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Surname _____

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Centre Number _____

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Candidate Signature _____

GCSE

COMBINED SCIENCE: TRILOGY

Higher Tier

Physics Paper 1H

H

8464/P/1H

Wednesday 22 May 2019 Afternoon

Time allowed: 1 hour 15 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]



JUN198464P1H01

For this paper you must have:

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

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **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.**
- **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.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

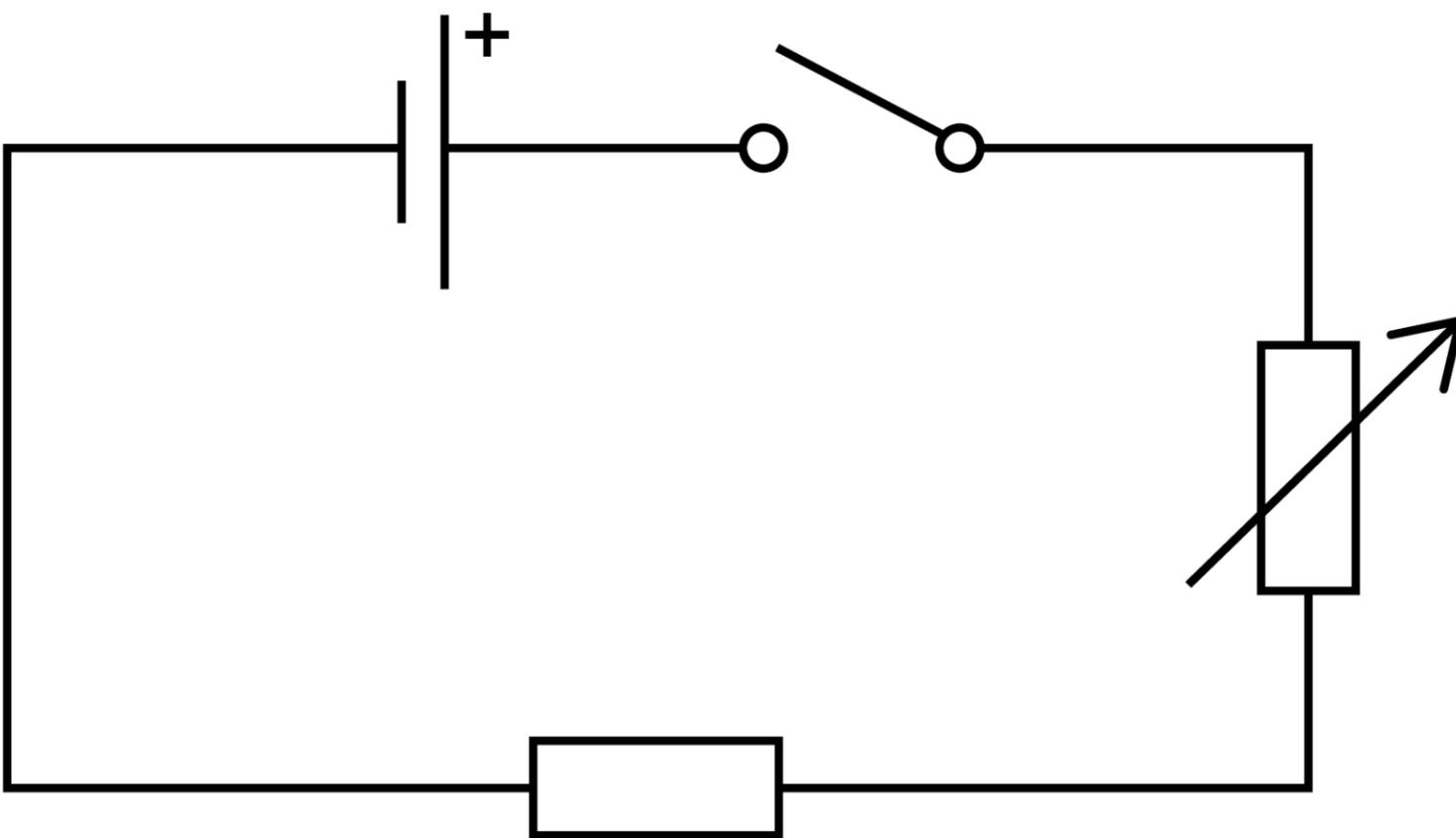


0	1
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A student investigated how the current in a resistor varies with the potential difference across the resistor.

FIGURE 1 shows part of the circuit used.

FIGURE 1



01.1

The student connected an ammeter and a voltmeter into the circuit.

What is the correct way to connect the ammeter and the voltmeter into the circuit? [1 mark]

Tick (✓) ONE box.

