AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

PHYSICS

H

Higher Tier   Paper 1

8463/1H

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 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.**

- **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).**

- **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 shows an electric car being recharged.

FIGURE 1

Charging station

Power cable

0 1 . 1

The charging station applies a direct potential difference across the battery of the car.

What does 'direct potential difference' mean? [1 mark]

_____

_____

_____

_____

0 1 . 2

Which equation links energy transferred (E), power (P) and time (t)? [1 mark]

Tick (✓) ONE box.

☐   **energy transferred = $\dfrac{\text{power}}{\text{time}}$**

☐   **energy transferred = $\dfrac{\text{time}}{\text{power}}$**

☐   **energy transferred = power × time**

☐   **energy transferred = power^2 × time**

[Turn over]

0 1 . 3

The battery in the electric car can store 162 000 000 J of energy.

The charging station has a power output of 7200 W.

Calculate the time taken to fully recharge the battery from zero. [3 marks]

_____

_____

_____

_____

_____

_____

Time taken = _____ s

| 0 | 1 | . | 4 |

Which equation links current (I), potential difference (V) and resistance (R)? [1 mark]

Tick (✓) ONE box.

☐ $I = V \times R$

☐ $I = V^2 \times R$

☐ $R = I \times V$

☐ $V = I \times R$

[Turn over]

0 1 . 5

The potential difference across the battery is 480 V.

There is a current of 15 A in the circuit connecting the battery to the motor of the electric car.

Calculate the resistance of the motor. [3 marks]

_____

_____

_____

_____

_____

_____

_____

Resistance = _____ Ω

0 1 . 6

Different charging systems use different electrical currents.

- Charging system A has a current of 13 A.

- Charging system B has a current of 26 A.

- The potential difference of both charging systems is 230 V.

How does the time taken to recharge a battery using charging system A compare with the time taken using charging system B? [1 mark]

Tick (✓) ONE box.

☐ Time taken using system A is half the time of system B

☐ Time taken using system A is the same as system B

☐ Time taken using system A is double the time of system B

[Turn over]

10

$\boxed{0}\boxed{2}$

Energy from the Sun is released by nuclear fusion.

$\boxed{0}\boxed{2}$. $\boxed{1}$

Complete the sentences. [2 marks]

Nuclear fusion is the joining together of

_____ .

During nuclear fusion the total mass of the particles

_____ .

0 2 . **2**

Nuclear fusion of deuterium is difficult to achieve on Earth because of the high temperature needed.

Electricity is used to increase the temperature of 4.0 g of deuterium by 50 000 000 °C.

specific heat capacity of deuterium = 5200 J/kg °C

Calculate the energy needed to increase the temperature of the deuterium by 50 000 000 °C.

Use the Physics Equations Sheet. [3 marks]

_____

_____

_____

_____

_____

_____

Energy = _____ J

[Turn over]

0 2 . 3

The idea of obtaining power from nuclear fusion was investigated using models.

The models were tested before starting to build the first commercial nuclear fusion power station.

Suggest TWO reasons why models were tested.
[2 marks]

1 _____

_____

_____

_____

2 _____

_____

_____

_____

| 0 | 2 | . | 4 |

Generating electricity using nuclear fusion will have fewer environmental effects than generating electricity using fossil fuels.

Explain ONE environmental effect of generating electricity using fossil fuels. [2 marks]

