

A



Surname _____

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Candidate Signature _____

I declare this is my own work.

**GCSE
PHYSICS**

H

Higher Tier Paper 1

8463/1H

Thursday 25 May 2023 Morning

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.

[Turn over]



J U N 2 3 8 4 6 3 1 H 0 1

MATERIALS

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. Pencil should only be used for drawing.**
- **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.**
- **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 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



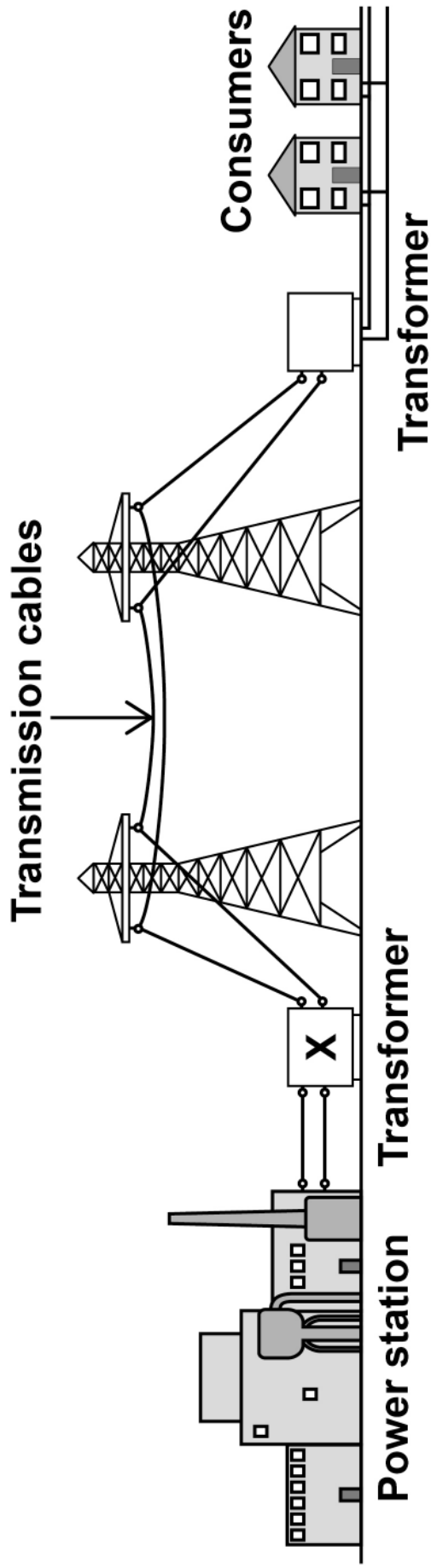


Answer ALL questions in the spaces provided.

0 1

FIGURE 1 shows how the National Grid connects a power station to consumers.

FIGURE 1





0 1 . 1

Complete the sentences. [2 marks]

Transformer X causes the potential difference to _____.

Transformer X causes the current to _____.

[Turn over]

Use the Physics Equations Sheet to answer questions 01.2 and 01.3.

01.2

Which equation links current (I), power (P) and resistance (R)? [1 mark]

Tick (✓) ONE box.

$$P = \frac{I}{R}$$

$$P = \frac{I}{R^2}$$

$$P = I^2 R$$

$$P = IR$$



| | | | |
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| 0 | 1 | . | 3 |
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A transmission cable has a power loss of 1.60×10^9 W.

The current in the cable is 2000 A.

Calculate the resistance of the cable. [3 marks]

Resistance = _____ Ω

[Turn over]



Use the Physics Equations Sheet to answer questions 01.4 and 01.5.

01.4

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



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The total energy input to the National Grid from one power station is 34.2 GJ.

The National Grid has an efficiency of 0.992

Calculate the useful energy output from this power station to consumers in GJ. [3 marks]

Useful energy output = _____ GJ

[Turn over]