	AMMETER	VOLTMETER
<input type="checkbox"/>	In parallel with the resistor	In series with the resistor
<input type="checkbox"/>	In parallel with the cell	In series with the resistor
<input type="checkbox"/>	In series with the resistor	In parallel with the resistor
<input type="checkbox"/>	In series with the resistor	In parallel with the cell

[Turn over]



0 1 . 2

The student increased the resistance of the variable resistor.

How did increasing the resistance affect the current in the circuit? [1 mark]

0 1 . 3

How should the student change the circuit to give negative values for current and potential difference? [1 mark]

01.4

Name the type of relationship between current and potential difference for a resistor at constant temperature.

[1 mark]

01.5

Write the equation which links current, potential difference and resistance.

[1 mark]

[Turn over]



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02

A scientist cooled the air inside a container.

02.1

The temperature of the air changed from 20 °C to 0 °C

The volume of the container of air stayed the same.

Explain how the motion of the air molecules caused the pressure in the container to change as the temperature decreased. [3 marks]

[Turn over]

0 2 . 2

The air contained water that froze at 0 °C

The change in internal energy of the water as it froze was 0.70 kJ

The specific latent heat of fusion of water is 330 kJ/kg

Calculate the mass of ice produced.

Use the Physics Equations Sheet.
[3 marks]

Mass of ice = _____ kg

[Turn over]

0 2 . 3

The air also contained oxygen, nitrogen and carbon dioxide.

Oxygen boils at $-183\text{ }^{\circ}\text{C}$ and freezes at $-218\text{ }^{\circ}\text{C}$

Nitrogen boils at $-195\text{ }^{\circ}\text{C}$ and freezes at $-210\text{ }^{\circ}\text{C}$

Carbon dioxide sublimates at $-78\text{ }^{\circ}\text{C}$

The scientist continued to cool the air to a temperature of $-190\text{ }^{\circ}\text{C}$

What is the state of each substance at $-190\text{ }^{\circ}\text{C}$? [2 marks]

Tick (✓) ONE box for EACH row of the table.

Substance	Solid	Liquid	Gas
Oxygen			
Nitrogen			
Carbon dioxide			

[Turn over]

0 2 . 4

The air also contained a small amount of argon.

As the temperature of the air decreased from 20 °C to –190 °C the argon changed from a gas to a liquid to a solid.

Explain the changes in the arrangement and movement of the particles of the argon as the temperature of the air decreased. [6 marks]

0 3

A hybrid car has an electric motor and a petrol engine.

0 3 . 1

Petrol is a non-renewable energy resource.

What is meant by a non-renewable energy resource? [1 mark]

03.2

The electric motor in the car is powered by a battery.

To charge the battery, the car is plugged into the mains supply at 230 V

The power used to charge the battery is 6.9 kW

Calculate the current used to charge the battery. [4 marks]

Current = _____ A

[Turn over]



03.3

Mains electricity is an ac supply.

Explain the difference between direct and alternating potential difference.

[2 marks]

03.4

The cable used to connect the car to the mains electricity supply has a low resistance.

Explain why it is better to use a cable with a low resistance than to use a cable with a high resistance. [2 marks]

