (c) (i) The height that the student dropped the parachute from was a control variable.

Name **one** other control variable in this experiment.

.....

(1 mark)

8 (c) (ii) Use the student's hypothesis to predict which parachute, **A**, **B** or **C**, will hit the ground first.

Write your answer in the box. ☐

Give a reason for your answer.

.....

.....

.....

(2 marks)

12

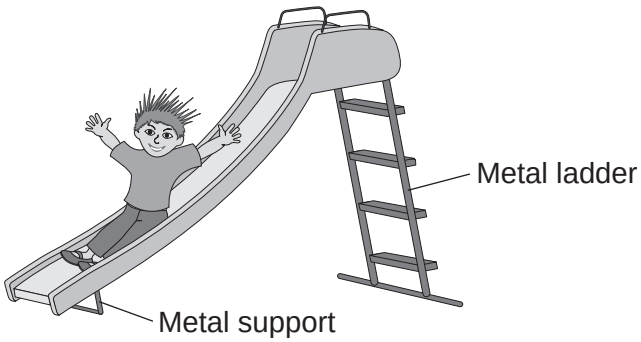
4.5.1.3 Gravity

Question 16

June 2014 | PH2FP | Original Q7 | Legacy

7 **Figure 12** shows a slide in a children's playground.

Figure 12



7 (a) A child of mass 18 kilograms goes down the slide.

The vertical distance from the top to the bottom of the slide is 2.5 metres.

Calculate the decrease in gravitational potential energy of the child sliding from the top to the bottom of the slide.

Gravitational field strength = 10 N/kg

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Decrease in gravitational potential energy = ... J

4.5.1.3 Gravity

Question 16 · continued

7 (b) The slide is made of plastic.

7 (b) (i) The child becomes electrically charged when he goes down the slide.

Explain why.

[2 marks]

.....

.....

.....

.....

7 (b) (ii) Going down the slide causes the child's hair to stand on end.

What conclusion about the electrical charge on the child's hair can be made from this observation?

[2 marks]

.....

.....

Give a reason for your answer.

.....

.....

7 (b) (iii) Why would the child **not** become electrically charged if the slide was made from metal?

[1 mark]

.....

.....

7

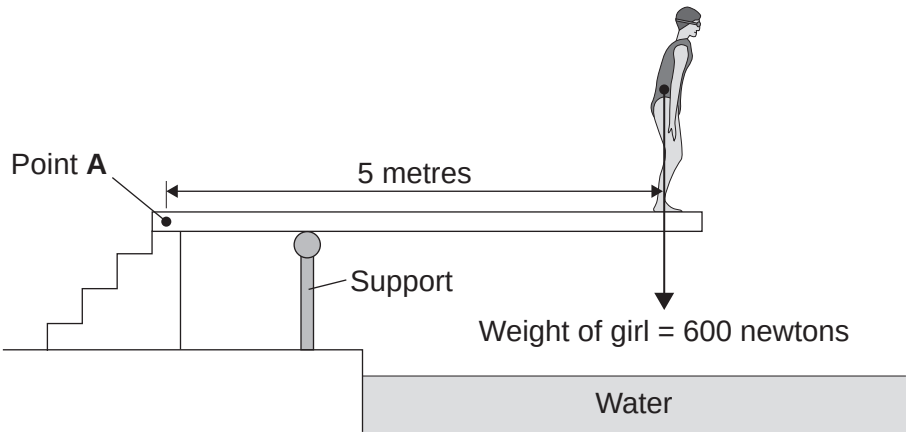
4.5.1.3 Gravity

Question 17

June 2014 | PH3FP | Original Q2 | Legacy

2 **Figure 2** shows a girl standing on a diving board.

Figure 2



2 (a) Calculate the moment of the girl's weight about Point **A**.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Moment = ... newton metres

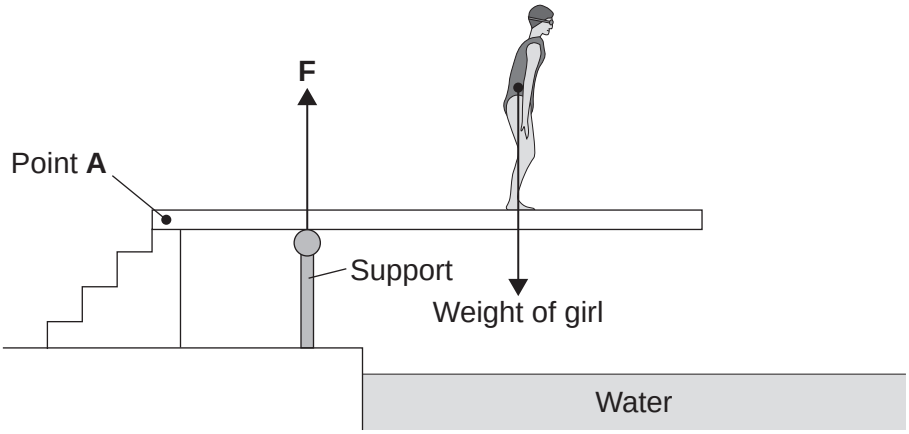
4.5.1.3 Gravity

Question 17 · continued

2 (b) **Figure 3** shows the girl standing at a different place on the diving board.

The support provides an upward force **F** to keep the diving board balanced.

Figure 3



Complete the following sentence.

[1 mark]

The diving board is not turning. The total clockwise moment is balanced

by the total ..... .

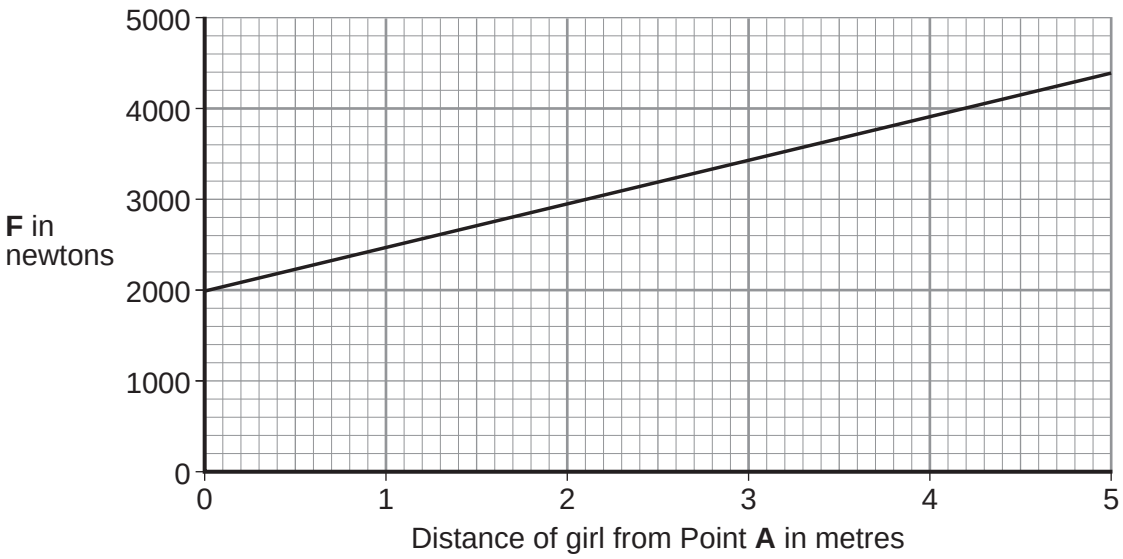
Question 2 continues on the next page

4.5.1.3 Gravity

Question 17 · continued

2 (c) **Figure 4** shows how the upward force **F** varies with the distance of the girl from Point **A**.

Figure 4



2 (c) (i) Use **Figure 4** to determine the upward force **F** when the girl is standing at a distance of 3 metres from point **A**.

[1 mark]

Upward force **F** = ... newtons

2 (c) (ii) What conclusion should be made from **Figure 4**?

[1 mark]

.....

.....

.....

5

4.5.1.3 Gravity

Question 18

June 2014 | PH3FP | Original Q4 | Legacy

4 (a) Use the correct answer from the box to complete the sentence.

[1 mark]

concentrated	**stored**	**pivoted**

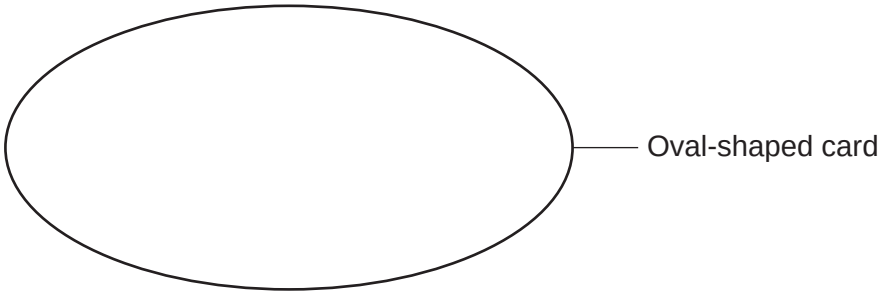
The centre of mass of an object is the point at which the mass of an object may be thought to be ..... .