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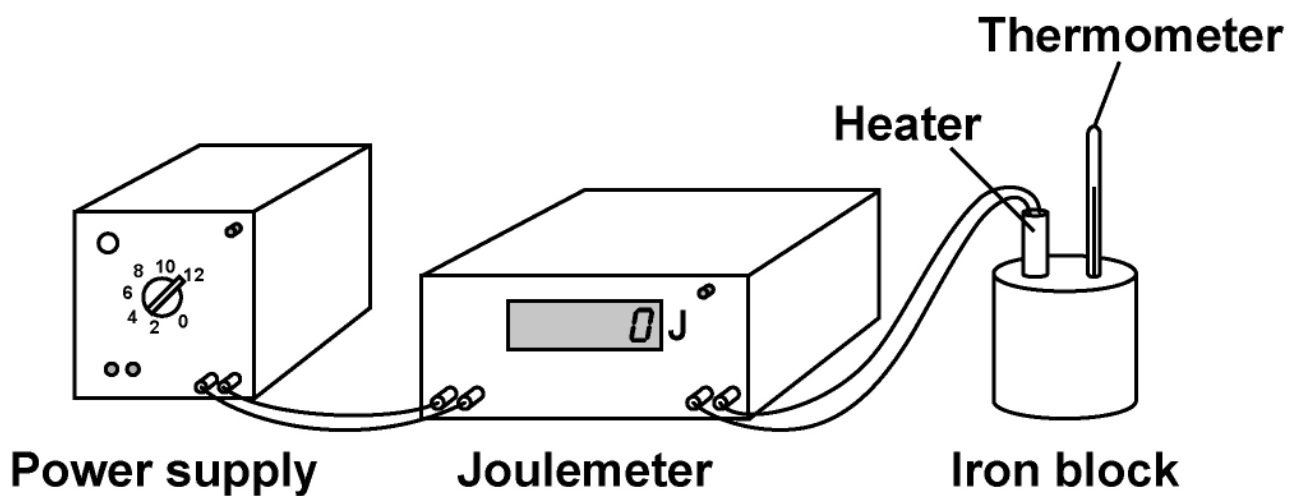


02

FIGURE 2 shows the equipment a student used to determine the specific heat capacity of iron.

The iron block the student used has two holes, one for the heater and one for the thermometer.

FIGURE 2



Stopclock



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

Before the power supply was switched on, the thermometer was used to measure the temperature of the iron block.

The student left the thermometer in the iron block for a few minutes before recording the initial temperature.

Suggest why. [1 mark]

[Turn over]

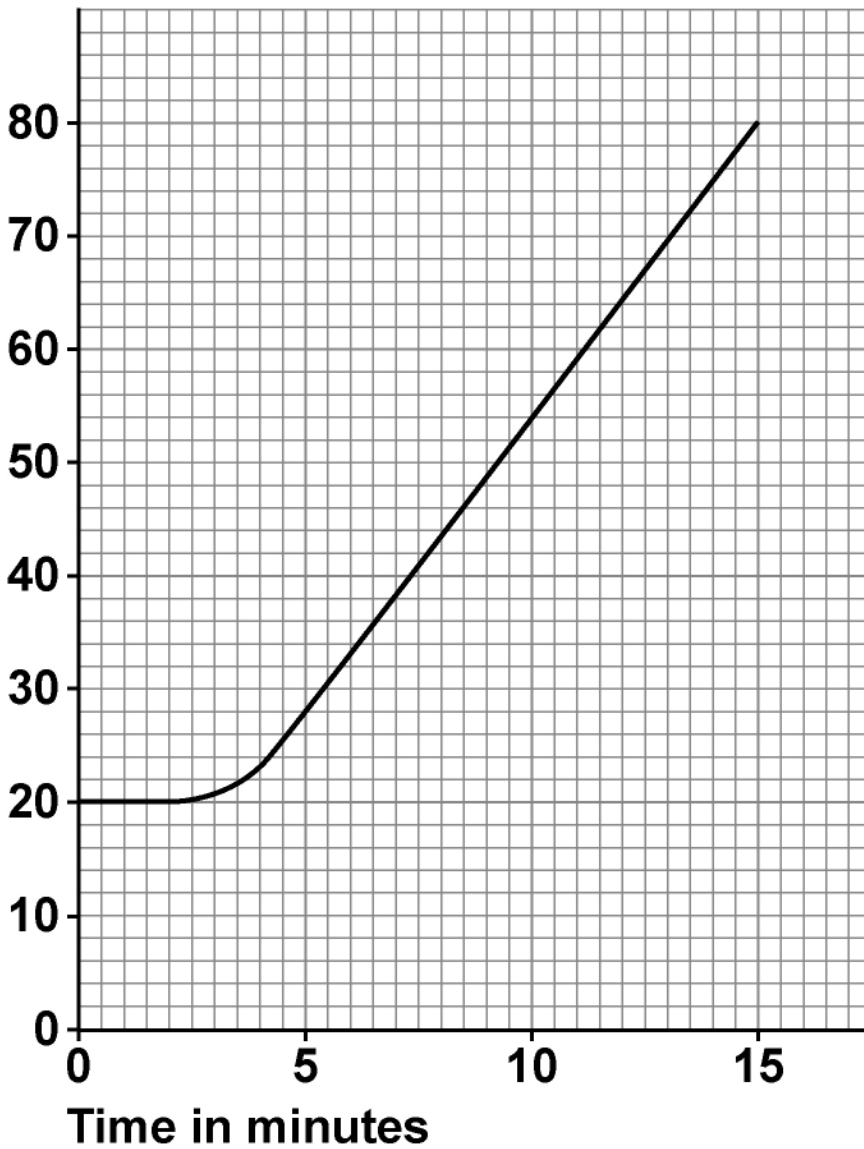


02.2

FIGURE 3 shows how the temperature changed after the power supply was switched on.

