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Candidate number

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Candidate signature

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I declare this is my own work.

# GCSE COMBINED SCIENCE: TRILOGY

# F

Foundation Tier  
Physics Paper 2F

Friday 12 June 2020

Morning

Time allowed: 1 hour 15 minutes

## Materials

For this paper you must have:

- a protractor
- a ruler
- a scientific calculator
- the Physics Equations Sheet (enclosed).

## Instructions

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- In all calculations, show clearly how you work out your answer.

## Information

- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
<b>TOTAL</b>	



0 1

**Figure 1** shows a girl bowling a ball along a ten-pin bowling lane.

**Figure 1**



The girl is trying to knock down the ten pins at the end of the bowling lane.

As the ball travels along the lane the velocity of the ball decreases.

0 1 1

Velocity is a vector.

Which statement describes a vector?

**[1 mark]**

Tick (✓) **one** box.

Vectors have direction only.

Vectors have magnitude and direction.

Vectors have magnitude only.



**0 1 . 2** Why does the velocity of the ball decrease as the ball travels along the lane?

**[1 mark]**

Tick (✓) **one** box.

The force of gravity slows the ball down.

There are no forces acting on the ball.

There is a resultant force acting on the ball.

**0 1 . 3** The ball travels along the lane at an average speed of 4.5 m/s

It takes the ball 4.0 seconds to travel the length of the lane.

Calculate the length of the lane.

Use the equation:

$$\text{distance travelled} = \text{speed} \times \text{time}$$

**[2 marks]**

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Length of the lane = \_\_\_\_\_ m

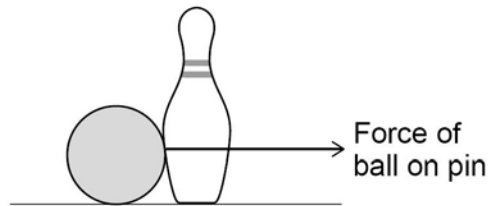
**Question 1 continues on the next page**

**Turn over ►**



**Figure 2** shows the ball hitting one of the pins.

**Figure 2**



**0 1 . 4** Draw an arrow on **Figure 2** to show the force of the pin on the ball.

**[2 marks]**

**0 1 . 5** The velocity of the pin changes from 0 to 12 m/s  
It takes 0.15 seconds for the velocity to change.

Calculate the acceleration of the pin.

Use the equation:

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

**[2 marks]**

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Acceleration = \_\_\_\_\_ m/s<sup>2</sup>



0 1 . 6 When the pin is struck it accelerates.

Complete the sentences.

Choose answers from the box.

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

[3 marks]

decreases

increases

stays the same

The displacement of the pin from the girl \_\_\_\_\_ .

The mass of the pin \_\_\_\_\_ .

The kinetic energy of the pin \_\_\_\_\_ .

11

Turn over for the next question

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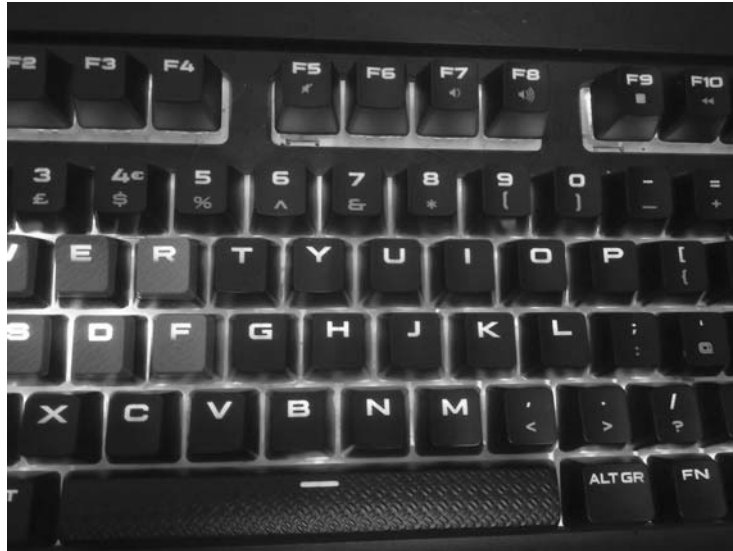


0 2

**Figure 3** shows a computer keyboard.

There is a spring under each key.