_____

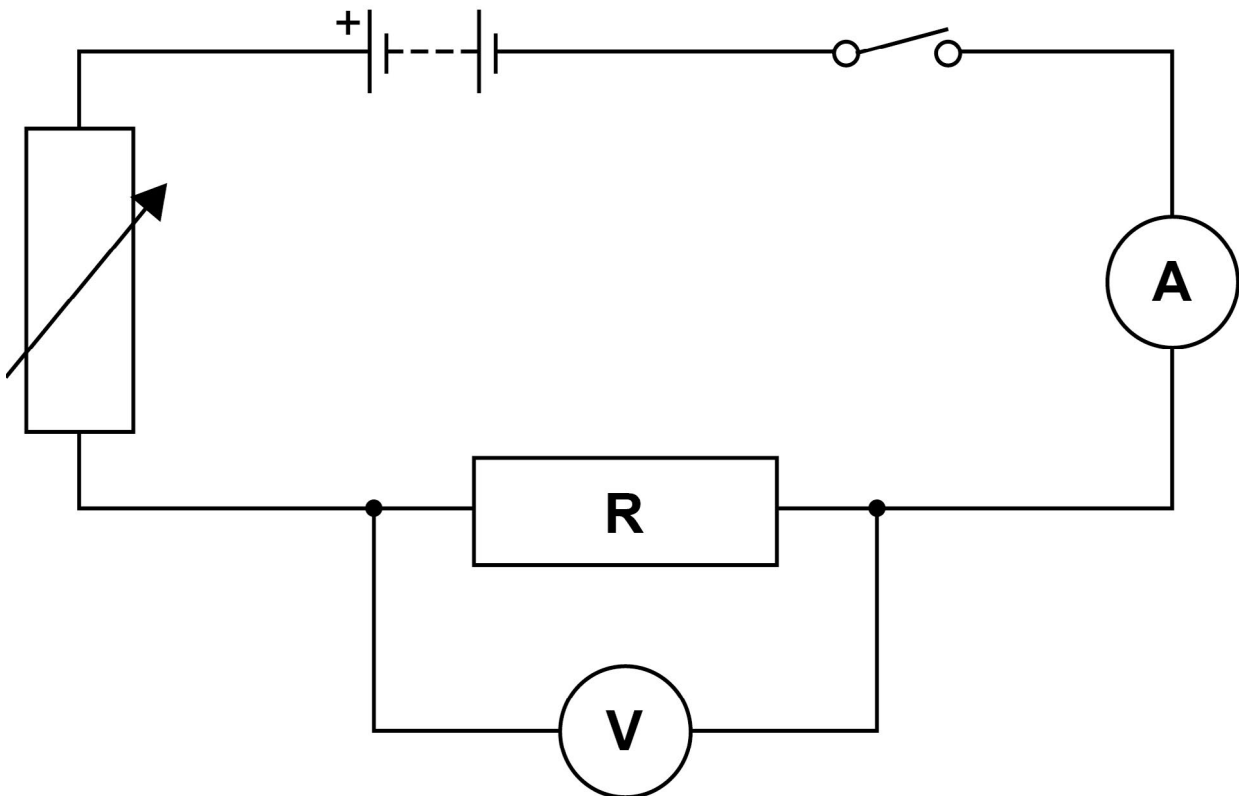_____

_____

_____

_____

_____

_____

[Turn over]

9

Student A investigated how the current in resistor R at constant temperature varied with the potential difference across the resistor.

Student A recorded both positive and negative values of current.

FIGURE 2 shows the circuit Student A used.

FIGURE 2

0 3 . **1**

Describe a method that Student A could use for this investigation. [6 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

[Turn over]

0 3 . 2

Student B repeated the investigation.

During Student B's investigation the temperature of resistor R increased.

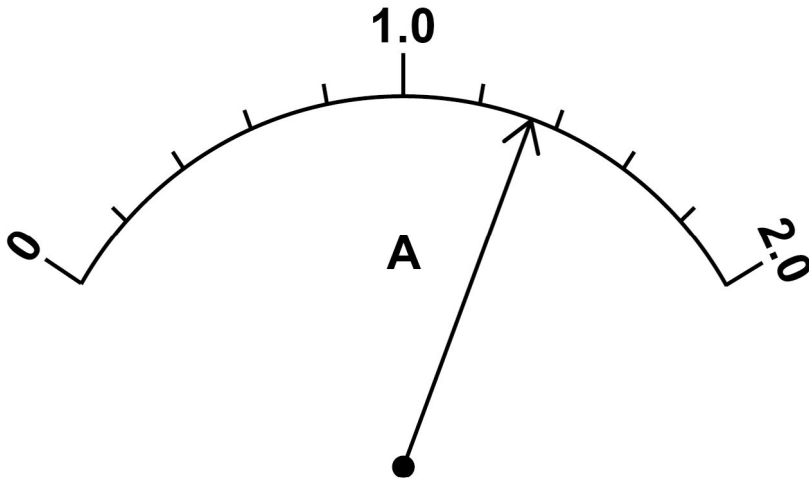**Explain how the increased temperature of resistor R would have affected Student B's results. [2 marks]**