FIGURE 3

Temperature in °C



02.3

The student repeated the investigation but wrapped insulation around the iron block.

What effect will adding insulation have had on the investigation? [2 marks]

Tick (✓) TWO boxes.

The calculated specific heat capacity will be more accurate.

The iron block will transfer thermal energy to the surroundings at a lower rate.

The power output of the heater will be lower than expected.

The temperature of the iron block will increase more slowly than expected.

The uncertainty in the temperature measurement will be greater.

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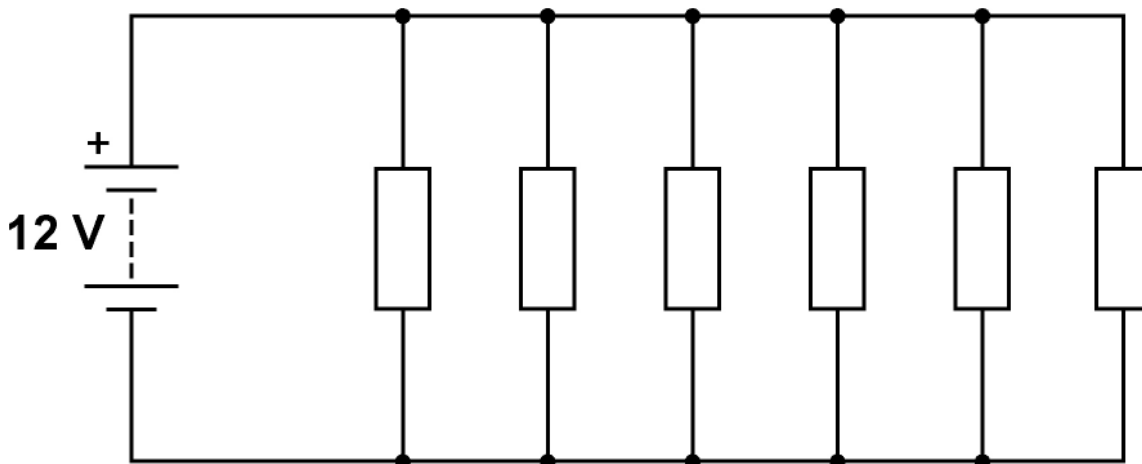


03

FIGURE 4 shows an electrical circuit used to heat the windscreen of a car.

Each resistor in the circuit represents a heating element.

FIGURE 4



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

The 12 V battery supplies direct potential difference.

What is meant by 'direct potential difference'? [1 mark]

[Turn over]



Use the Physics Equations Sheet to answer questions 03.2 and 03.3.

03.2

Which equation links charge flow (Q), energy (E) and potential difference (V)? [1 mark]

Tick (✓) ONE box.

$$E = \frac{V}{Q}$$

$$E = QV$$

$$E = \frac{Q}{V}$$

$$E = \frac{V^2}{Q}$$



| | | | |
|---|---|---|---|
| 0 | 3 | . | 3 |
|---|---|---|---|

Calculate the charge flow through the 12 V battery when the battery transfers 5010 J of energy. [3 marks]

Charge flow = _____ C

[Turn over]



| | | | |
|---|---|---|---|
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|---|---|---|---|

Ice forms on the windscreen at a temperature of $0\text{ }^{\circ}\text{C}$.

The electrical circuit transfers 5010 J of energy to the ice.

A mass of 0.015 kg of ice melts.

Calculate the specific latent heat of fusion of water.

Use the Physics Equations Sheet. [3 marks]

Specific latent heat of fusion of water =

_____ J/kg



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|---|---|
| 0 | 4 |
|---|---|

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

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

In one day, 2 500 000 kg of water passes through the hydroelectric generator.

The change in gravitational potential energy of the water is 367.5 MJ.

gravitational field strength = 9.8 N/kg

Calculate the mean change in vertical height of the water as it moves through the hydroelectric generator.