**Figure 3**



0 2 . 1

Why do the keys have springs under them?

[1 mark]

Tick (✓) **one** box.

Springs make the keys easier to press.

Springs make the keys lighter.

Springs push the keys back to their original position.

0 2 . 2

Why does every spring used in the keyboard have the same spring constant?

[1 mark]

Tick (✓) **one** box.

So that more than one key can be pressed at the same time.

So that the same force is needed to press each key.

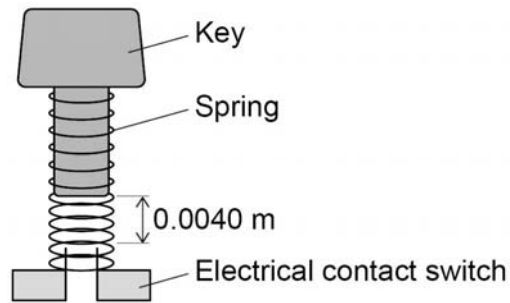
So that the springs are all the same length.

Turn over ►



Figure 4 shows one of the keys and its spring.

Figure 4



0 2 . 3

What happens to the length of the spring when the key is pressed?

[1 mark]

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0 2 . 4

How far must the key move before it touches the switch?

[1 mark]

Tick (✓) **one** box.

4.0 mm       4.0 cm       4.0  $\mu\text{m}$

0 2 . 5

If a key is not pressed with enough force, no signal is sent to the computer.

Explain why.

[2 marks]

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0 2 . 6

The spring in **Figure 4** has a spring constant of 200 N/m

Calculate the force on the spring when the key moves a distance of 0.0040 m

Use the equation:

$$\text{force} = \text{spring constant} \times \text{compression}$$

[2 marks]

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Force = \_\_\_\_\_ N

0 2 . 7

Suggest **two** ways the spring in the key in **Figure 4** could be changed so that the switch can be closed more quickly.

[2 marks]

1 \_\_\_\_\_

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2 \_\_\_\_\_

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10

**Turn over for the next question**

**Turn over ►**



0 3

X-rays and gamma rays are types of electromagnetic waves.

X-rays are used for medical imaging.

0 3 . 1

Which substance will **not** absorb X-rays?

[1 mark]

Tick (✓) **one** box.

Bone       Metal       Skin

**Table 1** shows the effect of exposure to different doses of radiation.

**Table 1**

Dose in mSv	Effect on the human body
100	slightly increased risk of cancer
1000	5% increased risk of cancer
5000	high risk of death

0 3 . 2

During one X-ray a person receives a dose of 0.100 mSv

Why is this dose unlikely to harm the person?

[1 mark]

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0 3 . 3

A doctor takes an X-ray photograph of a person.

When taking the X-ray photograph, the doctor stands behind a screen.

Suggest why.

[1 mark]

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**0 3 . 4** Which of the following are gamma rays used for?

**[1 mark]**

Tick (✓) **one** box.

Cooking food

Energy-efficient lamps

Sterilising medical equipment

**0 3 . 5** Why are gamma rays and X-rays harmful to humans?

**[1 mark]**

Tick (✓) **one** box.

They are ionising

They are radioactive

They travel at the speed of light

**0 3 . 6** Electromagnetic waves are also used in communications.

Describe how microwaves and visible light are used in communications.

**[4 marks]**

Microwaves \_\_\_\_\_

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Visible light \_\_\_\_\_

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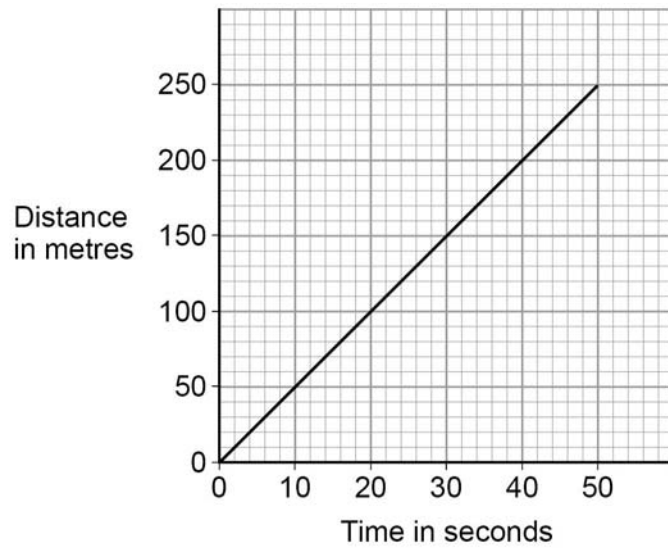
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0 4

Figure 5 shows a distance-time graph for 50 seconds of a bicycle ride.