_____

_____

_____

_____

_____

[Turn over]

FIGURE 3 shows the scale on a moving coil ammeter at one time in the investigation.

FIGURE 3

| 0 | 3 | . | 3 |

What is the resolution of the moving coil ammeter?
[1 mark]

Resolution = _____ A

0	3	.	4

Student B replaced the moving coil ammeter with a digital ammeter.

FIGURE 4 shows the reading on the digital ammeter.

FIGURE 4
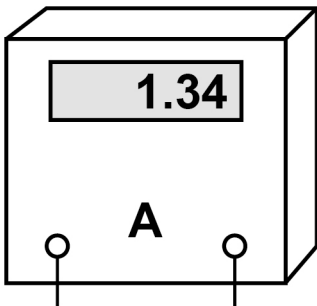
The digital ammeter has a higher resolution than the moving coil ammeter.

Give ONE other reason why it would have been better to use the digital ammeter throughout this investigation.
[1 mark]

_____

_____

_____

_____

[Turn over]

10

0 4

A student investigated the density of different fruits.

TABLE 1 shows the results.

TABLE 1

Fruit	Density in g/cm^3
Apple	0.68
Kiwi	1.03
Lemon	0.95
Lime	1.05

0 4 . 1

The student determined the volume of each fruit using a displacement can and a measuring cylinder.

What other piece of equipment would the student need to determine the density of each fruit? [1 mark]

_____

_____

0 4 . 2

Write down the equation which links density (ρ), mass (m) and volume (V). [1 mark]

_____

_____

[Turn over]

| 0 | 4 | . | 3 |

The mass of the apple was 85 g.

The density of the apple was 0.68 g/cm^3.

Calculate the volume of the apple.

Give your answer in cm^3. [3 marks]

_____

_____

_____

_____

_____

Volume = _____ cm^3

$\boxed{0}\,\boxed{4}$. $\boxed{4}$

The student only measured the volume of each fruit once.

The volume measurements CANNOT be used to show that the method to measure volume gives precise readings.

Give the reason why. [1 mark]

_____

_____

_____

[Turn over]

$\boxed{ \\ 6}$

0 5 . 1

During one year, 1.25 × 10^{18} J of energy was transferred from the National Grid.

number of seconds in 1 year = 3.16 × 10^7

Calculate the mean energy transferred from the National Grid each second.

Give your answer to 3 significant figures. [2 marks]

_____

_____

_____

_____

Energy each second (3 significant figures =)

_____ **J**

BLANK PAGE

[Turn over]

FIGURE 5 shows a house with a solar power system.

The solar cells generate electricity.

When the electricity generated by the solar cells is not needed, the energy is stored in a large battery.

FIGURE 5

0 5 . 2

The charge flow through the cable between the solar cells and the battery in 24 hours was 27 000 coulombs.

