



Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

GCSE

COMBINED SCIENCE: SYNERGY

Higher Tier

Paper 4 Physical sciences

H

8465/4H

Wednesday 12 June 2019 Morning

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]



For this paper you must have:

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

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Answer ALL questions in the spaces provided. Do not write on blank pages.**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **In all calculations, show clearly how you work out your answer.**



INFORMATION

- **The maximum mark for this paper is 100.**
- **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.**

DO NOT TURN OVER UNTIL TOLD TO DO SO



Answer ALL questions in the spaces provided.

0 1

FIGURE 1, on the opposite page, shows a crane being used to lift a shipping container.

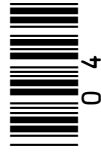
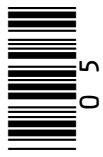
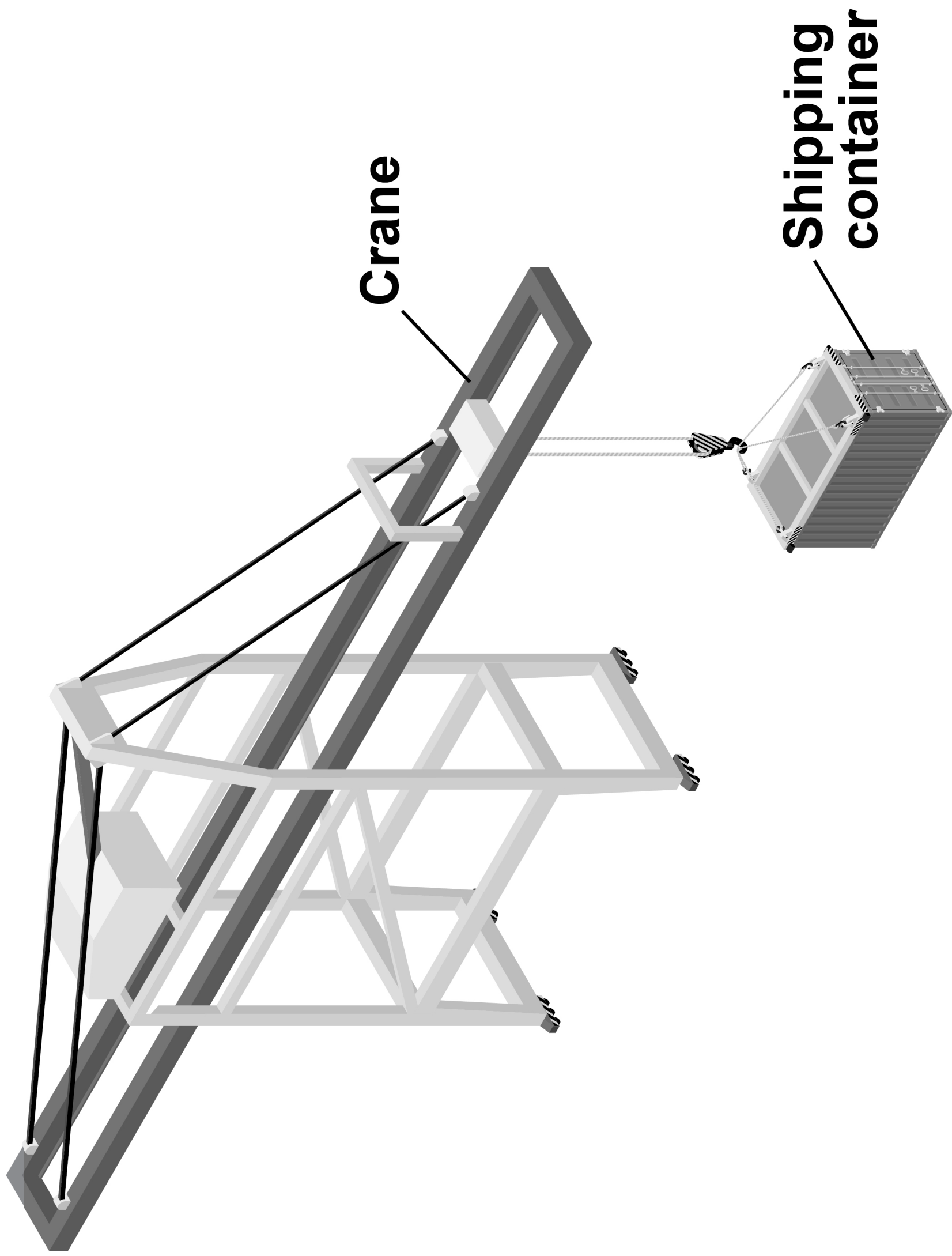


FIGURE 1



0	1	.	1
---	---	---	---

Write the equation which links distance, force and work done. [1 mark]

01.2

The container was lifted a height of 14 m

The crane did 3 430 000 J of work on the container.

Calculate the force exerted by the crane on the container. [3 marks]

Force = _____ N

[Turn over]

0	1	.	3
---	---	---	---

Write the equation which links power, time and work done. [1 mark]

0	1	.	4
---	---	---	---

The power of the crane was 68 600 W

Calculate the time taken for the crane to do 3 430 000 J of work.

Give the unit. [4 marks]

Time taken = _____

Unit _____

[Turn over]