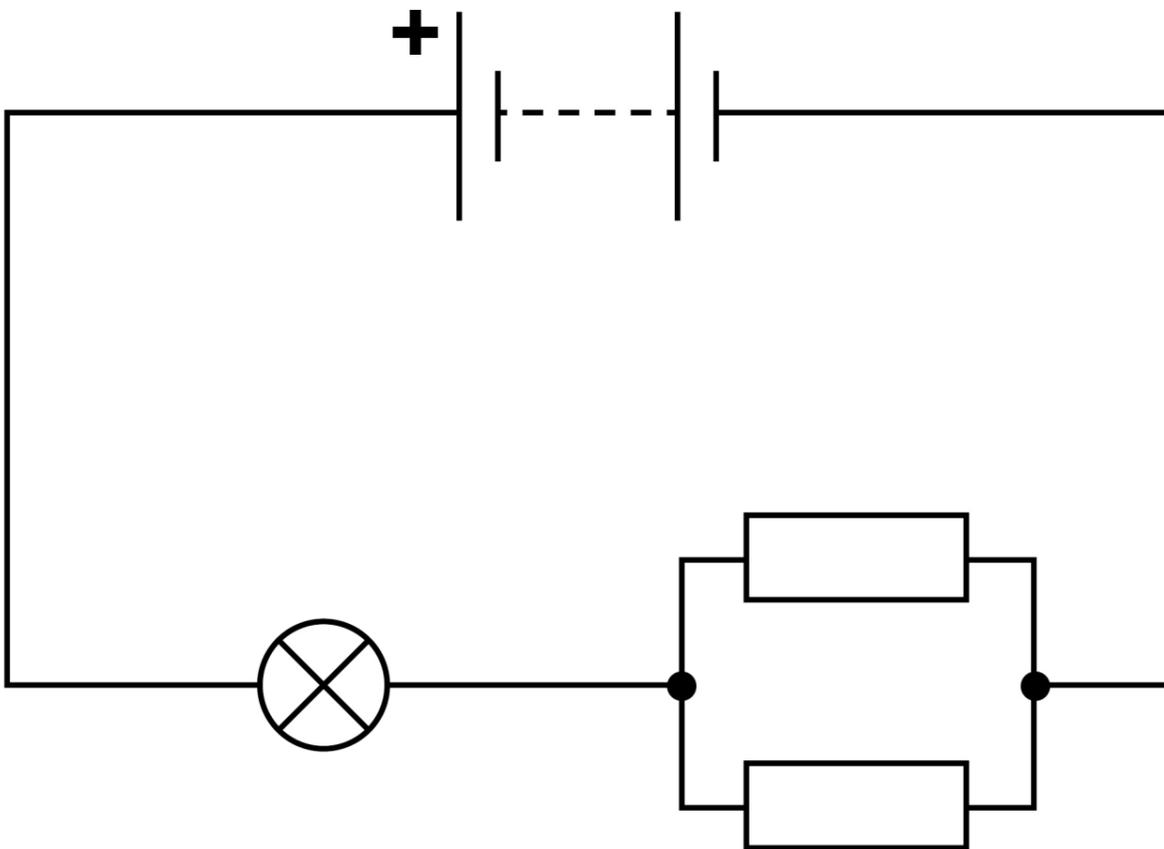
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9

04

FIGURE 2 shows a circuit that a student built.

FIGURE 2



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

The lamp has a resistance of $10\ \Omega$

Each resistor has a resistance of $10\ \Omega$

What is the total resistance of the circuit? [1 mark]

Tick (✓) ONE box.

Between 20 and 30 Ω

Exactly 20 Ω

Exactly 30 Ω

Less than 20 Ω

[Turn over]



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04.2

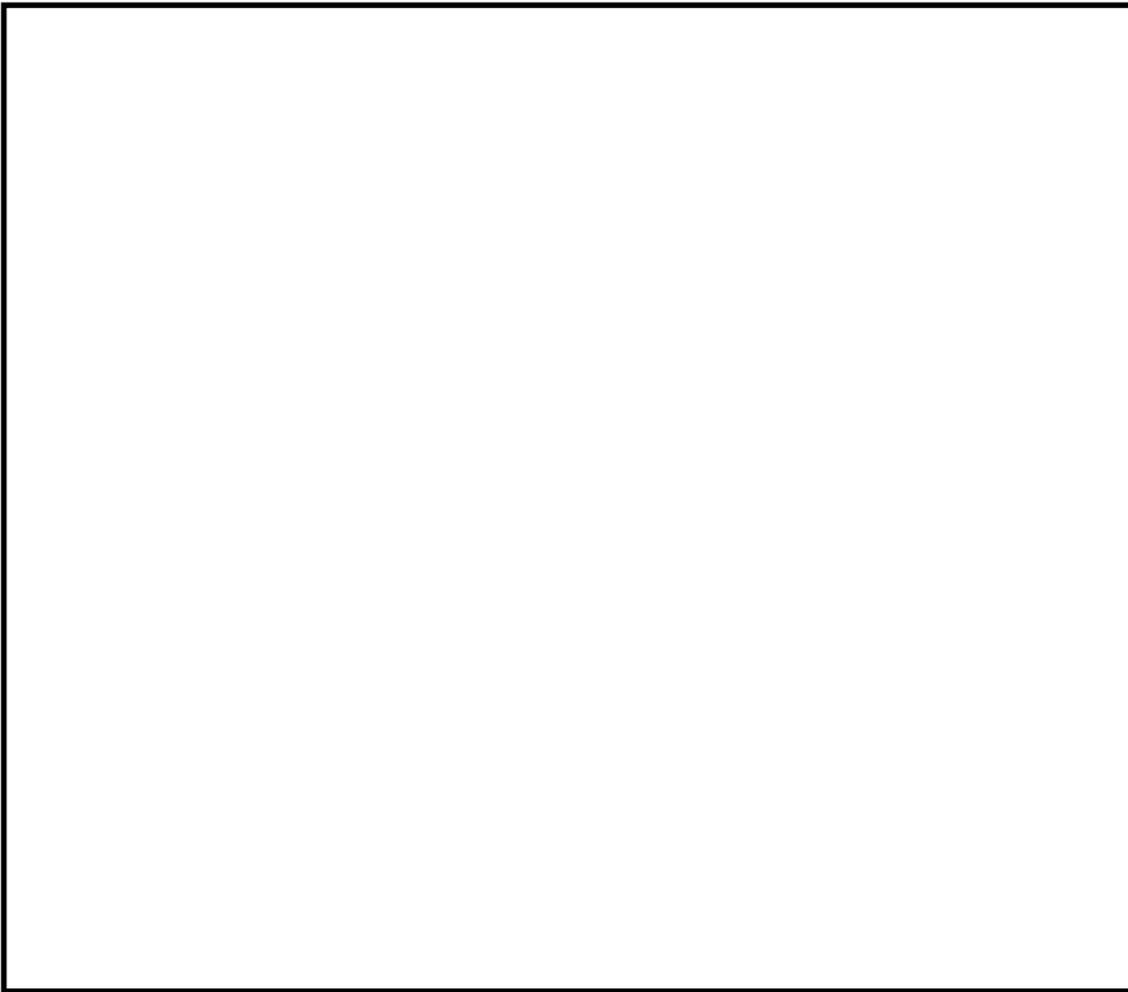
**Explain your answer to Question 04.1
[2 marks]**