4 (b) **Figure 6** shows an oval-shaped piece of card.

Draw an **X** on **Figure 6**, so that the centre of the **X** marks the centre of mass of the oval shape.

[1 mark]

Figure 6

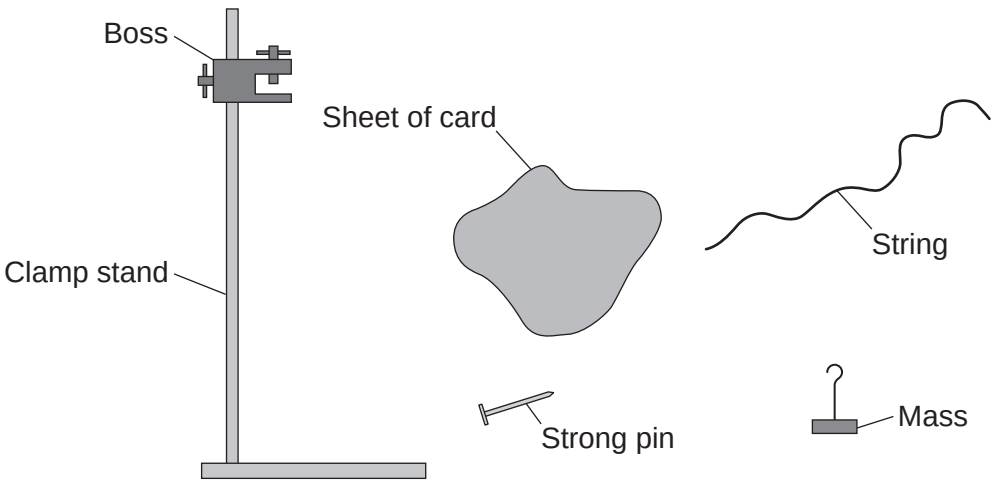


Question 4 continues on the next page

Question 18 · continued

4 (c) **Figure 7** shows some apparatus and a sheet of card.

Figure 7



The sentences describe how to find the centre of mass of the sheet of card.

The sentences are in the wrong order.

A Tie the mass to one end of the string and then hang the string from the pin.

B Repeat this using the other hole. The centre of mass is where the two lines cross on the card.

C Put the pin through one of the holes in the card and hold the pin in the boss.

D Draw a line on the card marking the position of the string.

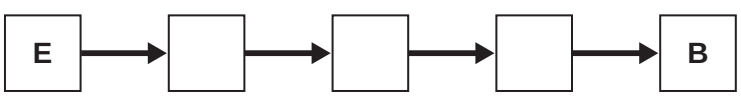
E Make two holes in the card, with each hole near to the edge of the card.

Put the sentences into the correct order to describe how to find the centre of mass of the card.

Start with **E** and end with **B**.

Write the correct order in these boxes.

[2 marks]

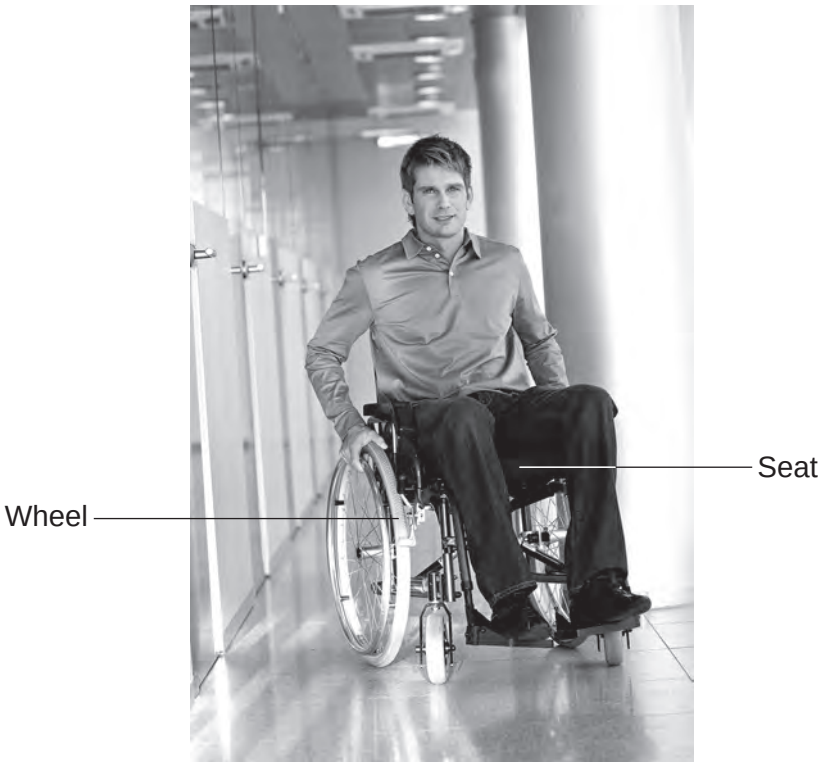


4.5.1.3 Gravity

Question 18 · continued

4 (d) **Figure 8** shows a person in a wheelchair.

Figure 8



Tipping the wheelchair at a large angle may cause it to become unstable and to topple over.

How could the design of this wheelchair be changed to make it less likely to be toppled over?

Tick (✓) **two** boxes.

[2 marks]

- Lower the person's seating position ☐
- Make the wheelchair from lighter materials ☐
- Move the wheels further apart ☐
- Use taller wheels ☐

6

4.5.1.3 Gravity

Question 19

June 2018 | 8463/1F | Original Q9

0 9 **Figure 13** shows a lift inside a building.

Figure 13



0 9 . 1 The motor in the lift does 120 000 J of work in 8.0 seconds.

Calculate the power output of the motor in the lift.

Use the equation:

$$\text{Power output} = \frac{\text{work done}}{\text{time}}$$

[2 marks]

Power output = _____ W

Question 19 · continued

0 9 . 2 The power input to the motor is greater than the power output.

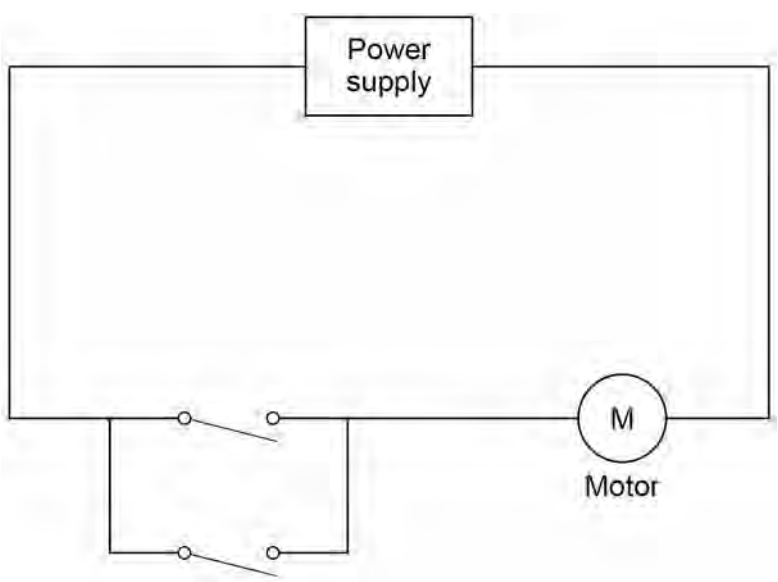
Tick **two** reasons why.

[2 marks]

- Energy is transferred in heating the surroundings. ☐
- Friction causes energy to be transferred in non-useful ways. ☐
- The motor is connected to the mains electricity supply. ☐
- The motor is more than 100% efficient. ☐
- There are only four people in the lift. ☐

0 9 . 3 **Figure 14** shows part of the circuit that operates the lift motor.

Figure 14



The lift can be operated using either of the two switches.

Explain why.

[2 marks]

4.5.1.3 Gravity

Question 19 · continued

0 9 . 4 Write down the equation that links gravitational field strength, gravitational potential energy, height and mass.

[1 mark]

0 9 . 5 The lift goes up 14 m. The total mass of the people in the lift is 280 kg.

gravitational field strength = 9.8 N/kg

Calculate the increase in gravitational potential energy of the people in the lift.

Give your answer to 2 significant figures.

[3 marks]

Increase in gravitational potential energy = _____ J

10

4.5.1.3 Gravity

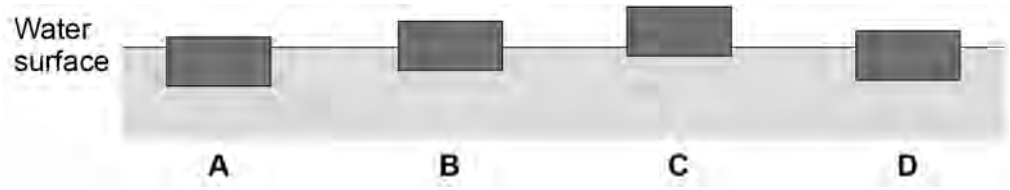
Question 20

June 2018 | 8463/2F | Original Q6

0 6 **Figure 7** shows four blocks of different materials floating on water.

The four blocks are the same volume.