Figure 5



0 4 . 1

The gradient of the distance-time graph gives the speed of the bicycle.

Determine the speed of the bicycle.

[2 marks]

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Speed = \_\_\_\_\_ m/s



**0 4 . 2** Which force acting on the moving bicycle is a non-contact force?

**[1 mark]**

Tick (✓) **one** box.

Air resistance

Friction

Gravitational force

Normal contact force

**0 4 . 3** The bicycle travels a distance of 250 m

The bicycle exerts a constant horizontal force of 30 N on the ground.

Calculate the work done.

Use the equation:

$$\text{work done} = \text{force} \times \text{distance}$$

Choose the unit from the box.

**[3 marks]**

**J**

**kg**

**m**

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Work done = \_\_\_\_\_ Unit \_\_\_\_\_

**Turn over ►**



0 4 . 4

The bicycle travels at a constant speed.

Complete the sentences.

Choose answers from the box.

**[3 marks]**

<b>chemical</b>	<b>frictional</b>	<b>kinetic</b>
<b>magnetic</b>		<b>tension</b>

As the bicycle moves, work is done against \_\_\_\_\_ forces.

There is no change in the cyclist's \_\_\_\_\_ store of energy.

There is a decrease in the cyclist's \_\_\_\_\_ store of energy.

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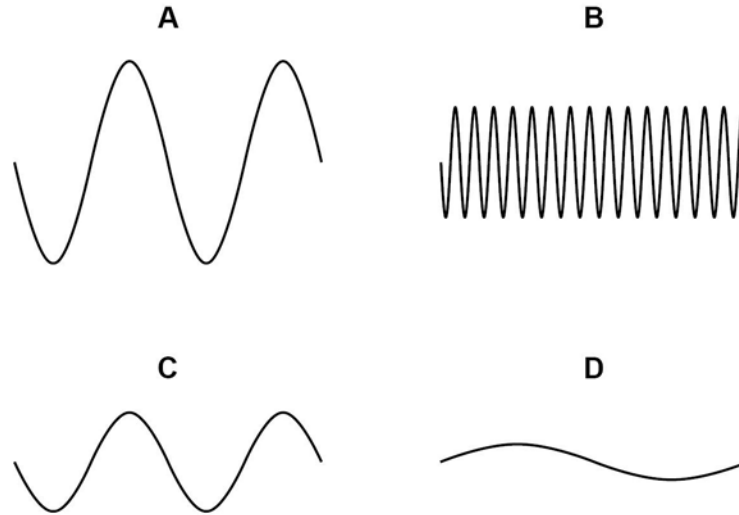
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0 5

**Figure 6** shows four waves.

The waves are drawn to the same scale.

**Figure 6**



0 5

1

Which wave has the greatest amplitude?

[1 mark]

Tick (✓) **one** box.

A       B       C       D

0 5

2

Which wave has the greatest frequency?

[1 mark]

Tick (✓) **one** box.

A       B       C       D

0 5

3

Which wave has the greatest wavelength?

[1 mark]

Tick (✓) **one** box.

A       B       C       D

Turn over ►



0 5 . 4

A wave has a frequency of 1650 Hz and a wavelength of 0.200 m

Calculate the wave speed.

Use the equation:

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

[2 marks]

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Wave speed = \_\_\_\_\_ m/s

A student uses a mobile phone app that displays sound waves.