Use the Physics Equations Sheet. [4 marks]



Mean change in vertical height =

_____ m

[Turn over]



Time taken (in standard form) =

_____ **s**

[Turn over]

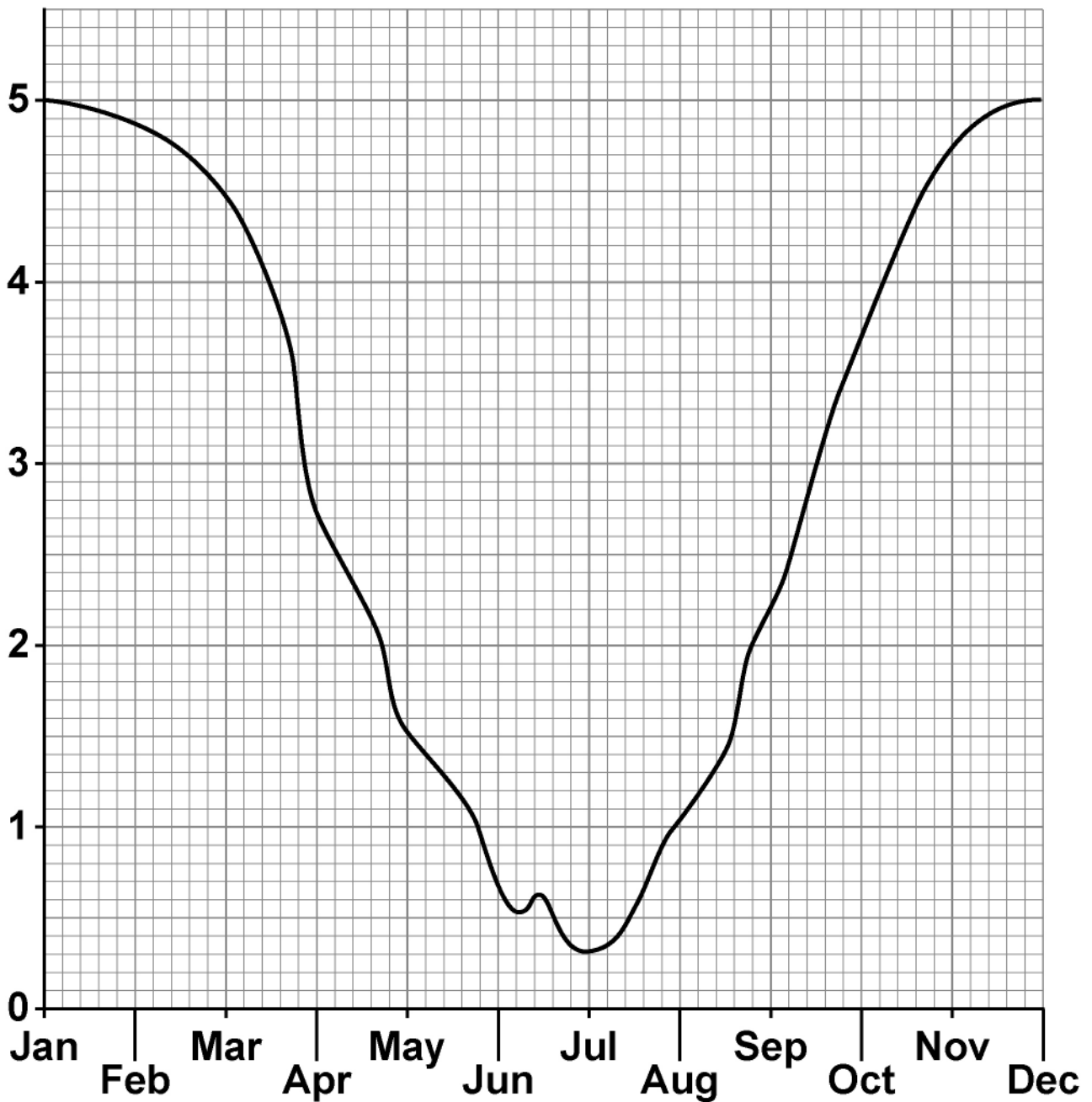


04.3

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

FIGURE 5

Power output of generator
in kilowatts



Month



A solar power system is installed in the remote village in addition to the hydroelectric generator.

Explain why this improves the reliability of the electricity supply to the village.

Use information from FIGURE 5. [2 marks]

[Turn over]

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05.2

Carbon-14 is a radioactive isotope.

Carbon-14 has a half-life of 5700 years.

What does 'a half-life of 5700 years' mean? [1 mark]

[Turn over]



TABLE 1 gives the half-life of some other radioactive isotopes.

TABLE 1

| ISOTOPE | HALF-LIFE IN SECONDS |
|-------------|----------------------|
| Nitrogen-18 | 0.62 |
| Nitrogen-17 | 4.17 |
| Fluorine-17 | 64.37 |
| Fluorine-18 | 6584.34 |

0 5 . 3

A sample of fluorine-17 has an activity that is one quarter of its original activity.

Calculate the age of the sample of fluorine-17.
[2 marks]

Age = _____ s



05.5

People who work in the nuclear power industry need to be aware of irradiation and contamination.