9



0 2

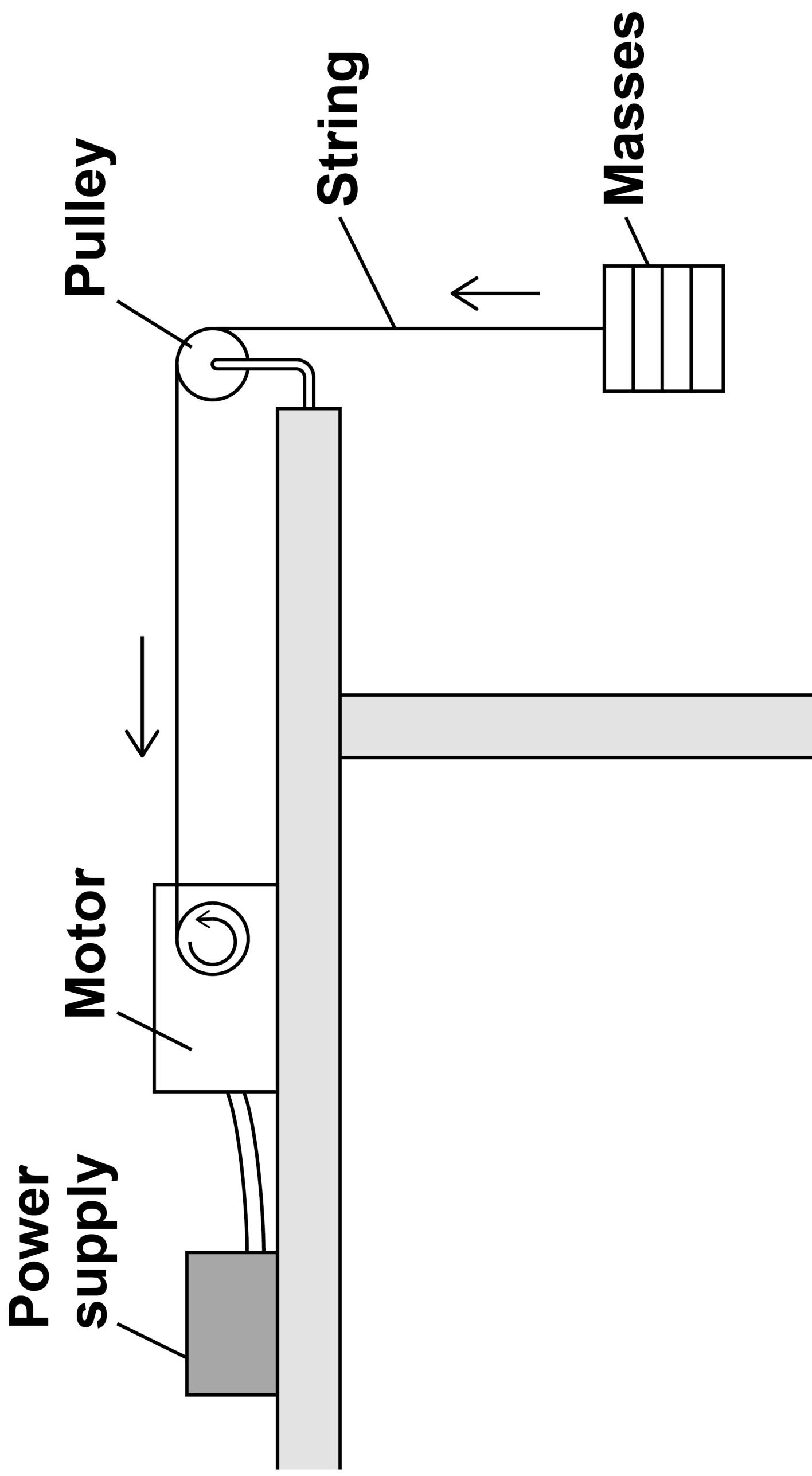
A student used an electric motor to lift a mass.

He investigated how the efficiency of the motor varied with the mass lifted.

FIGURE 2, on the opposite page, shows the apparatus used.



FIGURE 2



[Turn over]



0	2	.	1
---	---	---	---

Energy is transferred to the electric motor by the power supply.

**Why is the energy transferred to the motor greater than the gravitational potential energy gained by the mass?
[2 marks]**

Tick (✓) TWO boxes.

Energy is not conserved

Friction in the motor causes energy transfer to the surroundings

The temperature of the motor increases

Thermal energy from the surroundings is transferred to the mass

Wasted energy is destroyed



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[Turn over]



0	2	.	2
---	---	---	---

The student calculated the gravitational potential energy gained by different masses as they were lifted.

The student used the equation:

**gravitational potential energy =
mass \times 9.8 \times height**

Describe how the student could make accurate measurements to use in the calculations. [4 marks]

0 2 . 3

**Write the equation which links efficiency, total input energy transfer and useful output energy transfer.
[1 mark]**

[Turn over]

0 2 . 4

The efficiency of the motor was 15%.

The student calculated that the useful output energy transfer was 1.20 J

**Calculate the total input energy transfer.
[4 marks]**

Total input energy transfer =

_____ **J**

[Turn over]

11

0	3
---	---

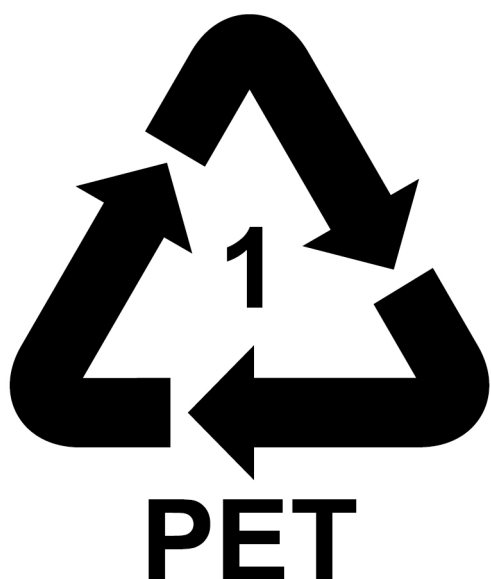
Some drinks containers are made from aluminium. Other drinks containers are made from a polymer called PET.

Both aluminium and PET can be recycled.

0	3	.	1
---	---	---	---

FIGURE 3 shows the recycling symbol for PET.

FIGURE 3



Suggest why this symbol is used on a PET bottle. [1 mark]

[Turn over]

0	3	.	2
---	---	---	---

50 000 000 kg of aluminium are used each year to make drinks cans.

70% of these aluminium cans are recycled.

Calculate the mass of aluminium that is recycled each year from drinks cans.

**Give your answer in standard form.
[3 marks]**

Mass = _____ kg



03.3

TABLE 1, on pages 22 and 23, gives information about the Life Cycle Assessments (LCAs) of two types of drinks containers.

[Turn over]



TABLE 1

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[Turn over]