**Figure 7** shows the student holding the mobile phone close to a loudspeaker.

**Figure 7**

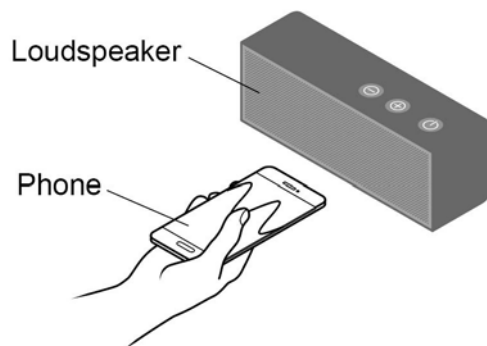
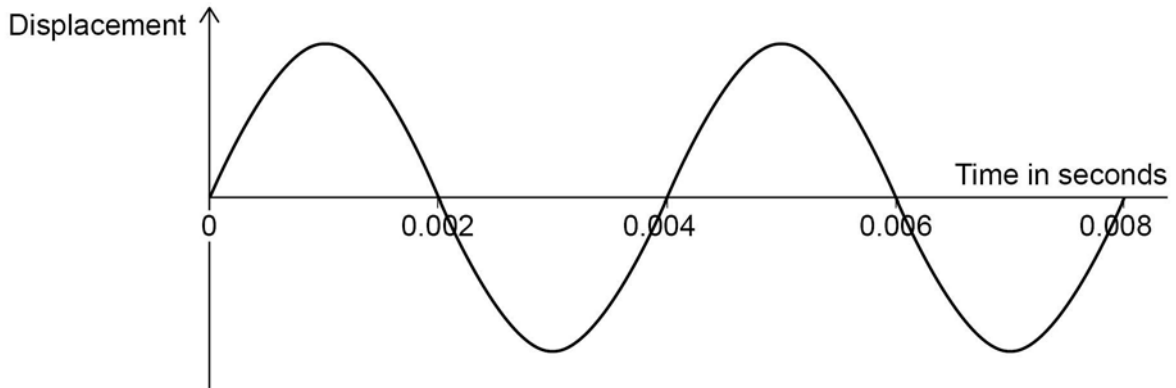




Figure 8 shows the wave pattern seen on the phone screen.

Figure 8



0 5 . 5

What is the period of the wave shown in Figure 8?

[1 mark]

Tick (✓) **one** box.

0.002 s

0.004 s

0.006 s

0.008 s

0 5 . 6

Determine the frequency of the wave shown in Figure 8.

Use the Physics Equations Sheet.

[3 marks]

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Frequency = \_\_\_\_\_ Hz

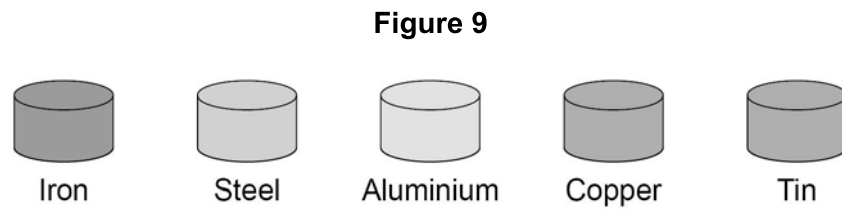
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0 6

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



0 6 . 1

A student placed a magnet close to each metal sample.

Describe what happened.

[2 marks]

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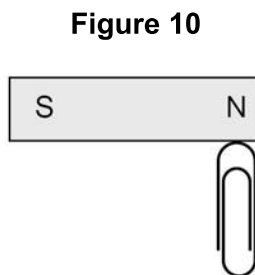


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**Figure 10** shows a paper clip being attracted to a permanent magnet.



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]

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0 6 . 3

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

**[1 mark]**

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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]**

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Force = \_\_\_\_\_ N

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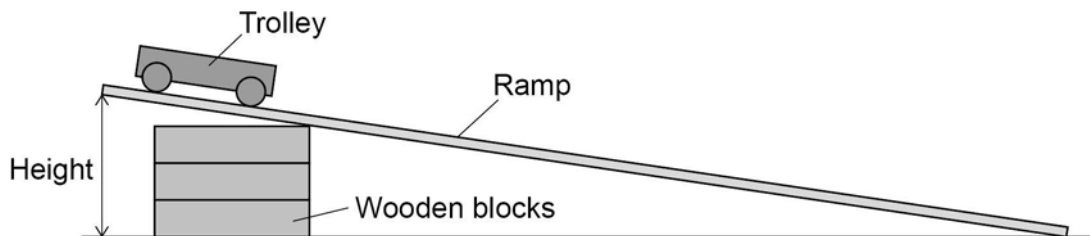
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0 7

A student investigated how the height of a ramp affects the acceleration of a trolley down the ramp.