Describe the difference between irradiation and contamination. [2 marks]

05.6

Give ONE health risk to a person working close to a source of nuclear radiation. [1 mark]



05.7

Workers in nuclear power stations are monitored to check the radiation they emit.

A worker stands 1 cm away from a radiation detector.

The amount of radiation the worker emits is recorded.

Explain why the worker needs to stand close to the radiation detector. [2 marks]

[Turn over]



0 5 . 8

Workers in the nuclear power industry are exposed to nuclear radiation.

Pilots on aircraft are exposed to cosmic radiation from space.

DAILY dose caused by working in a nuclear power station = 0.00050 mSv

HOURLY dose from cosmic rays to a pilot while flying = 0.0030 mSv

Calculate the number of days it takes for a nuclear power station worker to receive the same dose as a pilot flying for 24 hours. [3 marks]



Number of days = _____

[Turn over]

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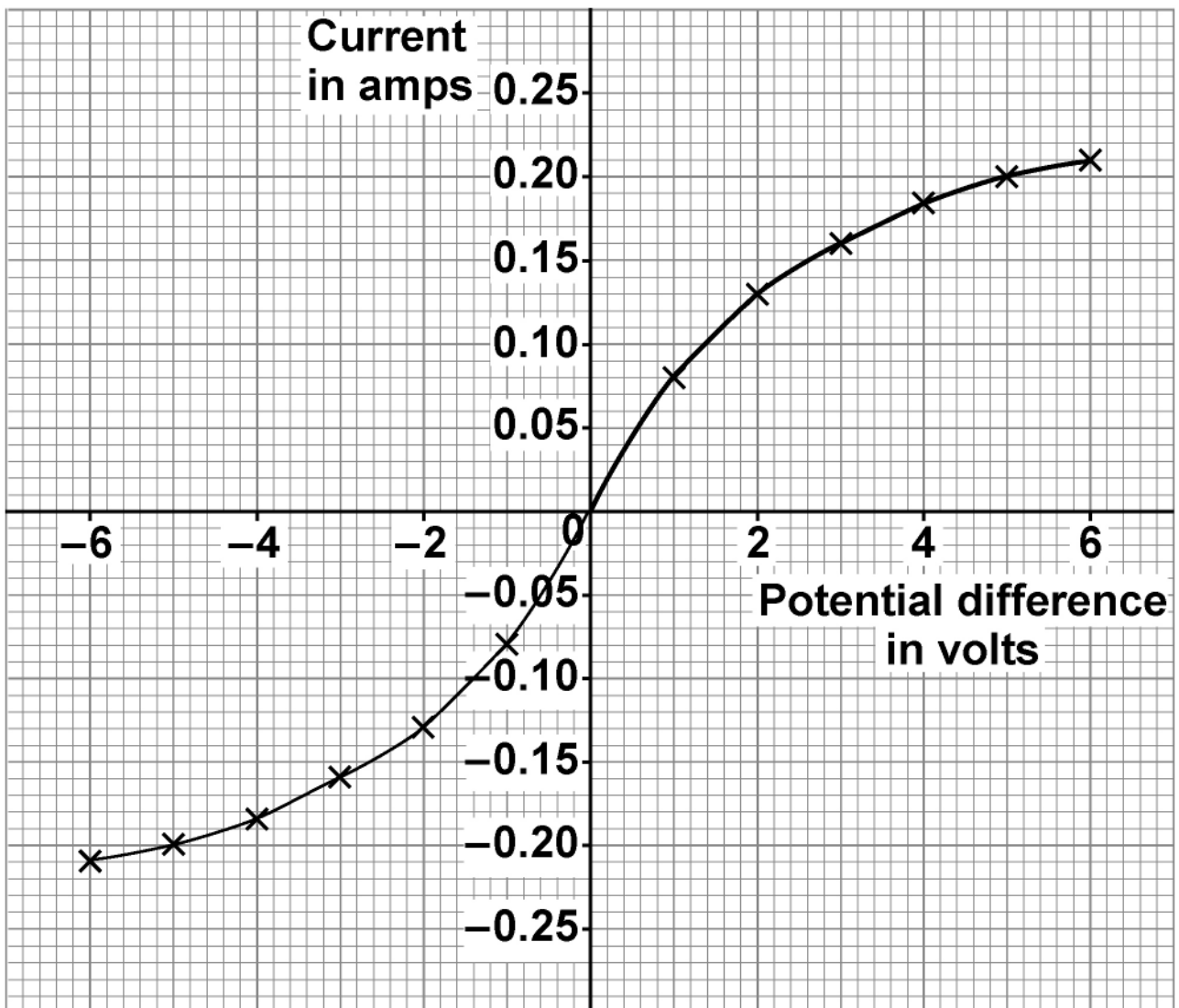


06

A student investigated how the current in a filament lamp varies with the potential difference across the filament lamp.