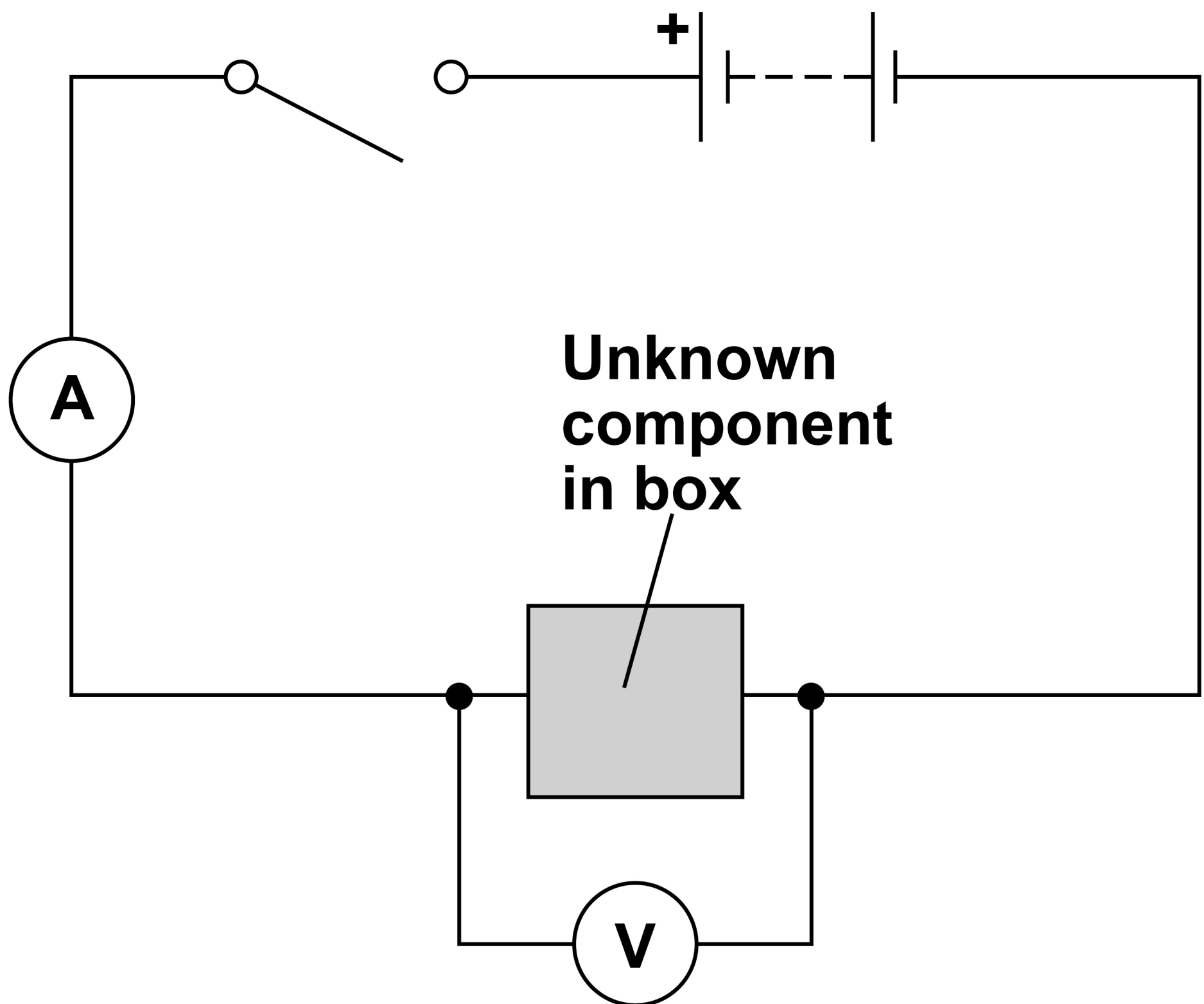


04

A teacher gave a student an unknown electrical component hidden in a box.

The student connected the box in the circuit shown in FIGURE 4.

FIGURE 4



0	4	.	1
---	---	---	---

The student measured the potential difference across the component and the current in the component.

She repeated this for several values of potential difference.

Give ONE way the circuit could be altered so that the potential difference across the component could be varied. [1 mark]

[Turn over]

BLANK PAGE



0 4 . 2

**Explain why the student needed to switch the circuit off between readings.
[2 marks]**

[Turn over]

TABLE 2 shows the student's results.

TABLE 2

Potential difference in volts	Current in amps
0.00	0.00
0.20	0.00
0.40	0.00
0.60	0.13
0.80	0.68
1.00	1.50

0	4	.	3
---	---	---	---

What was the resolution of the ammeter? [1 mark]

Tick (✓) ONE box.

0.01 A

0.05 A

0.10 A

1.50 A

[Turn over]



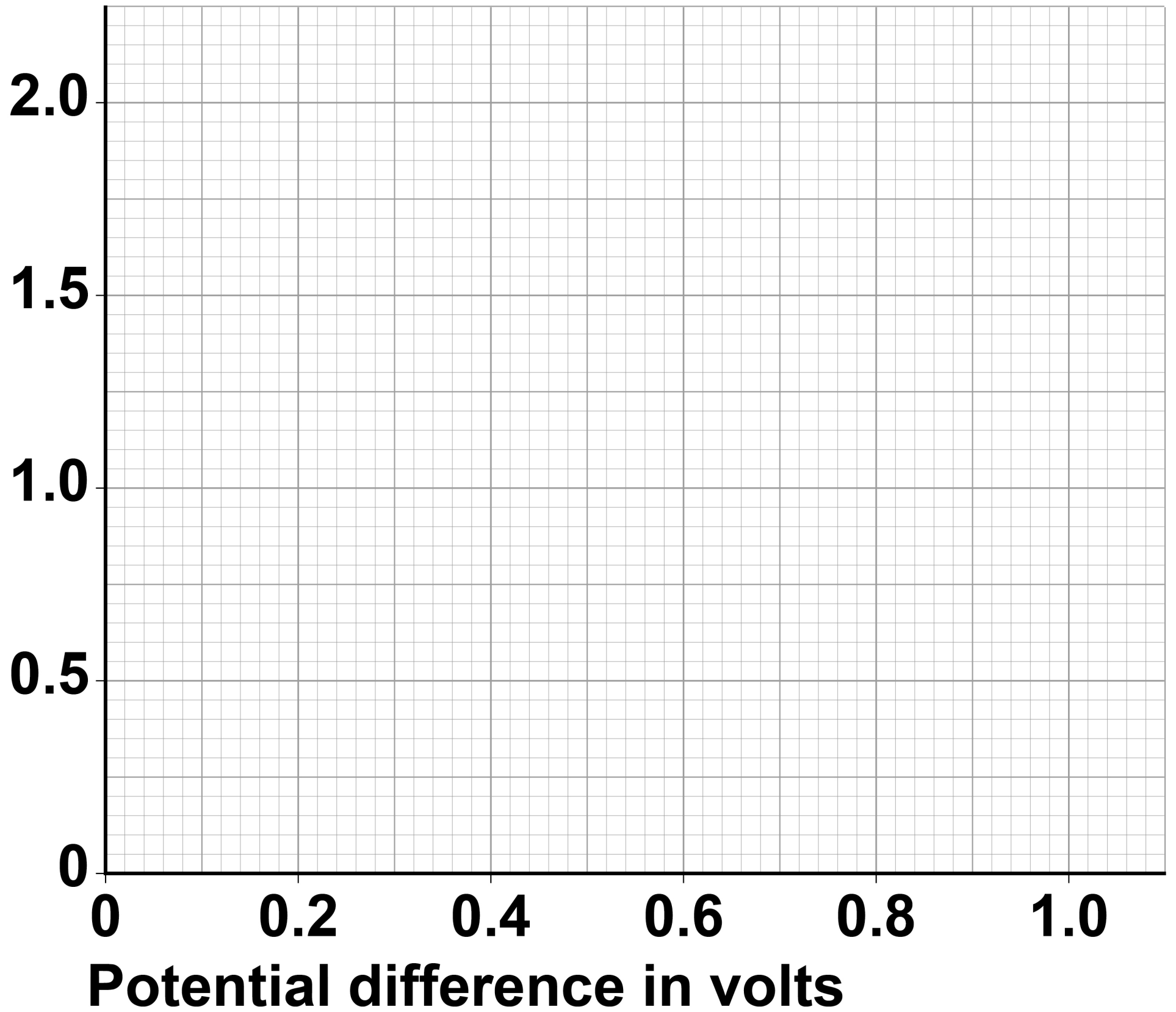
0	4	.	4
---	---	---	---

Complete FIGURE 5 on the opposite page.

You should:

- **plot the data from TABLE 2 on page 30**
- **draw a line of best fit.**

[3 marks]

FIGURE 5**Current
in amps****[Turn over]**

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0	4	.	5
---	---	---	---

**What was the unknown electrical component given to the student?
[1 mark]**

Tick (✓) ONE box.