Figure 7



0 6 . 1 Which of the blocks has the smallest weight?

Tick **one** box.

[1 mark]

A ☐ **B** ☐ **C** ☐ **D** ☐

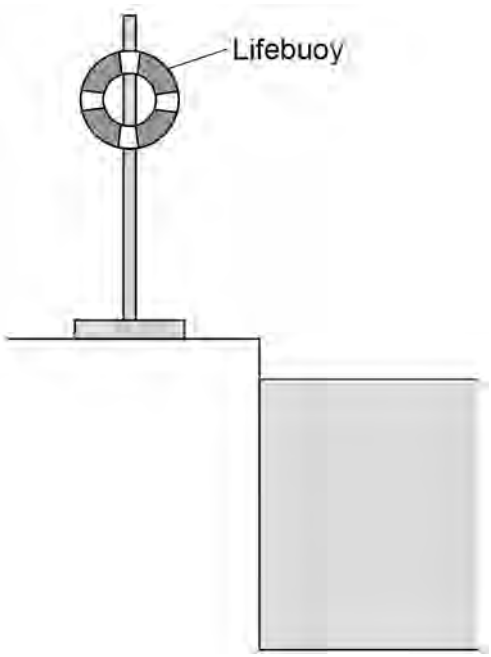
Question 6 continues on the next page

4.5.1.3 Gravity

Question 20 · continued

Figure 8 shows a lifebuoy next to a deep swimming pool.

Figure 8



0 6 . 2 The lifebuoy has a mass of 2.5 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the lifebuoy.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

Weight = _____ N

4.5.1.3 Gravity

Question 20 · continued

0 6 . 3 When thrown into the water the lifebuoy floats. The two forces acting on the lifebuoy are the weight of the lifebuoy downwards and upthrust upwards.

How big is the upthrust on the lifebuoy compared to the weight of the lifebuoy?

Tick **one** box.

[1 mark]

The upthrust is greater than the weight. ☐

The upthrust is less than the weight. ☐

The upthrust is the same as the weight. ☐

0 6 . 4 Write down the equation which links acceleration, mass and resultant force.

[1 mark]

_____

0 6 . 5 A rope is used to pull the lifebuoy to the side of the swimming pool.

A resultant force of 4.0 N acts on the lifebuoy.

The mass of the lifebuoy is 2.5 kg.

Calculate the acceleration of the lifebuoy.

[3 marks]

_____

_____

_____

_____

Acceleration = _____ m/s^2

8

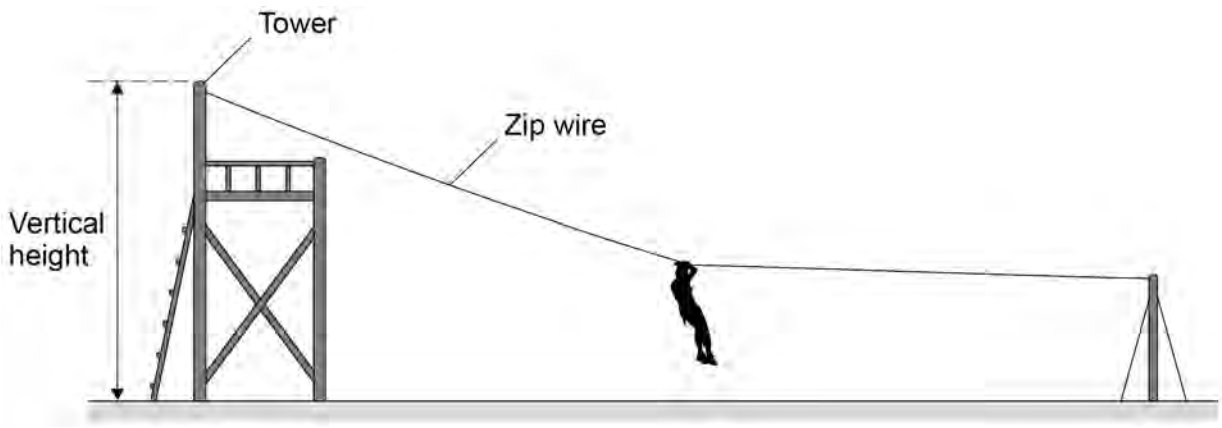
4.5.1.3 Gravity

Question 21

June 2019 | 8463/1F | Original Q3

0 3 **Figure 4** shows a person sliding down a zip wire.

Figure 4



0 3 . 1 Describe how the vertical height of the tower could be measured accurately.

[2 marks]

0 3 . 2 When using the zip wire, the person moved through a vertical height of 2.0 m

The person has a mass of 45 kg

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the person.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Change in gravitational potential energy = _____ J

4.5.1.3 Gravity

Question 21 · continued

0 3 . 3 Give **three** factors that affected the kinetic energy of the person as she reached the bottom of the zip wire.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

7

Turn over for the next question

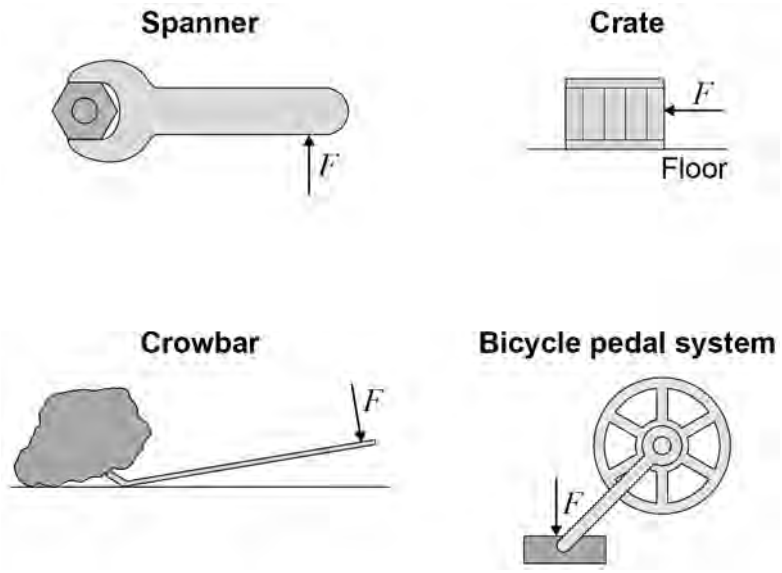
4.5.1.3 Gravity

Question 22

June 2019 | 8463/2F | Original Q7

0 7 . 1 **Figure 17** shows four examples of a force causing an object to move.

Figure 17



Which object is **not** likely to rotate?

[1 mark]

Tick (✓) **one** box.

- Bicycle pedal system ☐
- Crate ☐
- Crowbar ☐
- Spanner ☐

Question 7 continues on the next page

4.5.1.3 Gravity

Question 22 · continued

Figure 18 shows a simple device that can be used as a weighing scale.

Figure 19 shows the device being used to measure a quantity of rice.

The weight of the device is balanced by the weight of the rice and basket.

Figure 18

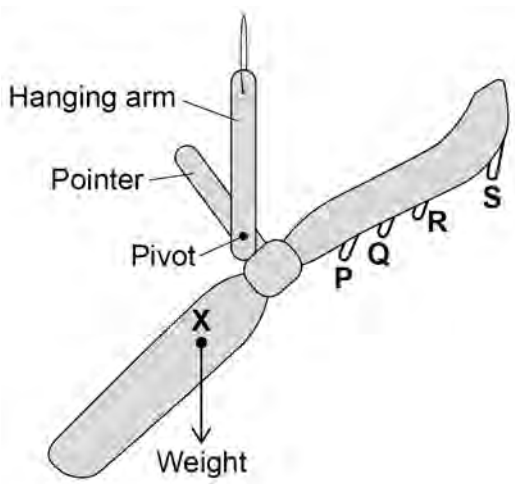
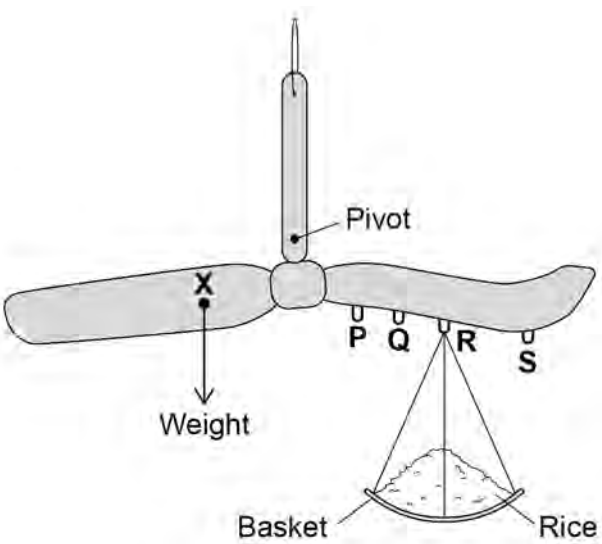


Figure 19



0 7 . 2 The weight of the device acts through the point labelled **X**.

What is point **X** called?

[1 mark]

Tick (✓) **one** box.