FIGURE 6 shows the results.

FIGURE 6



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

Describe a method the student could use to obtain these results.

You should include a circuit diagram. [6 marks]

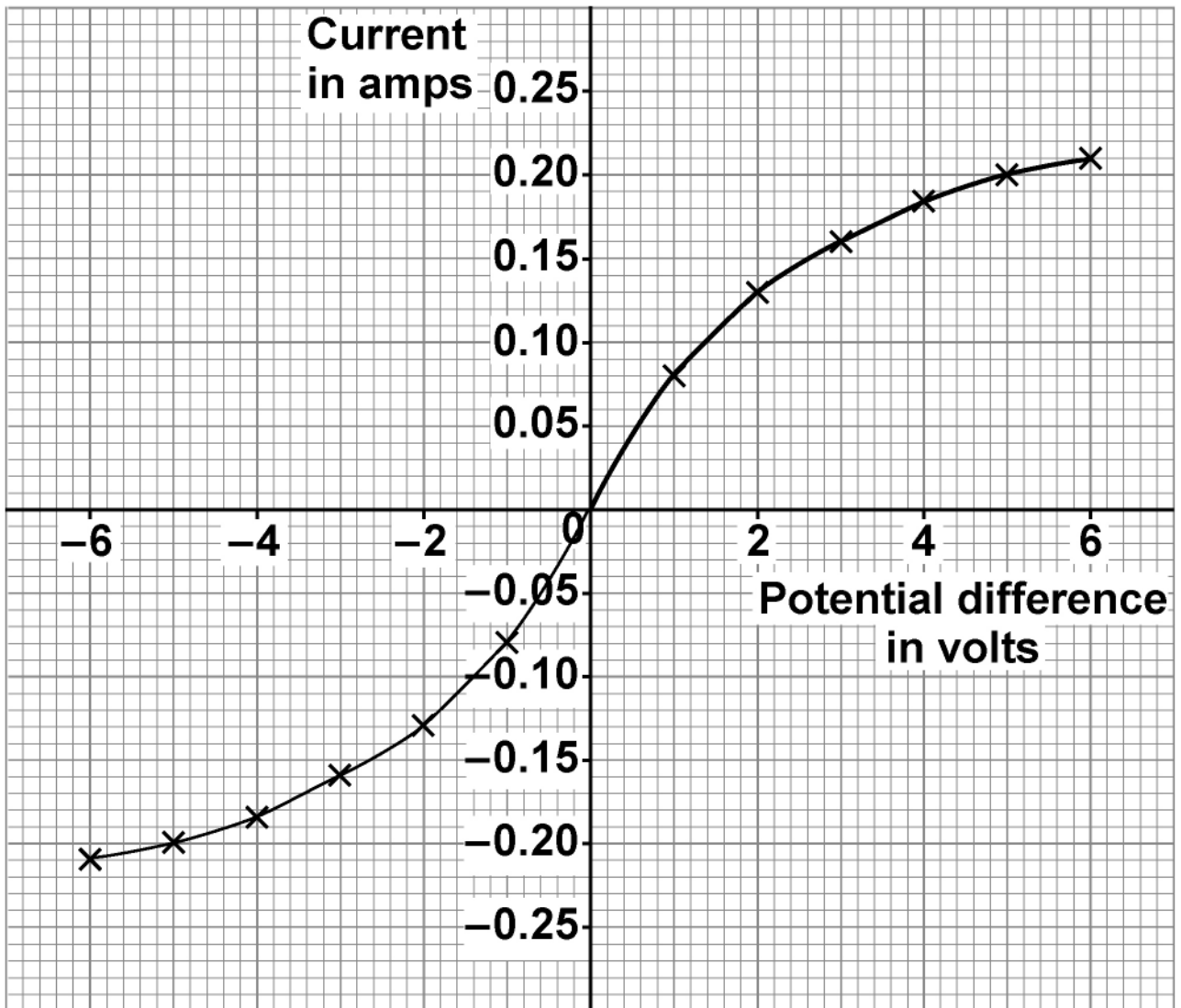
[Turn over]



[Turn over]



REPEAT OF FIGURE 6



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

Determine the resistance of the filament lamp when the potential difference across it is +3.0 V.

Use the Physics Equations Sheet.