[Turn over]

The student replaced one of the resistors with a thermistor.

0 4 . 3

Draw the circuit symbol for a thermistor in the box below. [1 mark]



04.4

The student increased the temperature of the thermistor.

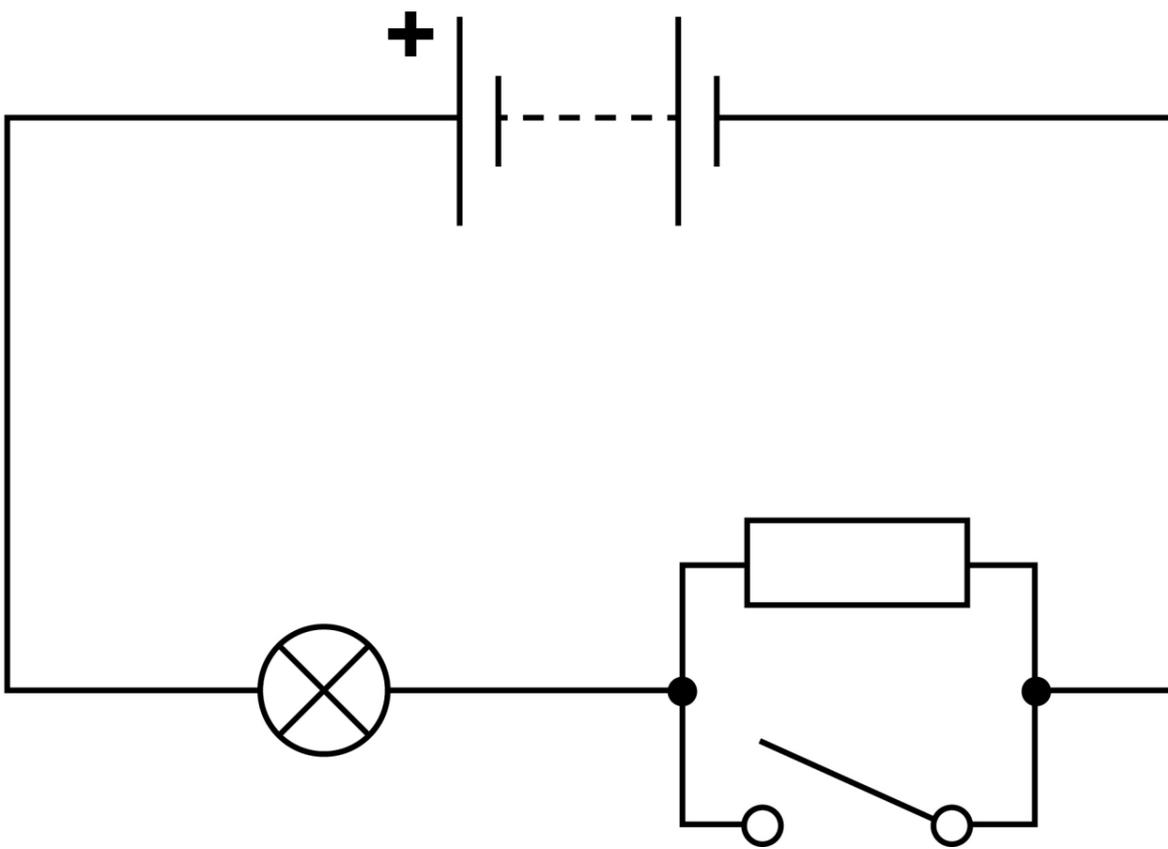
Explain how the current in the thermistor changed. [2 marks]

[Turn over]

04.5

FIGURE 3 shows another circuit the student built.