Centre of balance ☐

Centre of mass ☐

Centre of weight ☐

4.5.1.3 Gravity

Question 22 · continued

0 7 . 3 How does **Figure 19** show that the weight of the device is balanced by the weight of the rice and basket?

[1 mark]

0 7 . 4 The basket can hang from different points on the device.

Where should the basket hang to measure the largest quantity of rice?

[1 mark]

Tick (✓) **one** box.

P ☐ **Q** ☐ **R** ☐ **S** ☐

0 7 . 5 Write down the equation which links distance, force and moment of a force.

[1 mark]

0 7 . 6 In **Figure 19**, the weight of the device causes an anticlockwise moment of 0.15 Nm about the pivot.

The weight of the rice and basket acts 0.06 m from the pivot.

Calculate the weight of the rice and basket.

[3 marks]

Weight of rice and basket = _____ N

4.5.1.3 Gravity

Question 22 · continued

0 7 . 7 Write down the equation which links gravitational field strength, mass and weight.

[1 mark]

0 7 . 8 The basket has a mass of 0.04 kg

gravitational field strength = 9.8 N/kg

Calculate the mass of rice in the basket.

[3 marks]

Mass = _____ kg

12

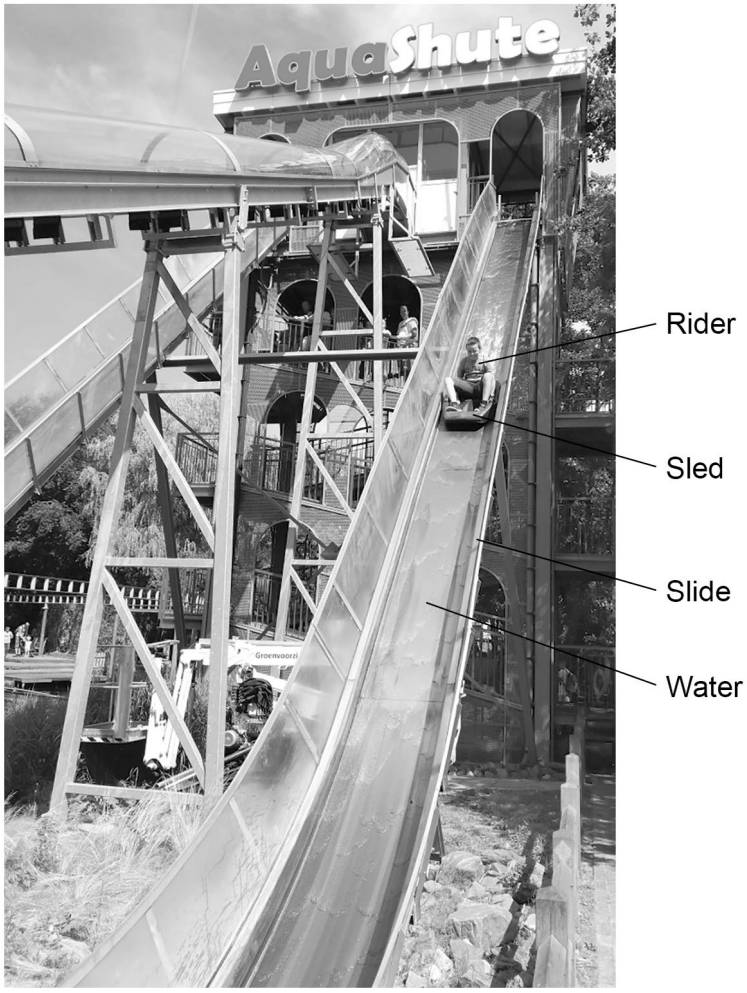
4.5.1.3 Gravity

Question 23

November 2020 | 8463/1F | Original Q2

0 2 **Figure 4** shows a theme park ride called AquaShute.

Figure 4



0 2 . 1 Riders of the AquaShute sit on a sled and move down a slide.

There is a layer of water between the sled and the slide.

How does the layer of water affect the friction between the sled and the slide?

[1 mark]

Tick (✓) **one** box.

The friction is decreased. ☐

The friction is increased. ☐

The friction is not affected. ☐

4.5.1.3 Gravity

Question 23 · continued

0 2 . 2 The mass of one rider is 62.5 kg.

The height of the slide is 16.0 m.

gravitational field strength = 9.8 N/kg

Calculate the gravitational potential energy of the rider at the top of the slide.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Gravitational potential energy = _____ J

0 2 . 3 At the bottom of the slide the speed of the rider is 12 m/s.

The mass of the rider is 62.5 kg.

Calculate the kinetic energy of the rider at the bottom of the slide.

Use the equation:

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

[2 marks]

Kinetic energy = _____ J

Question 2 continues on the next page

4.5.1.3 Gravity

Question 23 · continued

0 2 . 4 When a rider reaches the bottom of the slide, the sled decelerates and stops.

Give **two** factors that will affect how far the sled will move before it stops.

[2 marks]

1 _____

_____

2 _____

_____

7

4.5.1.3 Gravity

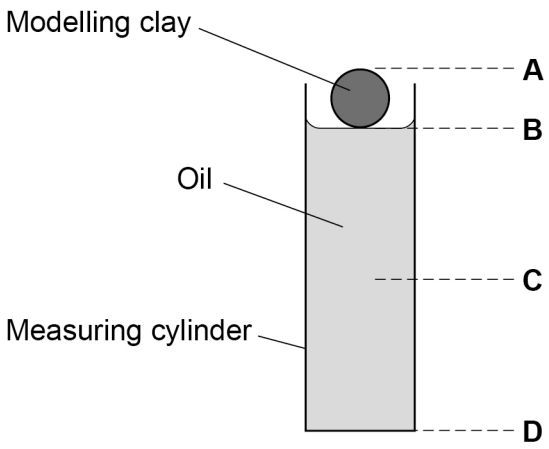
Question 24

November 2020 | 8463/2F | Original Q1

0 1 A student dropped a piece of modelling clay into oil.

Figure 1 shows the modelling clay just before it was dropped into the oil.

Figure 1



0 1 . 1 What was the distance fallen by the modelling clay?

[1 mark]

Tick (✓) **one** box.

from A to C ☐

from A to D ☐

from B to C ☐

from B to D ☐

0 1 . 2 What measuring instrument should be used to measure the distance fallen?

[1 mark]

_____

Question 1 continues on the next page

Question 24 · continued

The student dropped four pieces of modelling clay, each with a different shape.

For each piece the student measured the time taken to fall the same distance through the oil.

0 1 . 3 The student removed each piece of modelling clay from the oil before dropping the next piece.

Suggest **one** reason why.

[1 mark]

The student repeated the measurements and calculated mean values.

Table 1 shows the results.

Table 1

Shape	Time taken in seconds			
	Drop 1	Drop 2	Drop 3	Mean
 Sphere	47	38	41	42
 Cube	68	49	57	58
 Cylinder	34	37	34	**X**
 Cone	29	23	26	26

0 1 . 4 Calculate value **X** in **Table 1**.

[2 marks]

X = _____ s

Question 24 · continued

0 1 . 5 Each piece of modelling clay had the same mass.

Which shape in **Table 1** had the smallest resistive force acting against it as it fell?

Tick (✓) **one** box.

Give **one** reason for your answer.

[2 marks]

Cone ☐

Cube ☐

Cylinder ☐

Sphere ☐

Reason _____

_____

0 1 . 6 How would the time taken to fall change if the modelling clay was dropped through air instead of through oil?

[1 mark]

Tick (✓) **one** box.

Time through air would be less. ☐

Time through air would be more. ☐

Time through air would be the same. ☐

Question 1 continues on the next page

4.5.1.3 Gravity

Question 24 · continued

0 1 . 7 The mass of a piece of modelling clay was 0.050 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the piece of modelling clay.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

Weight = _____ N

0 1 . 8 Weight causes the modelling clay to fall through the oil.

Weight is a non-contact force.

Which of the following are also non-contact forces?

[2 marks]

Tick (✓) **two** boxes.

- Air resistance ☐
- Electrostatic force ☐
- Friction ☐
- Magnetic force ☐
- Tension ☐

12

4.5.1.3 Gravity

Question 25

November 2021 | 8463/2F | Original Q6

0 6 The Sun is the closest star to the Earth.

0 6 . 1 A 2.5 kg mass would have a weight of 750 N at the surface of the Sun.

Calculate the gravitational field strength at the surface of the Sun.

Use the equation:

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

[2 marks]

Gravitational field strength = _____ N/kg

0 6 . 2 Gravity is a non-contact force.

Which of the following is also a non-contact force?

[1 mark]

Tick (✓) **one** box.

- Air resistance ☐
- Electrostatic ☐
- Friction ☐
- Tension ☐

4.5.1.3 Gravity

Question 25 · continued

0 6 . 3 All stars have a life cycle.

Figure 15 shows part of the life cycle of a star that becomes a black dwarf.