Figure 11 shows some of the equipment used.

Figure 11



0 7 . 1

Plan an investigation to determine how the height of the ramp affects the acceleration of the trolley.

[6 marks]

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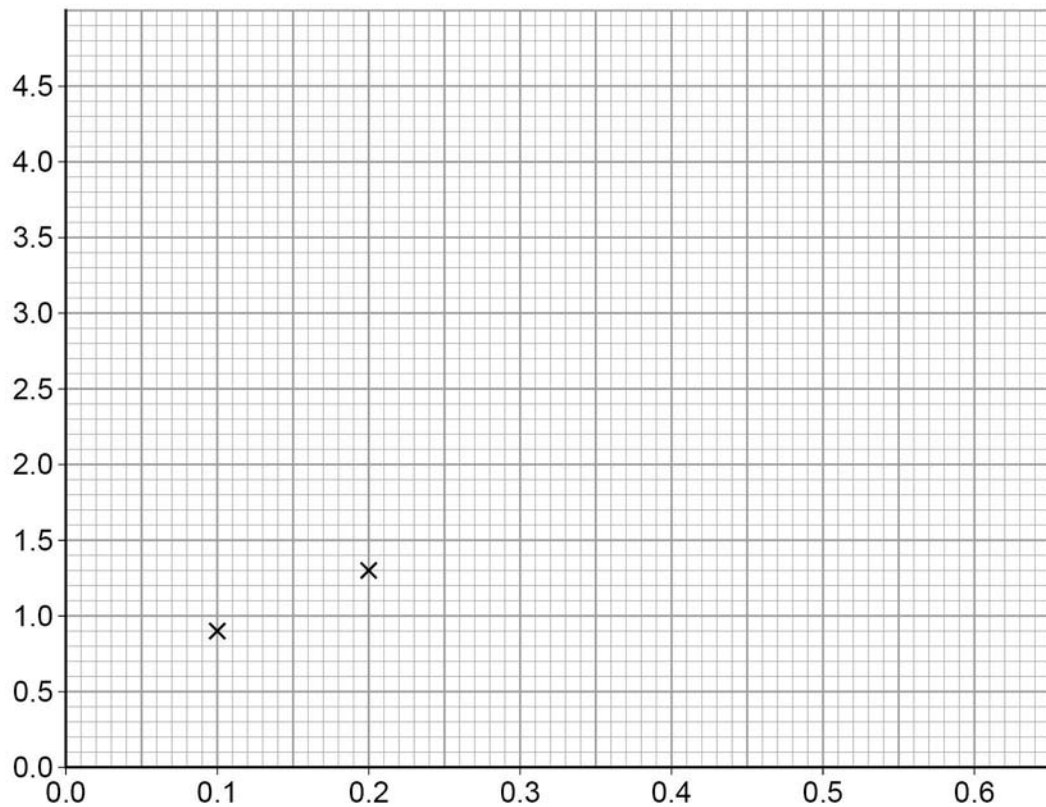
**Table 2** shows the results.

**Table 2**

<b>Height of ramp in metres</b>	0.1	0.2	0.3	0.4	0.5	0.6
<b>Acceleration in <math>\text{m/s}^2</math></b>	0.9	1.3	2.1	3.2	3.9	4.3

The first two results have been plotted on **Figure 12**.

**Figure 12**



**0 7 . 2**

Complete **Figure 12**.

You should:

- label the axes
- plot the remaining results from **Table 2**
- draw a line of best fit.

**[4 marks]**

**Question 7 continues on the next page**

**Turn over ►**



0	7	.	3
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Write down the equation that links acceleration ( $a$ ), mass ( $m$ ) and resultant force ( $F$ ).**[1 mark]**

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0	7	.	4
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When the resultant force on the trolley was 0.63 N the acceleration of the trolley was  $2.1 \text{ m/s}^2$ 

Calculate the mass of the trolley.

**[3 marks]**

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Mass of trolley = \_\_\_\_\_ kg

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**END OF QUESTIONS**

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