FIGURE 3



Explain how the potential difference across the resistor and the lamp will change when the switch is closed.

[4 marks]

The resistor _____

The lamp _____

[Turn over]

10



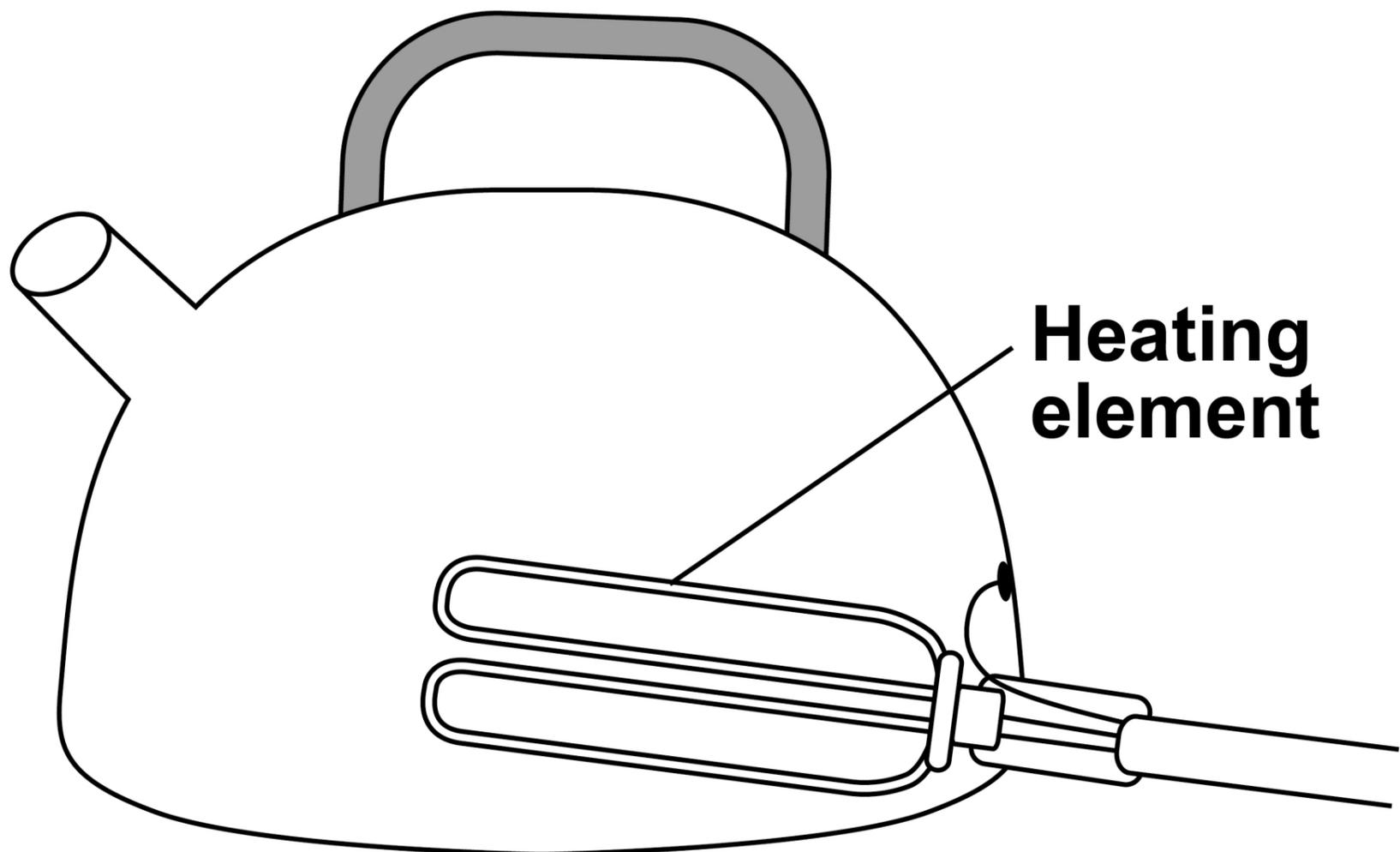
05

A student investigated how the mass of water in an electric kettle affected the time taken for the water to reach boiling point.

The kettle switched off when the water reached boiling point.

FIGURE 4 shows the kettle.