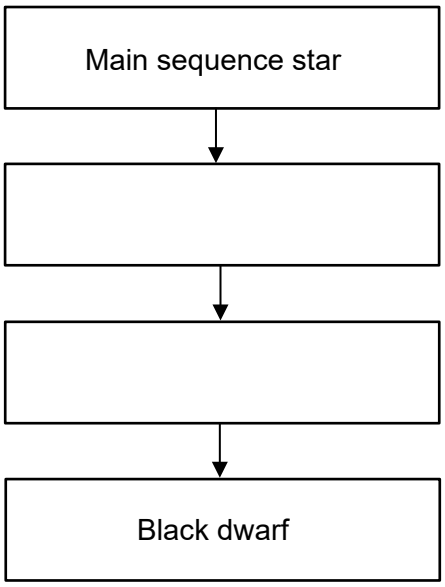
Complete **Figure 15**.

Choose answers from the box.

[2 marks]

Black hole		**Neutron star**
Red giant	**Supernova**	**White dwarf**

Figure 15



Question 6 continues on the next page

Question 25 · continued

Table 3 gives the mass of three stars compared to the mass of the Sun.

Table 3

Star	Mass compared to the mass of the Sun
X	× 25.0
Y	× 15.0
Z	× 0.9

0 6 . 4 Which letter represents the star most likely to become a black dwarf?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

X ☐ **Y** ☐ **Z** ☐

Reason _____

_____

_____

0 6 . 5 In which stage of the life cycle of a star are elements heavier than iron produced?

[1 mark]

Tick (✓) **one** box.

Nebula ☐

Protostar ☐

Supernova ☐

8

4.5.1.3 Gravity

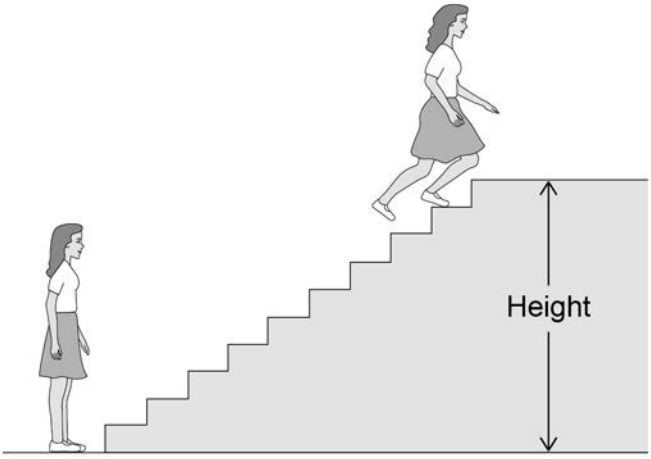
Question 26

June 2022 | 8463/1F | Original Q2

0 2 A girl ran to the top of some stairs.

Figure 2 shows the stairs.

Figure 2



0 2 . 1 The girl measured the height of the stairs.

What measuring instrument should she have used?

[1 mark]

0 2 . 2 The height of the stairs was 1.7 m.

The mass of the girl was 50 kg.

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the girl.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Gravitational potential energy = _____ J

Question 26 · continued

0 2 . 3 A boy ran up the same stairs and did 1800 J of work.

The time it took the boy to run up the stairs was 1.44 s.

Calculate the power of the boy.

Use the equation:

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

[2 marks]

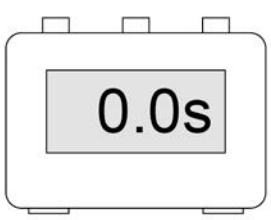
Power = _____ W

0 2 . 4 Which stop-clock was used to measure the time the boy took to run up the stairs?

[1 mark]

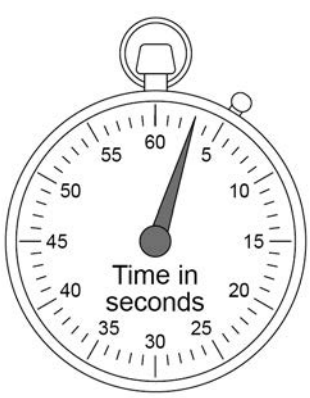
Tick (✓) **one** box.

Stop-clock A



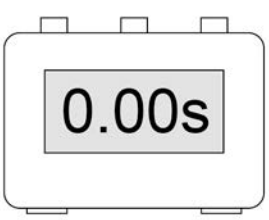
☐

Stop-clock B



☐

Stop-clock C



☐

4.5.1.3 Gravity

Question 26 · continued

0 2 . 5 The boy had a speed of 2.0 m/s at the top of the stairs.

The mass of the boy was 70 kg.

Calculate the kinetic energy of the boy at the top of the stairs.

Use the equation:

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

[2 marks]

Kinetic energy = _____ J

8

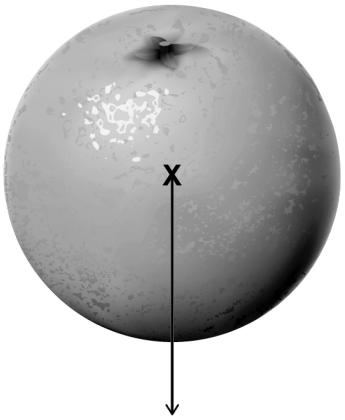
4.5.1.3 Gravity

Question 27

June 2022 | 8463/2F | Original Q4

0 4 **Figure 6** shows the weight of an orange acting from a point labelled **X**.

Figure 6



0 4 . 1 What name is given to point **X** in **Figure 6**?

[1 mark]

Tick (✓) **one** box.

Centre of force ☐

Centre of mass ☐

Centre of balance ☐

Centre of weight ☐

0 4 . 2 Weight and mass are not the same.

The relationship between weight and mass for an object can be written as:

$$\text{weight} \propto \text{mass}$$

Which sentence describes the relationship between weight and mass?

[1 mark]

Tick (✓) **one** box.

Weight is approximately equal to mass. ☐

Weight is directly proportional to mass. ☐

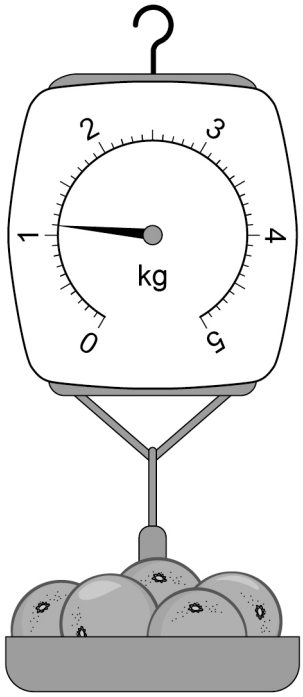
Weight is less than mass. ☐

4.5.1.3 Gravity

Question 27 · continued

Figure 7 shows a balance used to measure the mass of 5 oranges.

Figure 7



0 4 . 3 All 5 of the oranges have the same mass.

Determine the mass of 1 orange.

[2 marks]

Mass = _____ kg

0 4 . 4 Calculate the weight of 1 orange.

gravitational field strength = 9.8 N/kg

Use the equation:

weight = mass × gravitational field strength

[2 marks]

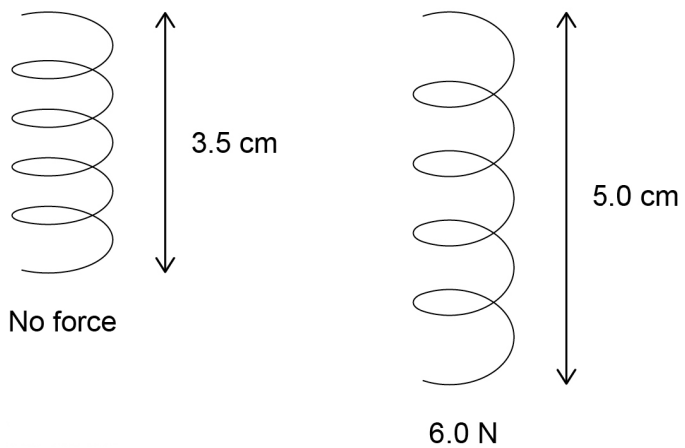
Weight = _____ N

Question 27 · continued

The balance shown in **Figure 7** contains a spring.

Figure 8 shows the spring with no force acting on it and with a force of 6.0 N acting on it.

Figure 8



0 4 . 5 What is the extension of the spring when a force of 6.0 N acts on it?

[1 mark]

Tick (✓) **one** box.

0.015 m ☐

0.035 m ☐

0.050 m ☐

0.085 m ☐

0 4 . 6 Calculate the spring constant of the spring.

Use the equation:

$$\text{spring constant} = \frac{\text{force}}{\text{extension}}$$

[2 marks]

Spring constant = _____ N/m

4.5.1.3 Gravity

Question 27 · continued

0 4 . 7 What will happen to the spring when the force is removed?