Diode

Filament lamp

Resistor

Thermistor

[Turn over]

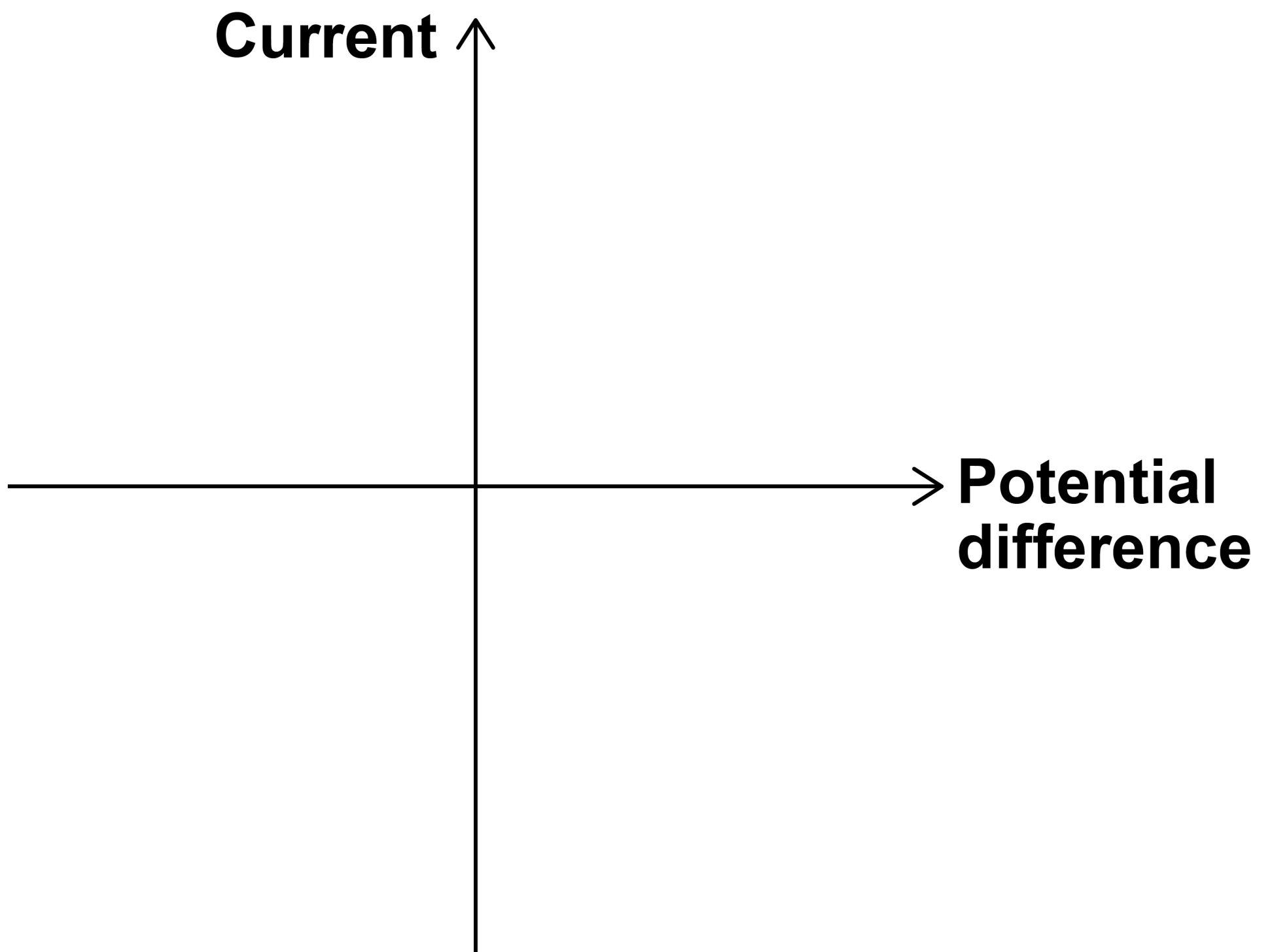


0	4	.	6
---	---	---	---

An ohmic conductor has constant resistance when its temperature is constant.

Sketch a current-potential difference graph for an ohmic conductor at constant temperature on FIGURE 6, on the opposite page. [2 marks]

FIGURE 6



10

[Turn over]



0	5
---	---

One type of indigestion tablet contains:

- **calcium carbonate**
- **magnesium carbonate**
- **non-active ingredients.**

0	5	.	1
---	---	---	---

Peppermint oil is one of the non-active ingredients in the tablet.

Suggest why peppermint oil is used in the tablet. [1 mark]

05.2

In one indigestion tablet the mass of magnesium carbonate is 64.0 mg

Calculate the number of moles of magnesium carbonate in this indigestion tablet.

Give your answer to 3 significant figures.

Relative formula mass (M_r) of magnesium carbonate = 84

[3 marks]

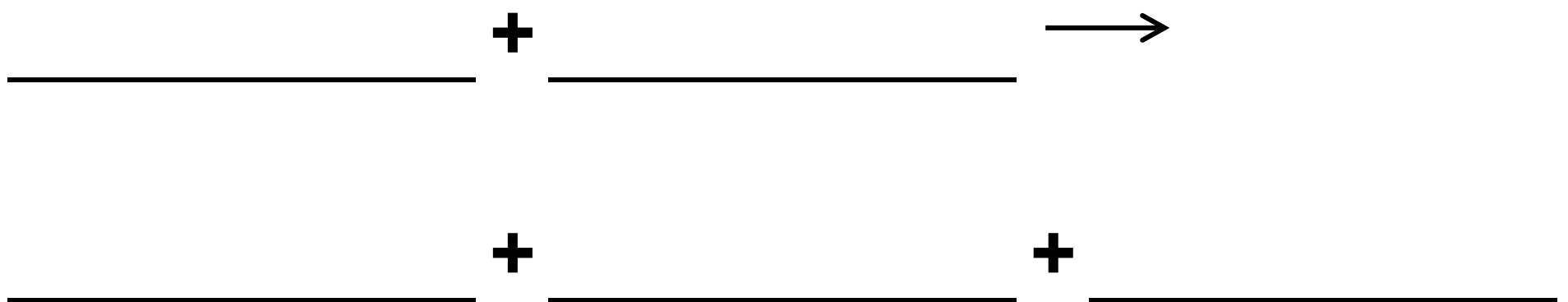
Number of moles = _____



0	5	.	3
---	---	---	---

Magnesium carbonate (MgCO_3) in the tablet reacts with hydrochloric acid (HCl) in the stomach.