FIGURE 4



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05.2

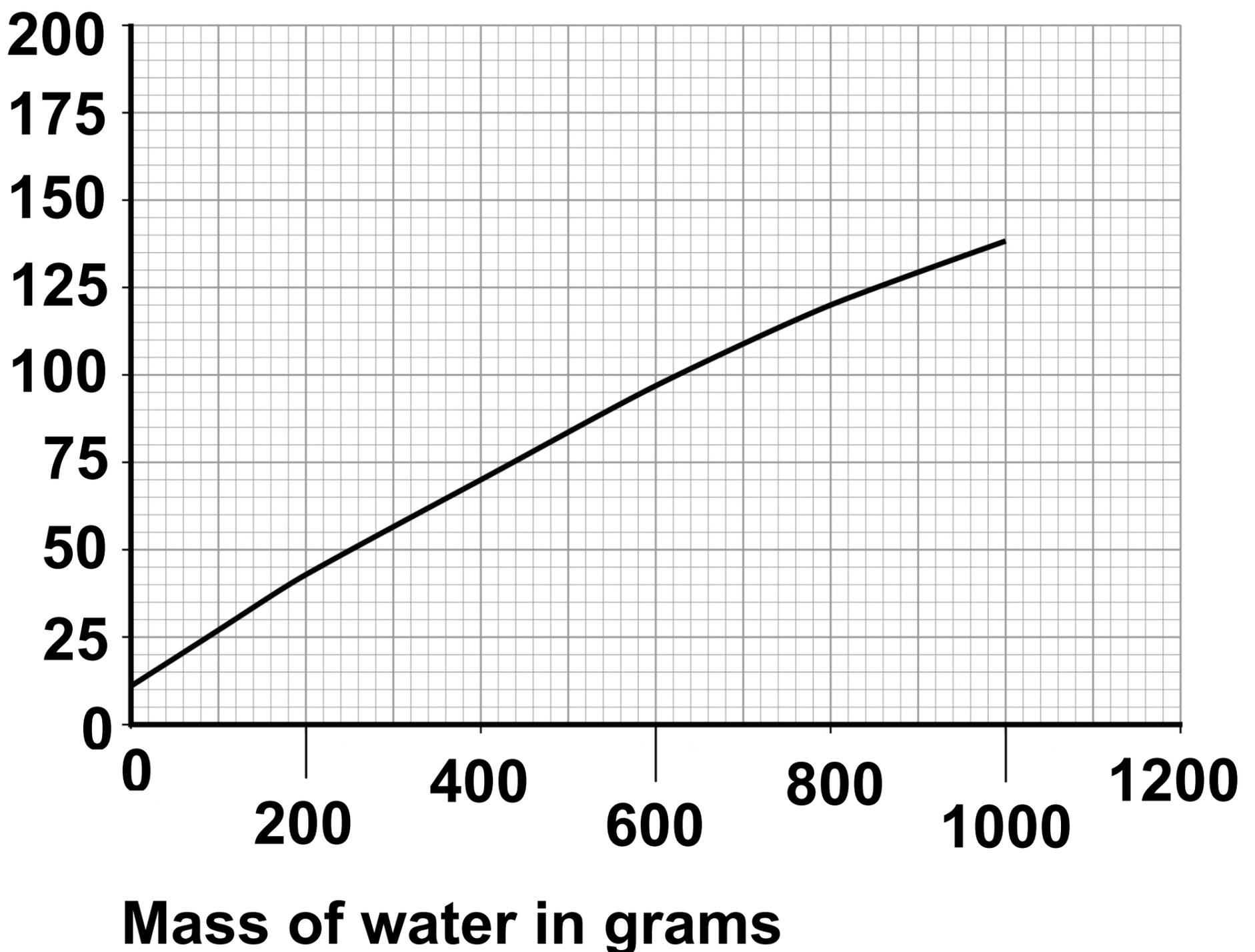
Give ONE variable that the student should have controlled. [1 mark]

[Turn over]

FIGURE 5 shows how the mass of water in the kettle affected the time taken for the kettle to switch off.

FIGURE 5

**Time taken for
the kettle to
switch off in
seconds**



0 5 . 3

Suggest why the line on FIGURE 5 does NOT go through the origin. [1 mark]

0 5 . 4

Suggest why the results give a non-linear pattern. [1 mark]

[Turn over]

0	6
---	---

Lanthanum-140 is a radioactive isotope.

0	6	.	1
---	---	---	---

A nucleus of lanthanum-140 emits gamma radiation.

What happens to the mass number and the charge of the nucleus when gamma radiation is emitted? [1 mark]

Tick (✓) ONE box on the opposite page.