[1 mark]

10

Turn over for the next question

4.5.1.3 Gravity

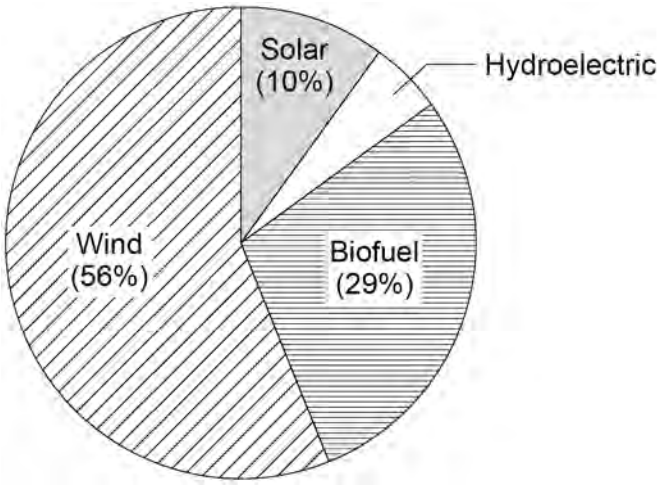
Question 28

June 2023 | 8463/1F | Original Q4

0 4 The UK uses renewable energy resources to generate some of its electricity.

Figure 4 shows the proportion of electricity generated by different renewable energy resources in the UK in 2020.

Figure 4



0 4 . 1 Calculate the percentage of electricity generated using hydroelectric power.

[2 marks]

Percentage = _____ %

4.5.1.3 Gravity

Question 28 · continued

A remote village in the UK uses a hydroelectric generator to provide electricity.

0 4 . 2 The mass of water that passes through the hydroelectric generator each day is 2 500 000 kg.

The change in vertical height of the water is 15.0 m.

gravitational field strength = 9.8 N/kg

Calculate the decrease in gravitational potential energy of the water.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Decrease in gravitational potential energy = _____ J

Question 4 continues on the next page

4.5.1.3 Gravity

Question 28 · continued

Use the Physics Equations Sheet to answer questions **04.3** and **04.4**.

0 4 . 3 Write down the equation which links energy (*E*), power (*P*) and time (*t*).

[1 mark]

0 4 . 4 The hydroelectric generator transfers electrical power of 3000 W to the village.

Calculate the energy transferred to the village in 60 minutes.

[3 marks]

Energy transferred = _____ J

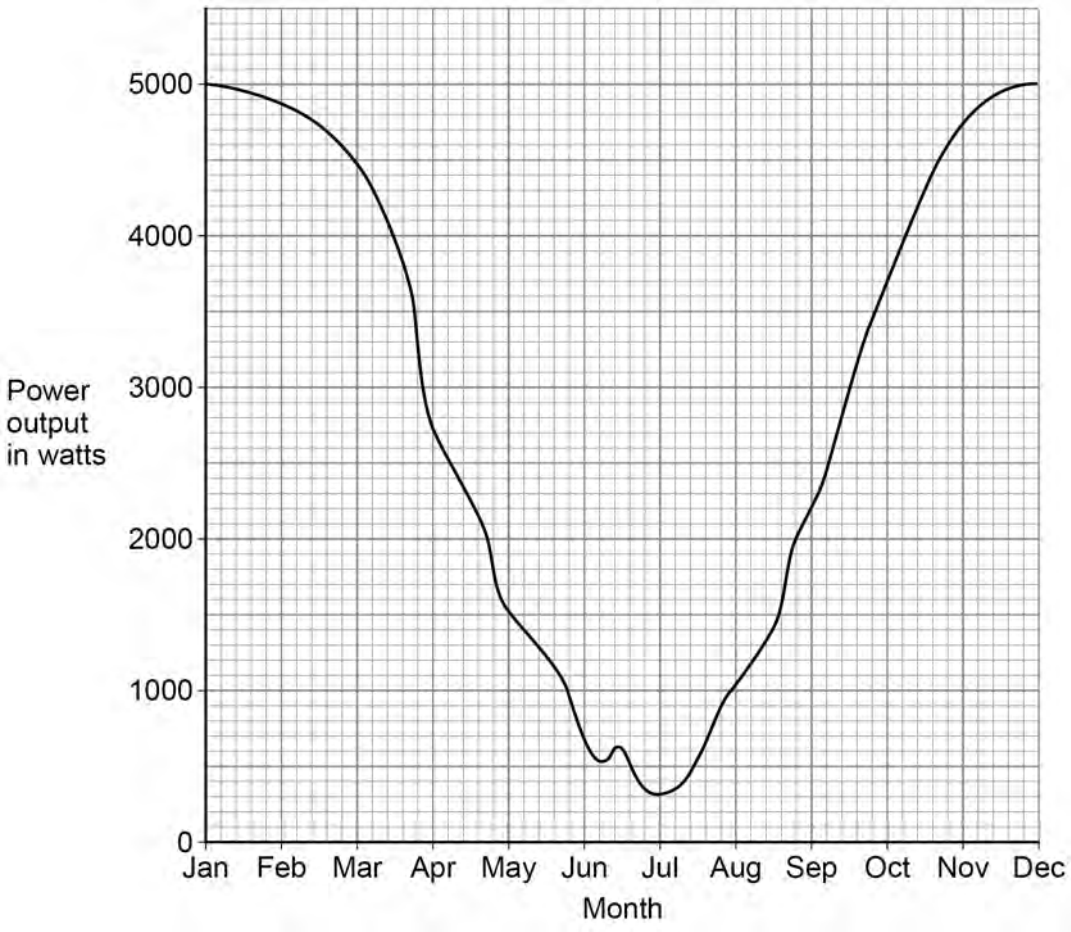
4.5.1.3 Gravity

Question 28 · continued

0 4 . 5 The hydroelectric generator is turned by falling river water.

Figure 5 shows how the power output of the hydroelectric generator varied during one year.

Figure 5



Explain **one** reason why the power output varied.

[2 marks]

10

4.5.1.3 Gravity

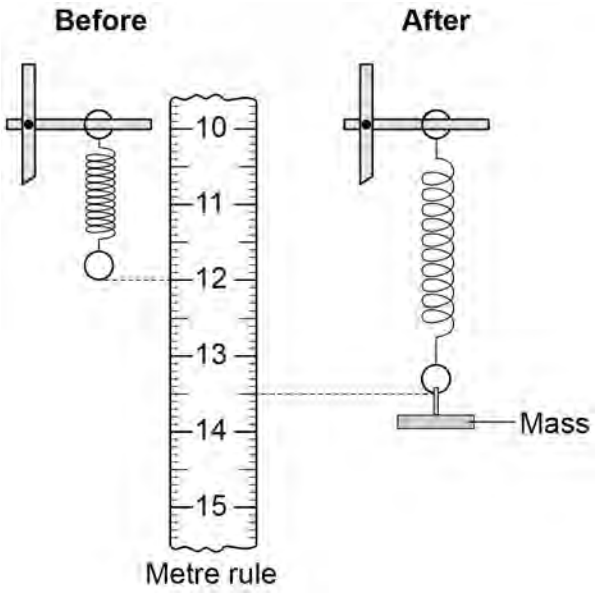
Question 29

June 2023 | 8463/2F | Original Q1

0 1 A student carried out an investigation to determine the spring constant of a spring.

Figure 1 shows the spring before and after a mass was hung from the end of the spring.

Figure 1



0 1 . 1 What is the extension of the spring in **Figure 1**?

[1 mark]

Tick (✓) **one** box.

1.5 cm ☐

3.5 cm ☐

13.5 cm ☐

Question 29 · continued

0 1 . 2 Give **one** safety precaution the student should have taken during this investigation.

[1 mark]

0 1 . 3 The student hung a mass of 0.050 kg from the spring.

gravitational field strength = 9.8 N/kg

Calculate the weight of the 0.050 kg mass.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

Weight = _____ N

0 1 . 4 The weight of the mass applies a force to the spring.

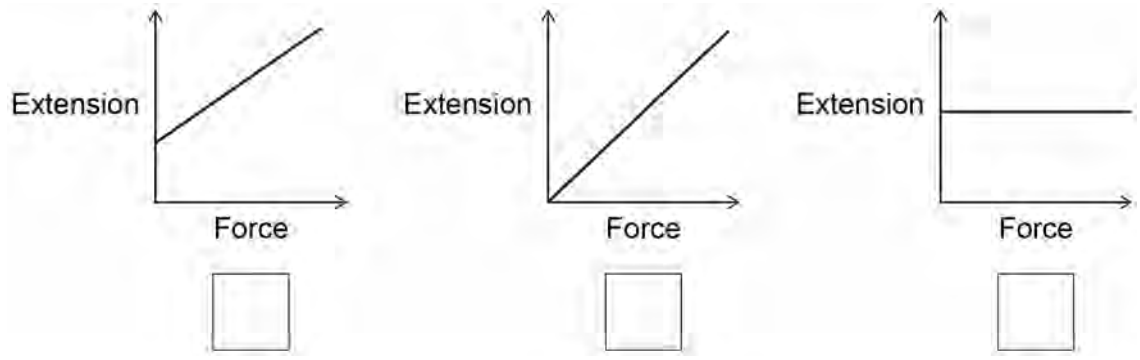
The student added more masses and recorded the extension of the spring.

Which graph in **Figure 2** shows the relationship between the force applied to the spring and the extension of the spring?

[1 mark]

Tick (✓) **one** box.

Figure 2



4.5.1.3 Gravity

Question 29 · continued

0 1 . 5 A force of 2.0 N was applied to a different spring.

The extension of the spring was 0.080 m.

Calculate the spring constant of the spring.