Write a balanced chemical equation for the reaction. [3 marks]



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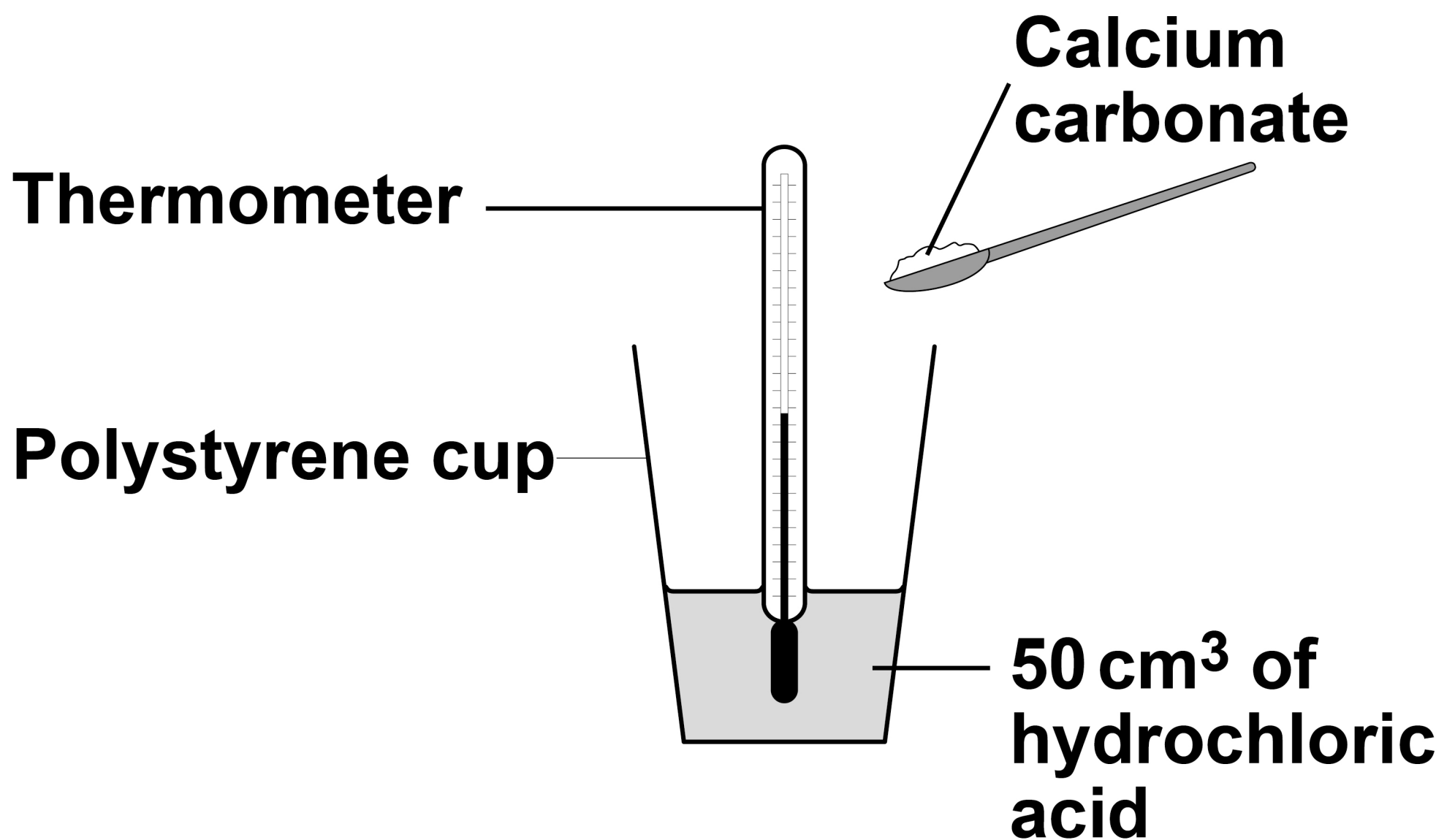
[Turn over]



A student investigated the temperature change when different masses of calcium carbonate were reacted with hydrochloric acid.

FIGURE 7 shows the apparatus used.

FIGURE 7



This is the method used.

- 1. Add 50 cm³ of hydrochloric acid to a polystyrene cup.**
- 2. Record the temperature of the hydrochloric acid.**
- 3. Add 1 g of calcium carbonate to the hydrochloric acid.**
- 4. Stir the mixture.**
- 5. Record the highest temperature of the mixture.**
- 6. Repeat steps 1–5 with different masses of calcium carbonate.**

[Turn over]



0	5	.	4
---	---	---	---

What was the dependent variable in this investigation? [1 mark]

0 5 . 5

Suggest TWO changes to the investigation that would improve the accuracy of the results.

Give a reason why each change would improve the accuracy. [4 marks]

Change 1 _____

Reason _____

Change 2 _____

Reason _____

[Turn over]



BLANK PAGE



0	5	.	6
---	---	---	---

How should the results of the investigation be displayed?

Give a reason for your answer. [2 marks]

Tick (✓) ONE box.

Bar chart

Histogram

Line graph

Pie chart

Reason _____

[Turn over]