	MASS NUMBER	CHARGE
<input type="checkbox"/>	Decreases	Decreases
<input type="checkbox"/>	Decreases	Stays the same
<input type="checkbox"/>	Stays the same	Decreases
<input type="checkbox"/>	Stays the same	Stays the same

[Turn over]

06.2

Why is it difficult to detect gamma radiation? [1 mark]

06.3

Activity is the rate at which a radioactive source decays.

A teacher measured the count-rate from a sample of lanthanum-140 using a Geiger-Muller (G-M) tube.

Explain why the count rate was less than the activity of the sample of lanthanum-140 [2 marks]

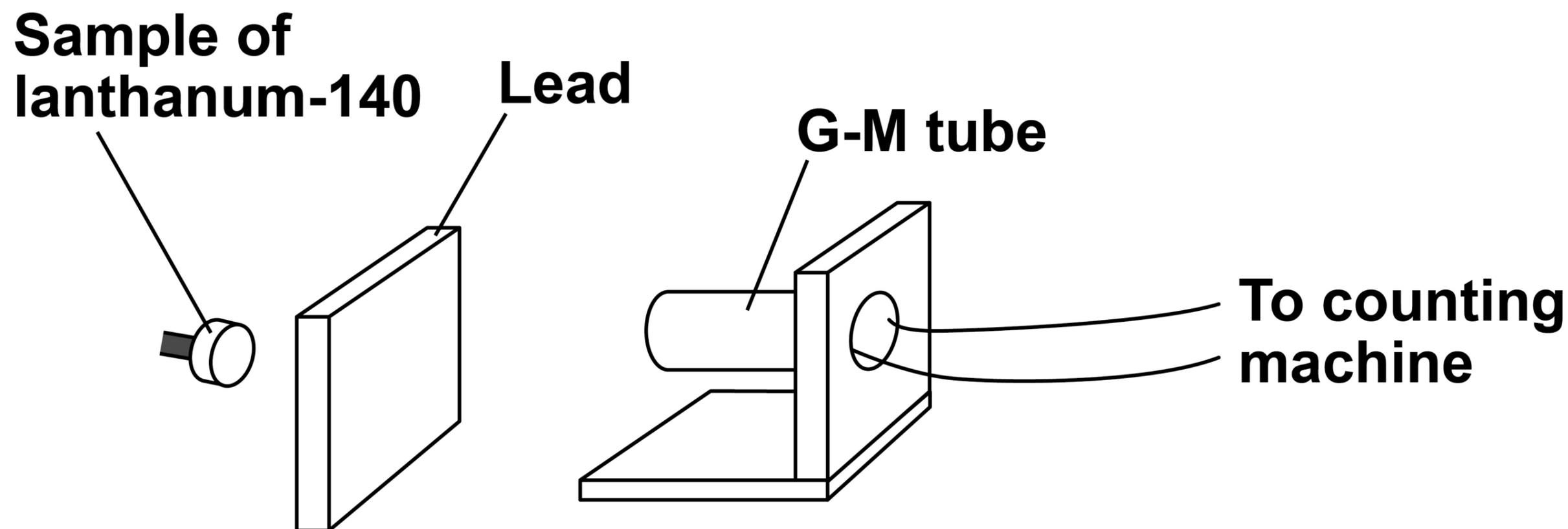
[Turn over]



The teacher investigated how the thickness of lead affected the amount of gamma radiation that could pass through it.

FIGURE 6 shows the apparatus.

FIGURE 6



06.4

Explain why the teacher stood as far away from the apparatus as possible. [2 marks]

43

[Turn over]



TABLE 1 shows the results.

TABLE 1

Thickness of lead in cm	Count rate in counts per second
0.5	110
1.0	60
1.5	33
2.0	18
2.5	10

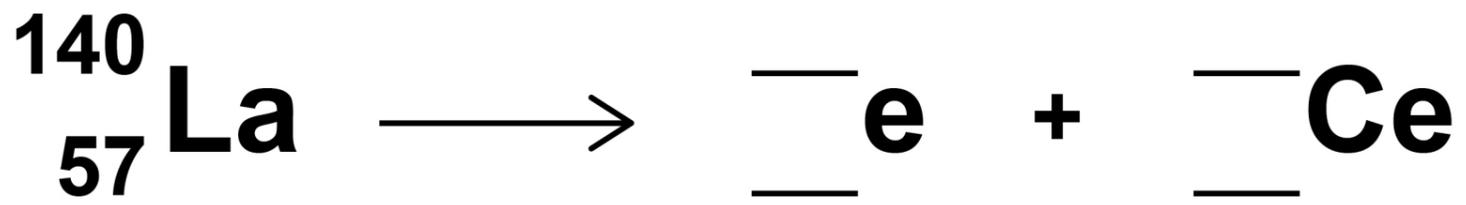
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0	6	.	6
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Lanthanum-140 can also emit beta radiation and change into cerium.