Calculate the mean current in the cable. [4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

Mean current = _____ A

[Turn over]
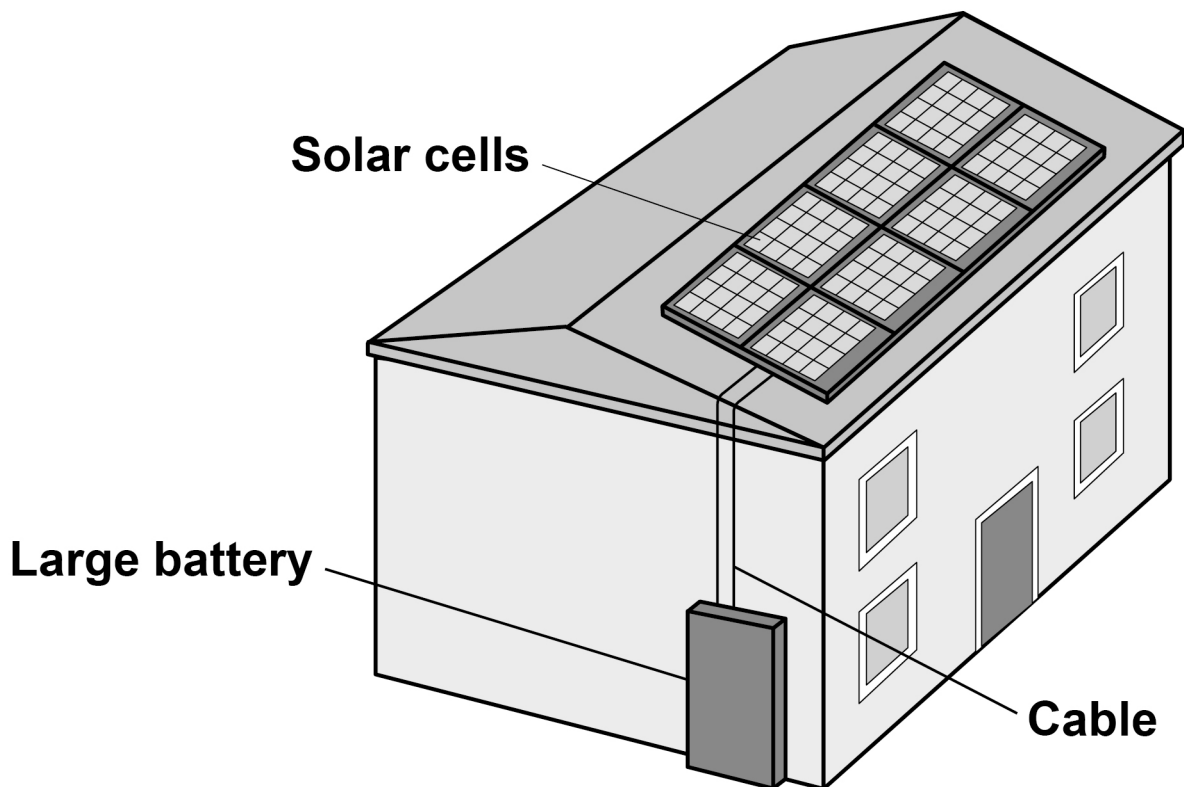
| 0 | 5 | . | 3 |

At one time, the total power input to the solar cells was 7.8 kW.

The efficiency of the solar cells was 0.15

Calculate the useful power output of the solar cells. [3 marks]

_____

_____

_____

_____

_____

_____

Useful power output = _____ W

0 5 . 4

It is unlikely that ALL of the electricity that the UK needs can be generated by solar power systems.

Explain why. [2 marks]

_____

_____

_____

_____

_____

[Turn over]

11

0 6

FIGURE 6 shows the mass number and the atomic number for the nuclei of five different atoms.