Use the equation:

$$\text{spring constant} = \frac{\text{force}}{\text{extension}}$$

[2 marks]

Spring constant = _____ N/m

7

4.5.1.3 Gravity

Question 30

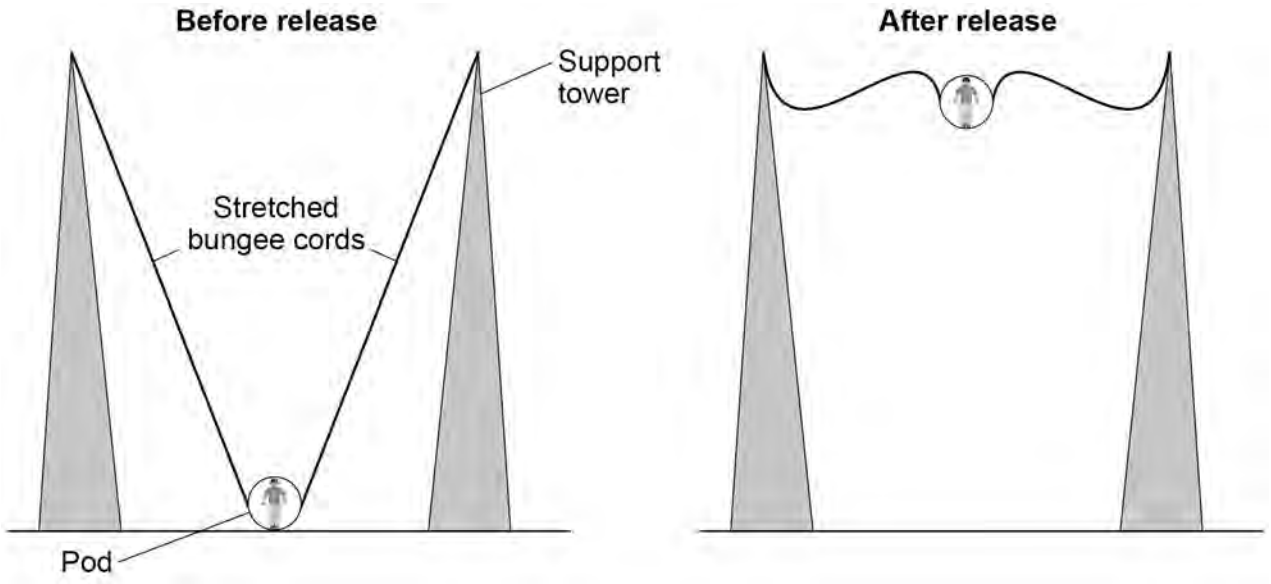
June 2024 | 8463/1F | Original Q3

0 3 In a ride at a theme park, a person is strapped into a pod that is attached to two stretched bungee cords.

The bungee cords behave like springs.

Figure 7 shows a person using the ride.

Figure 7



0 3 . 1 How is the extension of each bungee cord calculated?

[1 mark]

Tick (✓) **one** box.

stretched length + original length ☐

stretched length – original length ☐

stretched length × original length ☐

stretched length ÷ original length ☐

Question 30 · continued

0 3 . 2 Before the pod is released, the extension of each bungee cord is 7.5 m.

spring constant of the bungee cord = 800 N/m

Calculate the elastic potential energy stored in each stretched bungee cord.

Use the equation:

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

[2 marks]

Elastic potential energy = _____ J

0 3 . 3 The maximum speed of the pod is 15 m/s.

The mass of the pod is 240 kg.

Calculate the maximum kinetic energy of the pod.

Use the equation:

kinetic energy = 0.5 × mass × (speed)^2

[2 marks]

Maximum kinetic energy = _____ J

Question 30 · continued

Use the Physics Equations Sheet to answer questions **03.4** and **03.5**.

0 3 . 4 Which equation links gravitational field strength (g), gravitational potential energy (E_p), height (h) and mass (m)?

[1 mark]

Tick (✓) **one** box.

$E_p = \frac{m \times g}{h}$ ☐

$E_p = \frac{m}{g \times h}$ ☐

$E_p = m \times g \times h$ ☐

0 3 . 5 The pod has 24 000 J of gravitational potential energy when at its maximum height.

The mass of the pod is 240 kg.

gravitational field strength = 9.8 N/kg

Calculate the maximum height reached by the pod.

[3 marks]

Maximum height = _____ m

Question 3 continues on the next page

4.5.1.3 Gravity

Question 30 · continued

0 3 . 6 Why is the maximum gravitational potential energy of the pod less than the initial elastic potential energy of the bungee cords?

[2 marks]

Tick (✓) **two** boxes.

- Energy is created. ☐
- Energy is destroyed. ☐
- Energy is transferred to the surroundings. ☐
- Work is done against air resistance. ☐
- Work is done by the force of gravity. ☐
- Work is done by the person in the pod. ☐

11

4.5.1.3 Gravity

Question 31

June 2024 | 8463/2F | Original Q7

0 7 A swimming pool is being filled with water.

0 7 . 1 Calculate the weight of the water in the swimming pool when the mass of the water is 25 000 kg.

gravitational field strength = 9.8 N/kg

Use the equation:

weight = mass × gravitational field strength

[2 marks]

Weight = _____ N

Question 31 · continued

0 7 . 2 When the swimming pool is full, the weight of the water is 1 960 000 N.

The bottom of the swimming pool has an area of 49 m^2.

Calculate the pressure at the bottom of the swimming pool when it is full.

Use the equation:

$$\text{pressure} = \frac{\text{weight}}{\text{area}}$$

Choose the unit from the box.

[3 marks]

m^2	**m^3**	**N**	**Pa**

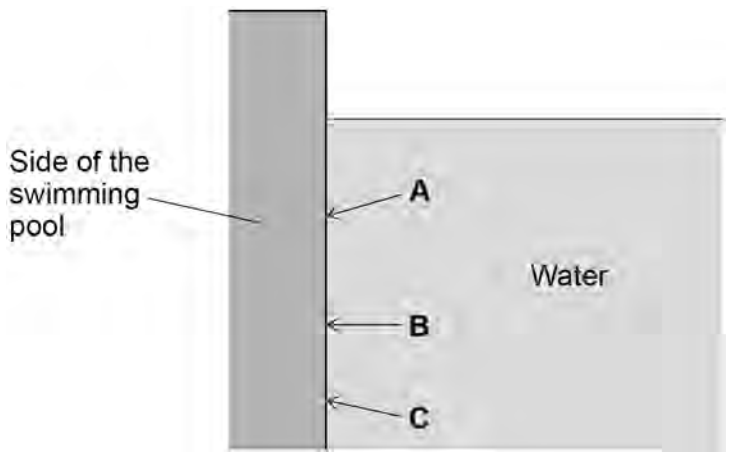
Pressure = _____ Unit _____

Question 7 continues on the next page

0 7 . 3 There is a force acting on the side of the swimming pool because of the water pressure.

Figure 11 shows the side of the swimming pool.

Figure 11



Which arrow shows the direction of the force acting on the side of the swimming pool?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐

0 7 . 4 A child is swimming in the pool. The velocity of the child is 0.70 m/s.

The child then accelerates for 5.0 s, reaching a final velocity of 1.3 m/s.

Calculate the acceleration of the child.

Use the equation:

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

[2 marks]

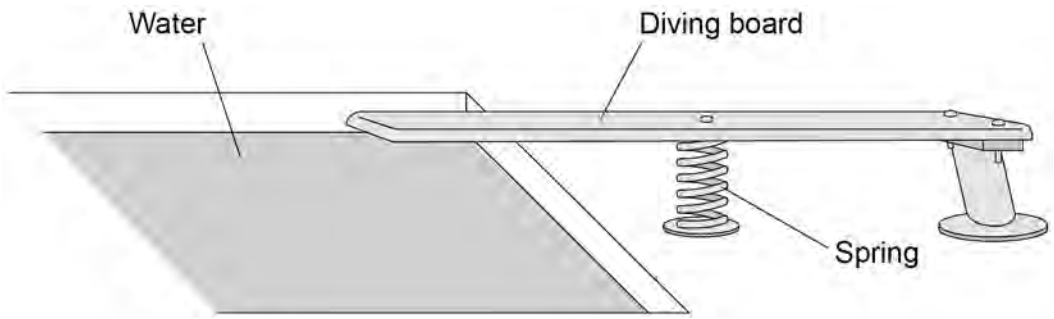
Acceleration = _____ m/s^2

4.5.1.3 Gravity

Question 31 · continued

Figure 12 shows a diving board at the side of the swimming pool.

Figure 12



0 7 . 5 The original length of the spring is 0.84 m.

When the child stands on the diving board, the length of the spring decreases by 0.21 m.

Calculate the percentage change in the length of the spring.

[2 marks]

Percentage change in length = _____ %

Question 7 continues on the next page

4.5.1.3 Gravity

Question 31 · continued

Use the Physics Equations Sheet to answer questions **07.6** and **07.7**.

0 7 . 6 Write down the equation which links extension (*e*), force applied to a spring (*F*) and spring constant (*k*).