Complete the equation showing the decay of lanthanum (La) 140 into cerium (Ce). [2 marks]



[Turn over]

There are other isotopes of cerium which are radioactive.

Different isotopes of cerium have different half-lives.

The half-life of an isotope can be found by studying how the number of atoms changes over time.

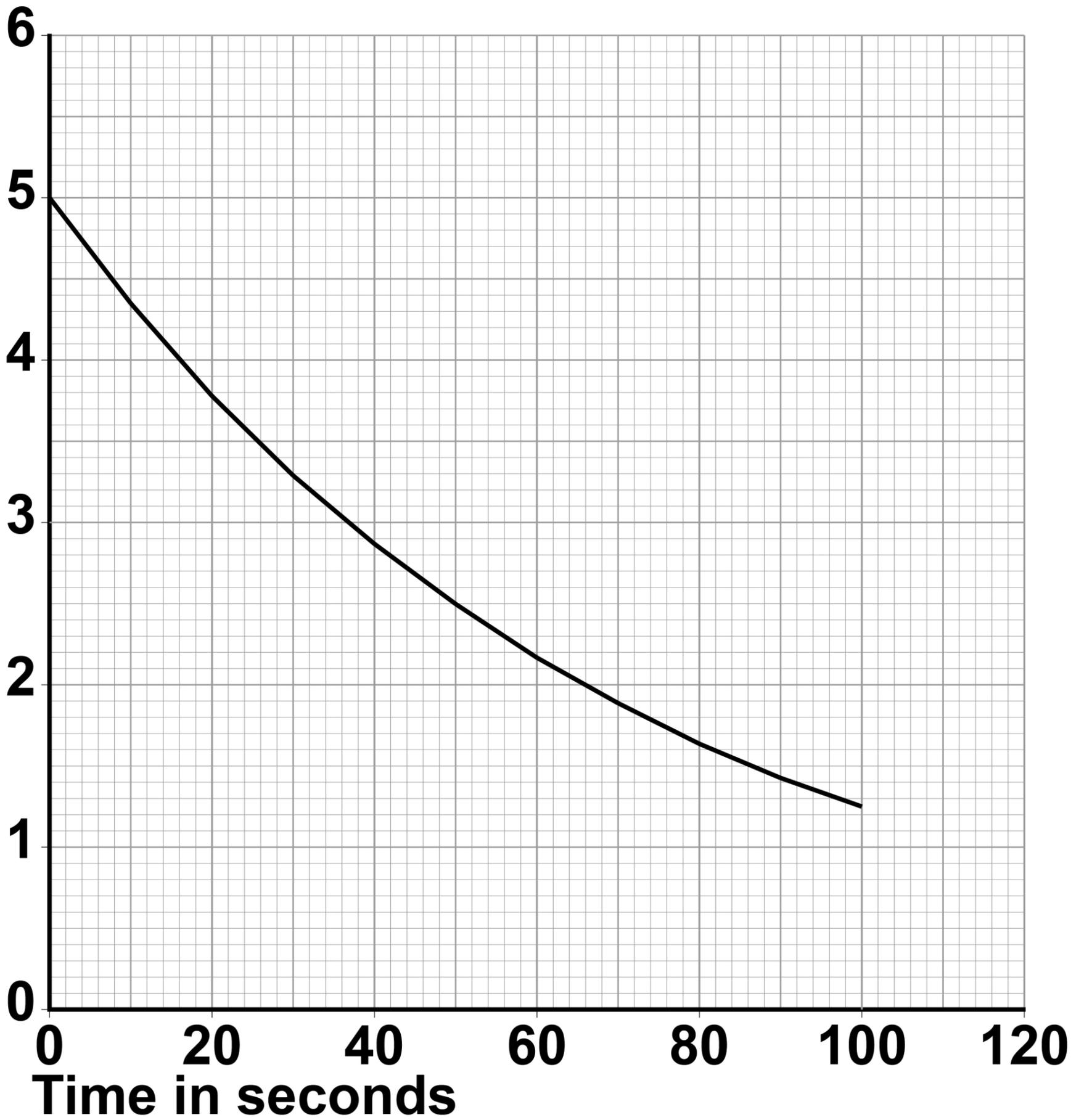
FIGURE 7, on page 50, shows how the number of atoms of cerium-148 in a 120 g sample changes over time.

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[Turn over]

FIGURE 7

**Number of
atoms of
cerium-148
 $\times 10^{23}$**



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Question	Mark
1	
2	
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4	
5	
6	
TOTAL	

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