Use FIGURE 6 on the opposite page. [3 marks]

Resistance = _____ Ω

[Turn over]



Energy transferred = _____ J

[Turn over]



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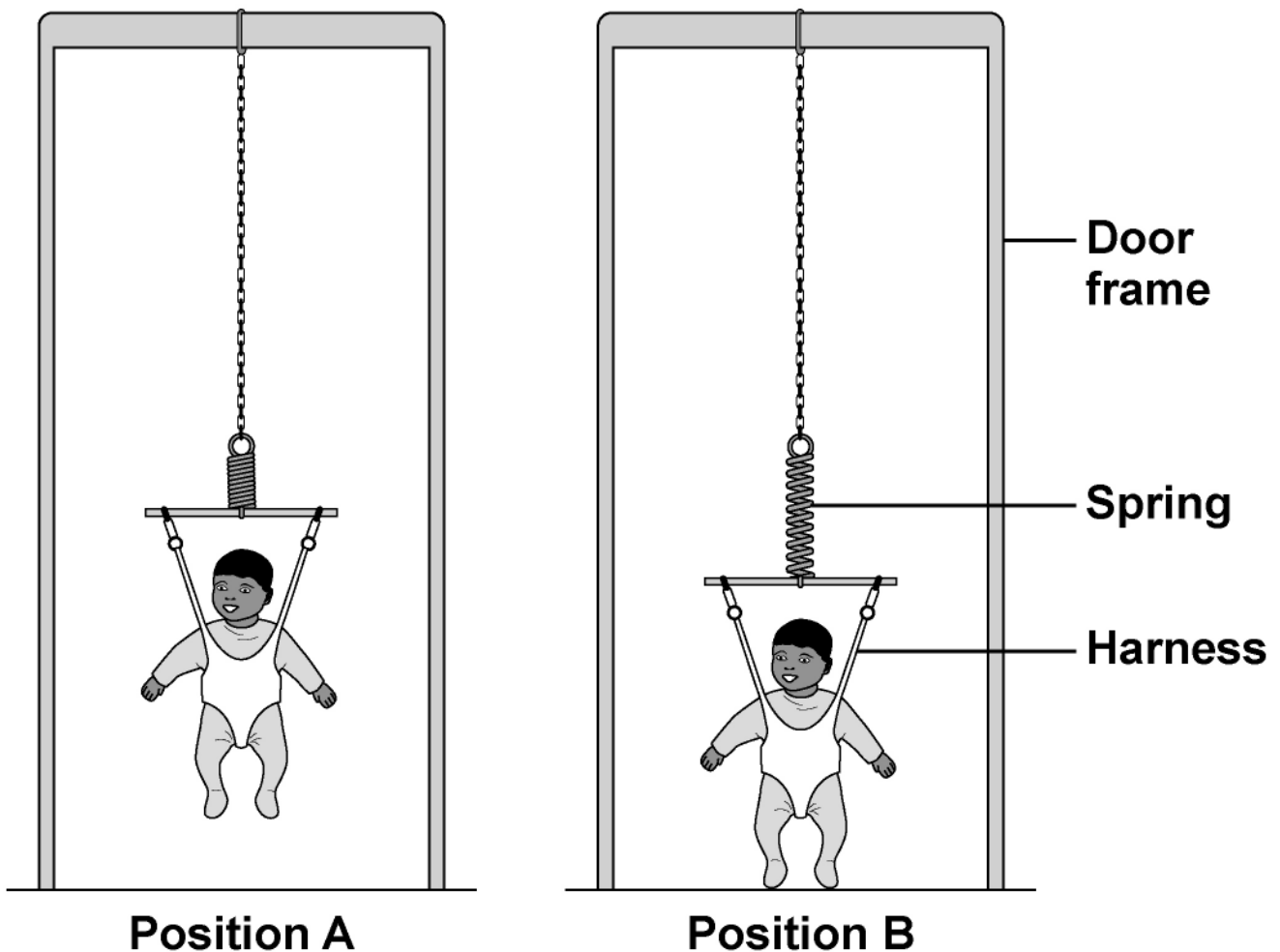


07

A baby bouncer is a harness attached to a spring that hangs from a door frame.

FIGURE 7 shows a baby in a baby bouncer in two positions.

FIGURE 7



| | | | |
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|---|---|---|---|

The baby bouncer should not be used with babies that have a mass greater than 12 kg.

Suggest ONE reason why. [1 mark]

[Turn over]



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| | | | |
|---|---|---|---|
| 0 | 7 | . | 2 |
|---|---|---|---|

In positions A and B the baby is stationary.

Describe the energy transfers as the baby moves from position A to position B. [3 marks]

[Turn over]



08

Scientists developed new models of the atom as new particles were discovered.