14



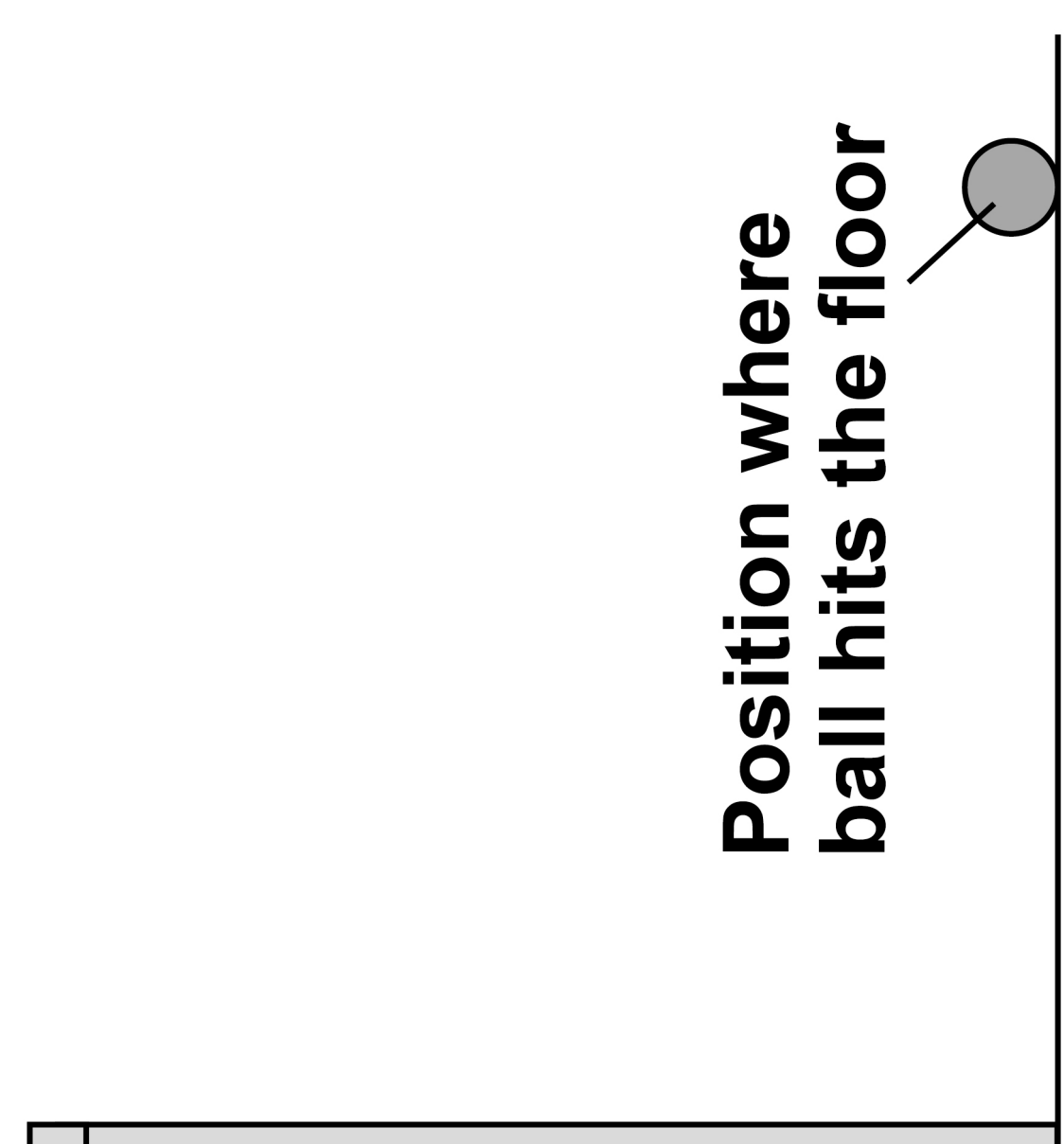
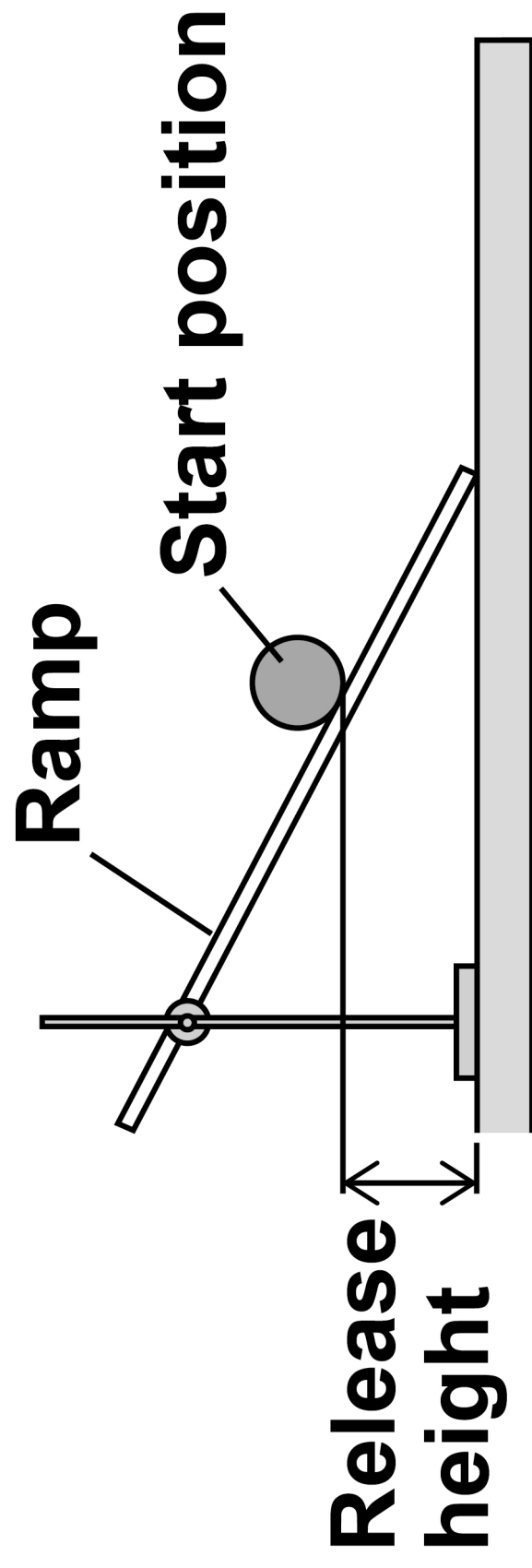
A student investigated how the horizontal distance travelled by a ball varied with release height.

The student used a ramp to launch the ball horizontally from the edge of a table.

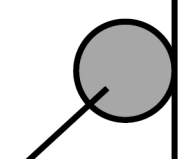
FIGURE 8, on page 49, shows some of the equipment the student used.

The ball was released from a point on the ramp and the student recorded where the ball hit the floor. The student measured the release height and the horizontal distance travelled by the ball.

FIGURE 8

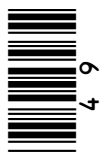


**Position where
ball hits the floor**



Horizontal distance

[Turn over]



0 6 . 1

Describe what the student should do to make the measurements for this investigation as accurate as possible. [6 marks]



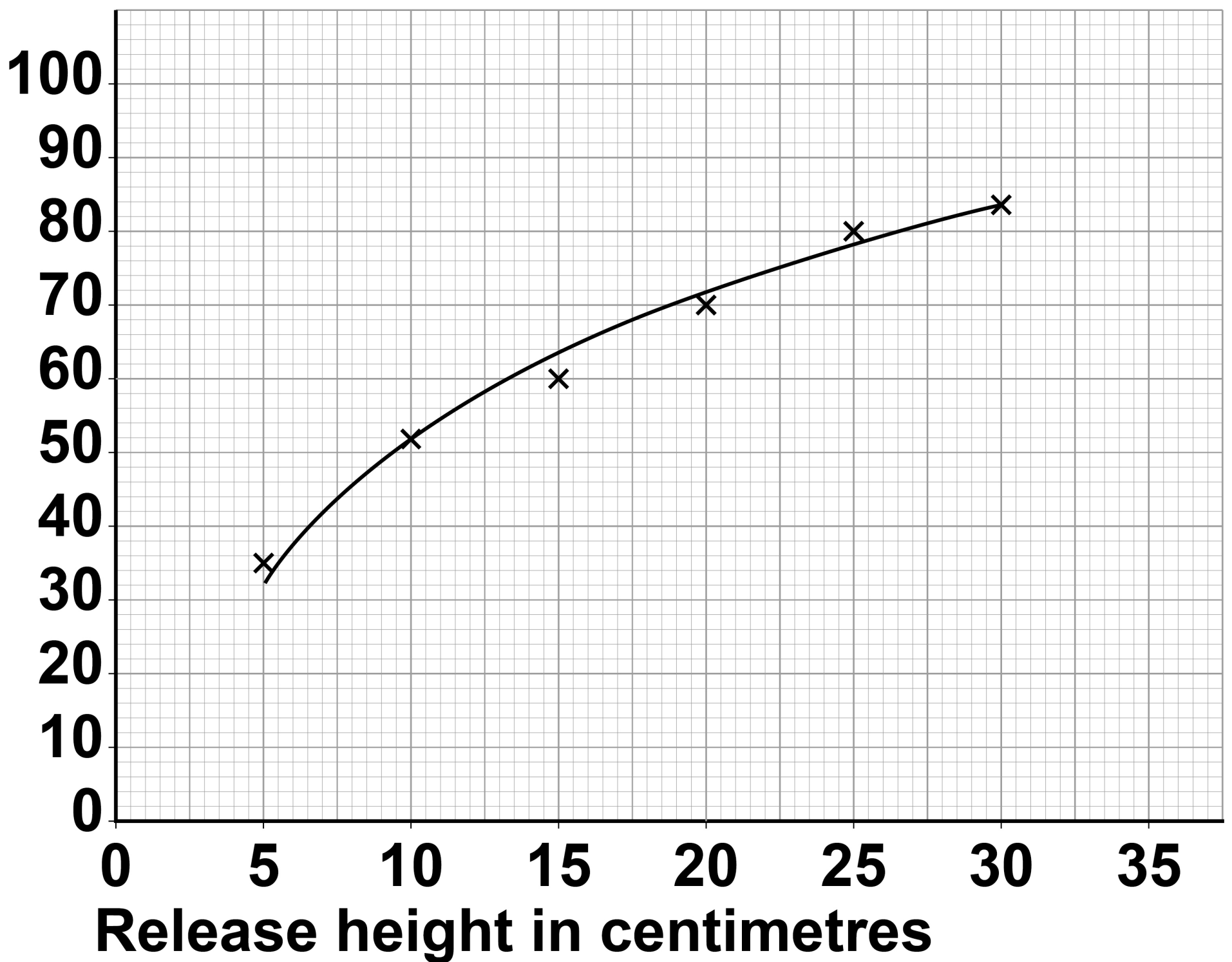
[Turn over]