[1 mark]

0 7 . 7 The force applied to the spring by the weight of the child is 336 N.

The change in length of the spring is 0.21 m.

Calculate the spring constant of the spring.

[3 marks]

Spring constant = _____ N/m

4.5.1.3 Gravity

Question 31 · continued

0 7 . 8 The child steps off the diving board and falls into the swimming pool.

The initial velocity of the child is 0 m/s.

acceleration due to gravity = 9.8 m/s^2

Calculate the final velocity when the child has fallen a distance of 0.95 m through the air.

Give your answer to 2 significant figures.

Use the Physics Equations Sheet.

[4 marks]

Final velocity of child (2 significant figures) = _____ m/s

18

4.5.1.3 Gravity

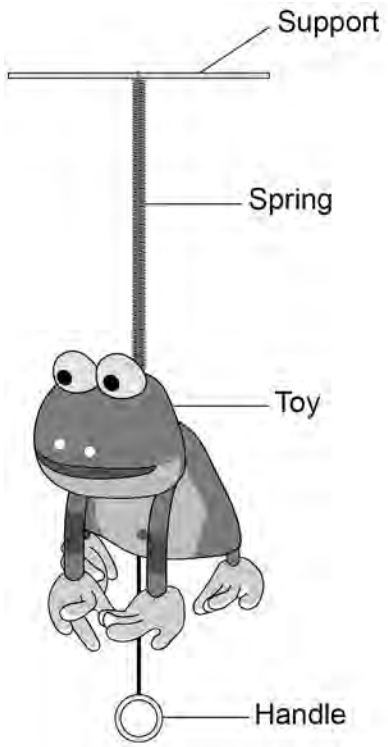
Question 32

June 2025 | 8463/1F | Original Q6

0 6 **Figure 10** shows a toy which is hung from a support.

When the handle is pulled down and then released, the toy bounces up and down.

Figure 10



0 6 . 1 When the handle is pulled down, the spring extends.

The extension of the spring is 0.35 m.

The spring constant of the spring is 5.6 N/m.

Calculate the elastic potential energy stored by the stretched spring.

Use the equation:

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

[2 marks]

Elastic potential energy = _____ J

Question 32 · continued

Use the Physics Equations Sheet to answer questions **06.2** and **06.3**.

0 6 . 2 Which equation links gravitational field strength (g), gravitational potential energy (E_p), height (h) and mass (m)?

[1 mark]

Tick (✓) **one** box.

$E_p = \frac{mg}{h}$ ☐

$E_p = \frac{m}{gh}$ ☐

$E_p = mgh$ ☐

0 6 . 3 When the handle is released, the toy moves upwards through a height of 0.60 m.

The toy has 0.294 J of gravitational potential energy in its highest position.

gravitational field strength = 9.8 N/kg

Calculate the mass of the toy.

[3 marks]

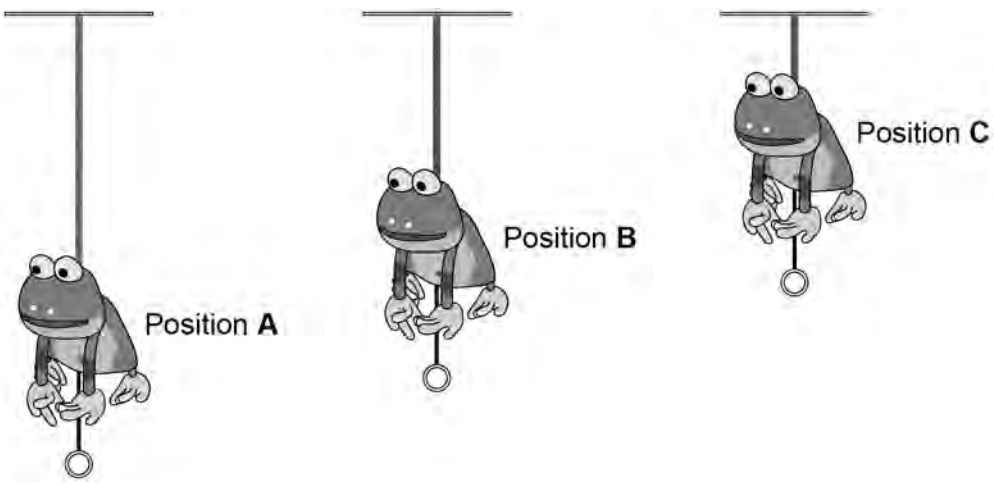
Mass of the toy = _____ kg

Question 6 continues on the next page

Question 32 · continued

Figure 11 shows the toy in three different positions.

Figure 11



The toy is released from position **A** and moves upwards.

The toy is moving upwards in position **B**.

The toy is at maximum height in position **C**.

0 6 . 4 Between position **A** and position **B**, the extension of the spring decreases.

How does the elastic potential energy stored by the spring change as the extension decreases?

[1 mark]

Tick (✓) **one** box.

Elastic potential energy decreases. ☐

Elastic potential energy stays the same. ☐

Elastic potential energy increases. ☐

4.5.1.3 Gravity

Question 32 · continued

0 6 . 5 Between position **B** and position **C**, the toy slows down.

How does the kinetic energy of the toy change as the toy slows down?

[1 mark]

Tick (✓) **one** box.

Kinetic energy decreases. ☐

Kinetic energy stays the same. ☐

Kinetic energy increases. ☐

0 6 . 6 How does the gravitational potential energy of the toy change as the toy moves from position **B** to position **C**?

[1 mark]

Tick (✓) **one** box.

Gravitational potential energy decreases. ☐

Gravitational potential energy stays the same. ☐

Gravitational potential energy increases. ☐

Question 6 continues on the next page

4.5.1.3 Gravity

Question 32 · continued

0 6 . 7 The toy moves up and down many times before eventually stopping.

Which **two** of the following are reasons why the toy eventually stops?

[2 marks]

Tick (✓) **two** boxes.

- Air resistance opposes the motion of the toy. ☐
- Energy is destroyed. ☐
- Energy is transferred to the surroundings. ☐
- The gravitational field strength decreases. ☐
- The spring loses its elasticity. ☐

11

4.5.1.3 Gravity

Question 33

June 2025 | 8463/2F | Original Q2

0 2 Very long trains can be pulled by more than one engine.

A train is made up of four engines pulling trucks filled with coal.

0 2 . 1 The coal in one truck has a mass of 75 000 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the coal in **one** truck.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

Weight = _____ N

0 2 . 2 **One** engine exerts a forward force of 850 000 N.

Calculate the work done by **one** engine when the train moves a distance of 80 m.

Use the equation:

work done = force × distance moved

[2 marks]

Work done = _____ J

0 2 . 3 Each of the four engines exerts a forward force of 850 000 N on the trucks.

Calculate the total forward force on the trucks.

[2 marks]

Total forward force = _____ N

0 2 . 4 The force exerted by the engines on the trucks is a contact force.

Which of the following is also a contact force?

[1 mark]

Tick (✓) **one** box.

- Electrostatic force ☐
- Frictional force ☐
- Gravitational force ☐

Question 2 continues on the next page

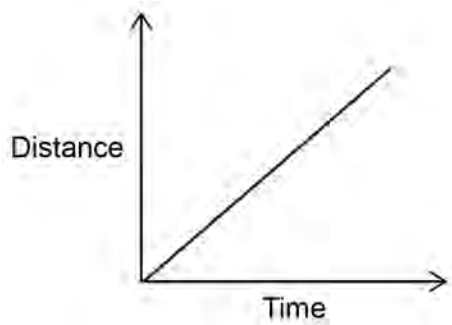
4.5.1.3 Gravity

Question 33 · continued

0 2 . 5 Which sketch graph represents the train moving at a constant speed?

[1 mark]

Tick (✓) **one** box.



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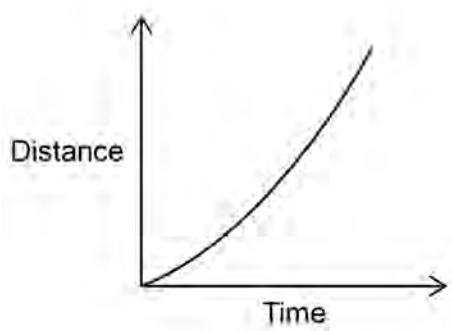

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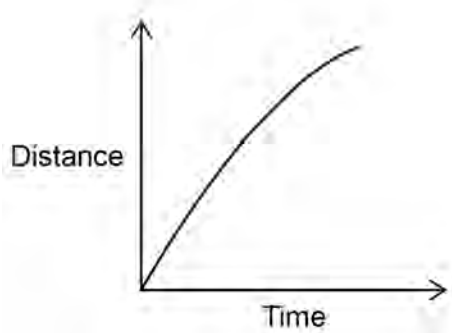

☐

4.5.1.3 Gravity

Question 33 · continued

0 2 . 6 The train accelerates for 150 s.

The velocity of the train changes from 16 m/s to 25 m/s.

Calculate the acceleration of the train.

Use the equation:

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

[3 marks]

Acceleration = _____ m/s^2

11

Turn over for the next question