08.1

Draw ONE line from each particle to the year it was discovered. [2 marks]

PARTICLE

YEAR OF DISCOVERY

Electron

1897

Neutron

1911

Nucleus

1920

Proton

1932

[Turn over]

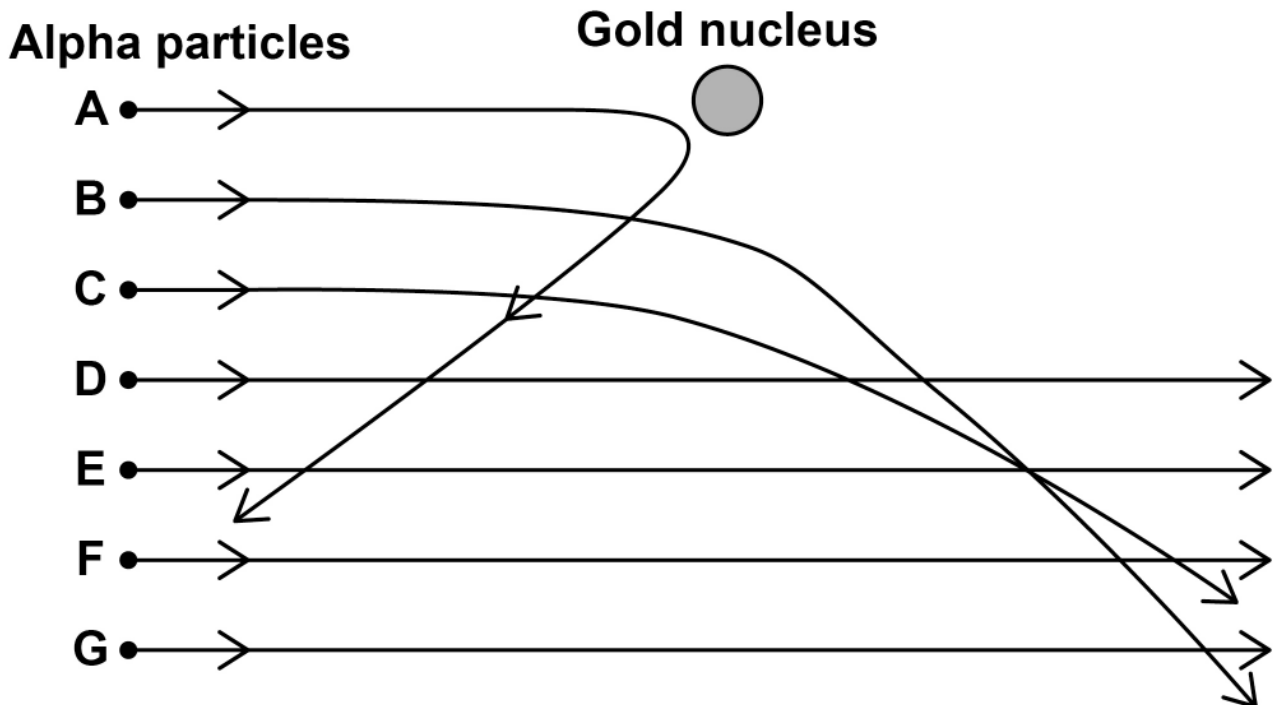


The nucleus was discovered using an alpha particle scattering experiment.

Alpha particles were directed at a sheet of gold foil.

FIGURE 8 shows the paths taken by seven alpha particles, A, B, C, D, E, F and G.

FIGURE 8



08.2

Explain why alpha particle A takes the path shown in FIGURE 8. [2 marks]



0 8 . 3

Explain why the path of alpha particle B is more tightly curved than the path of alpha particle C. [2 marks]

[Turn over]



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

What can be deduced about the atom from the paths taken by alpha particles D, E, F and G in FIGURE 8, on page 54? [1 mark]

Tick (✓) ONE box.

The atom contains a nucleus.

The atom contains protons, neutrons and electrons.

The atom is mostly empty space.

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

How is the Bohr model of the atom different from the nuclear model of the atom? [1 mark]



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

Explain how an electron can move up and down between energy levels in an atom. [2 marks]

[Turn over]

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09

FIGURE 9 shows air being pumped into a car tyre.

FIGURE 9

**09.1**

Complete the sentence. [1 mark]

Air particles in the tyre move quickly in
_____ directions.



| | | | |
|---|---|---|---|
| 0 | 9 | . | 2 |
|---|---|---|---|

When the tyre is at the correct pressure, pumping more air into the tyre causes the pressure to increase further.

The volume and temperature of the air in the tyre do NOT change.

Explain why the pressure increases as more air is pumped into the tyre. [2 marks]

[Turn over]



09.3

The air pressure in a car tyre changes if the temperature of the air in the tyre increases.

Explain why. [4 marks]

END OF QUESTIONS

7



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| Question | Mark |
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| TOTAL | |

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