FIGURE 9 shows the student's results.

FIGURE 9

**Horizontal
distance in
centimetres**



0	6	.	2
---	---	---	---

Give ONE reason why some of the points in FIGURE 9 are NOT on the line of best fit. [1 mark]

[Turn over]

BLANK PAGE



0 6 . 3

The student concluded that the horizontal distance was directly proportional to the release height.

**Explain why the student was incorrect.
[2 marks]**

[Turn over]

9

0	7
---	---

Conservation of momentum can be used to understand what happens during collisions.

0	7	.	1
---	---	---	---

Momentum is a vector quantity.

Explain the difference between a vector quantity and a scalar quantity. [2 marks]

07.2

Describe what is meant by ‘conservation of momentum’. [2 marks]

07.3

FIGURE 10, on pages 58 and 59, shows two people ice-skating.

Person A collides with person B. After the collision they move together with the same velocity.

[Turn over]



FIGURE 10

BEFORE COLLISION

Person A
mass = 60 kg

Person B
mass, m

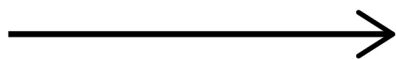


→
Speed of
Person A =
5.5 m/s

→
Speed of
Person B =
2.0 m/s

FIGURE 10 (continued)**AFTER COLLISION**

**Person A and person B
moving off together**



**Speed of Person A and
Person B = 4.0 m/s**

[Turn over]



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**Calculate the mass, m , of person B.
[5 marks]**

Mass, m = _____ kg

[Turn over]

9



0	8
---	---

Iceland is a country with many waterfalls.

0	8	.	1
---	---	---	---

Which energy resource uses falling water to generate electricity? [1 mark]

0	8	.	2
---	---	---	---

Most of the electricity generated in Iceland is used in the production of aluminium.

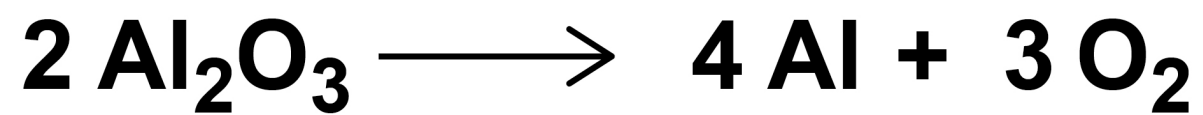
Aluminium ore is imported and used to produce aluminium. The aluminium is then exported.

Suggest ONE advantage of producing aluminium in Iceland. [1 mark]

[Turn over]

Aluminium is produced from aluminium oxide by electrolysis.

The equation for the reaction is:



0 8 . 3

Calculate the mass of aluminium produced from 1000 kg of aluminium oxide.

Relative atomic masses (A_r):

Al = 27 O = 16

[4 marks]

Mass of aluminium = _____ kg

[Turn over]



0	8	.	4
---	---	---	---

Complete the half equation for the production of aluminium at the negative electrode. [1 mark]



0	8	.	5
---	---	---	---

Explain why the electrolyte used is a mixture of aluminium oxide and cryolite. [2 marks]

0	8	.	6
---	---	---	---

Explain why the electrolysis of aluminium oxide produces large quantities of carbon dioxide. [3 marks]

[Turn over]

0	8	.	7
---	---	---	---

A ceramic material could be used as the positive electrode in the electrolysis of aluminium oxide.

The ceramic material must be a good conductor of electricity.

Suggest TWO other properties the ceramic material must have for use in the electrolysis of aluminium oxide.

Give a reason why each property is needed. [4 marks]

Property 1 _____

Reason _____

Property 2 _____

Reason _____

[Turn over]

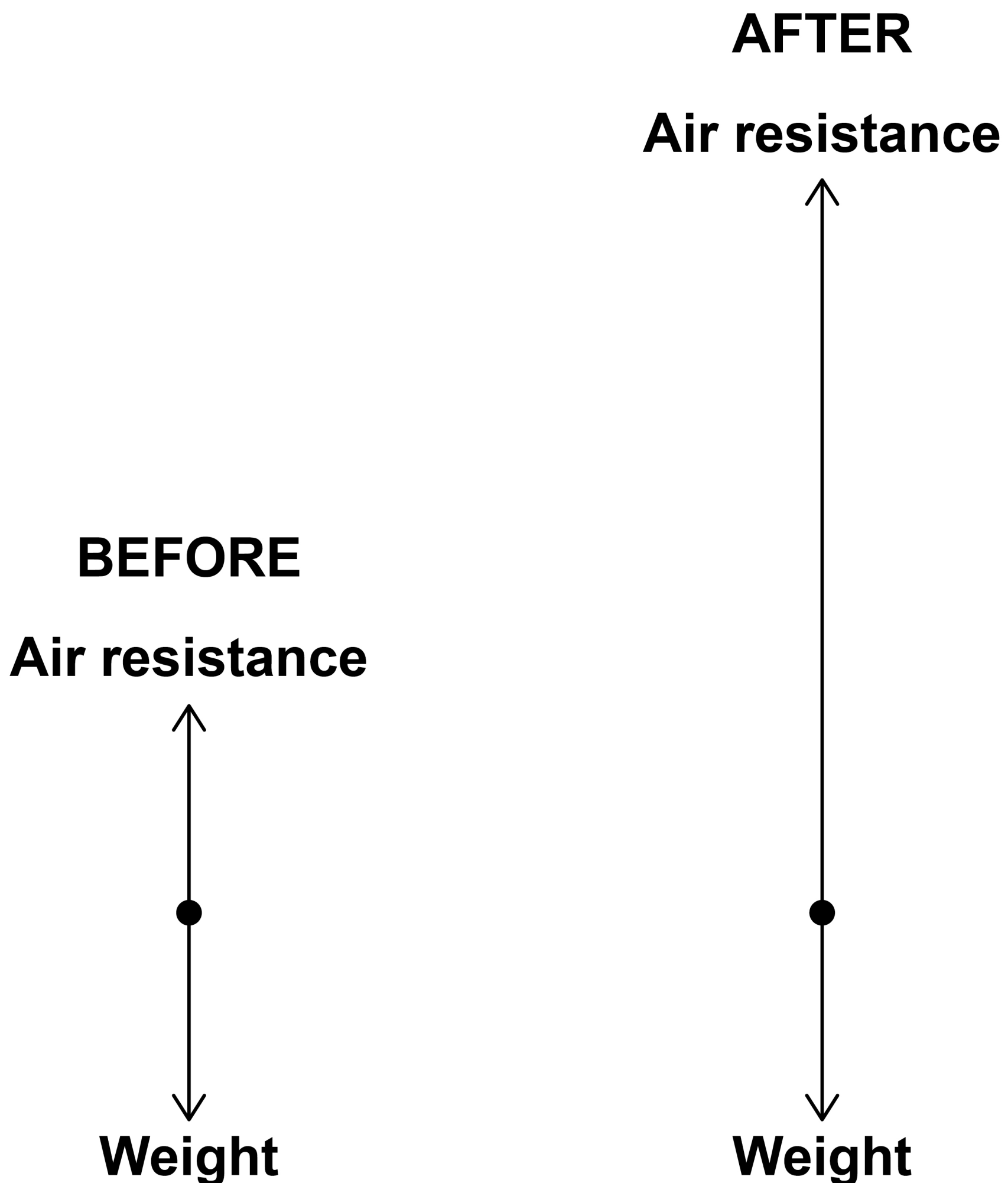
16



0	9
---	---

FIGURE 11 shows free body diagrams for a skydiver before and after her parachute opened.

FIGURE 11



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[Turn over]



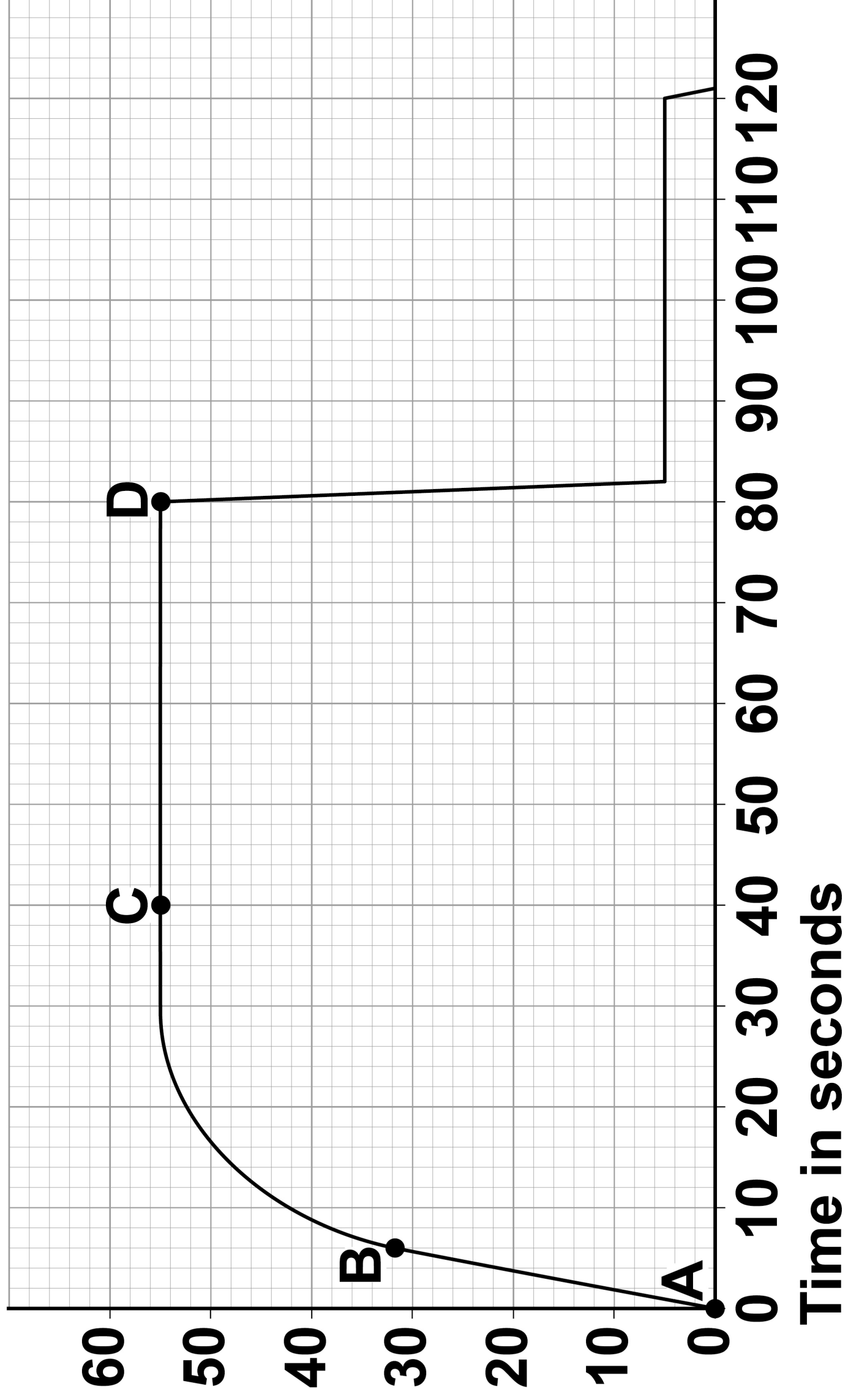
FIGURE 12, on the opposite page, shows the velocity-time graph for the skydiver.

The skydiver:

- **left the plane at 0 s**
- **opened her parachute at 80 s**
- **landed on the ground at 120 s**

FIGURE 12

**Velocity
in m/s**



Time in seconds

[Turn over]



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0	9	.	1
---	---	---	---

What does the area under the graph represent? [1 mark]

Tick (✓) ONE box.

The acceleration of the skydiver

The gravitational field strength of the Earth

The height from which the skydiver jumped

The mass of the skydiver

[Turn over]



09.2

Explain why the velocity of the skydiver changed between A and C on FIGURE 12 on page 73.

Your answer should refer to the forces on the skydiver. [6 marks]

[Turn over]

0	9	.	3
---	---	---	---

Between leaving the plane and opening her parachute, the change in gravitational potential energy of the skydiver was 3.50 MJ

The speed of the skydiver when she opened her parachute was 55 m/s

The mass of the skydiver was 80 kg

Calculate the energy transferred to the surroundings. [5 marks]

Energy transferred to surroundings =
_____ J

12

END OF QUESTIONS

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Question	Mark
1	
2	
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6	
7	
8	
9	
TOTAL	

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