FIGURE 6
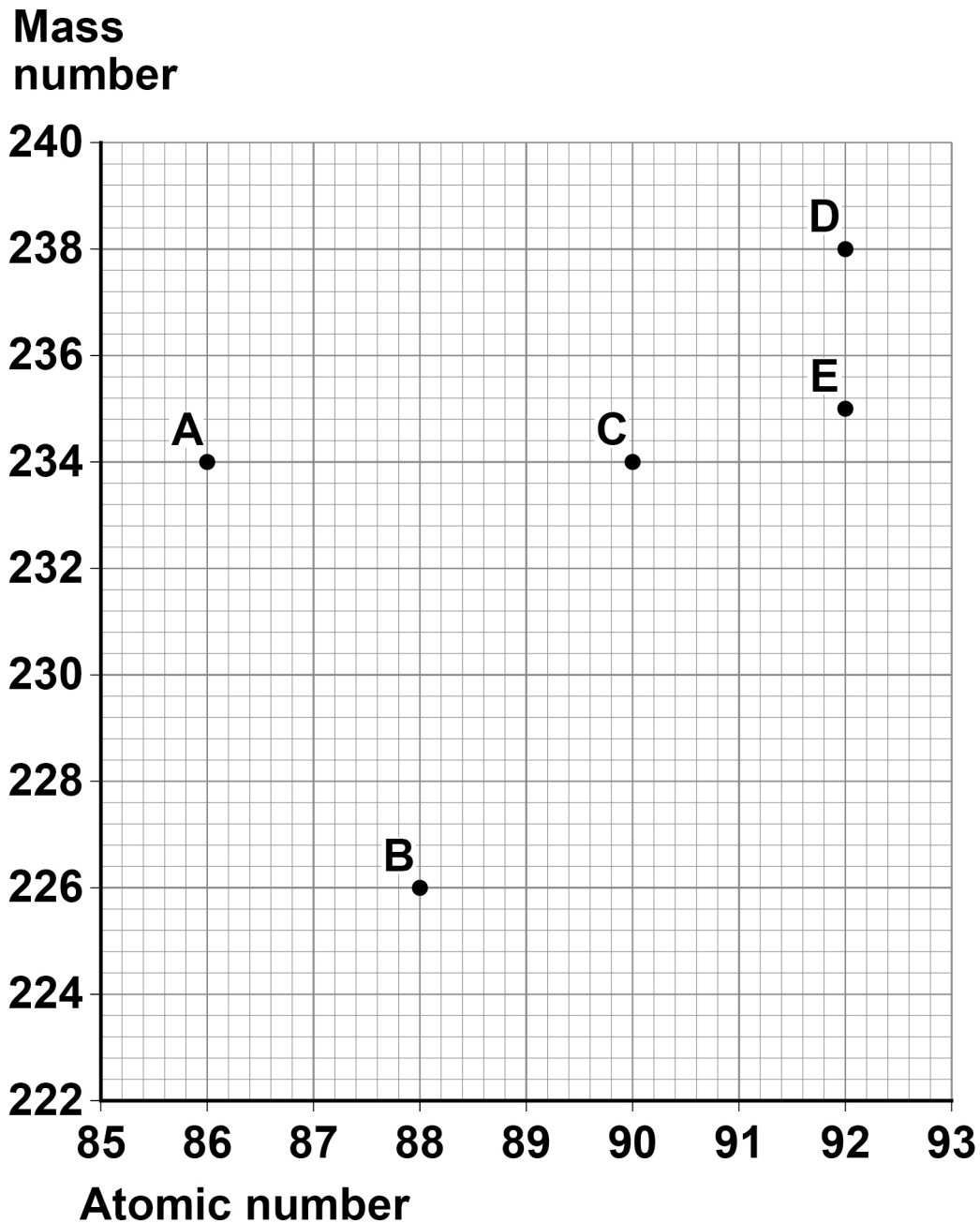
0 6 . 1

How many neutrons are there in a nucleus of atom A?
[1 mark]

_____

_____

0 6 . 2

Which TWO atoms in FIGURE 6 are the same element?
[1 mark]

Tick (✓) ONE box.

☐　**A and B**

☐　**A and C**

☐　**C and D**

☐　**D and E**

[Turn over]

0 6 . 3

Nucleus B decays by emitting an alpha particle.

Draw an arrow on FIGURE 7 to represent the alpha decay. [2 marks]

FIGURE 7

Mass number
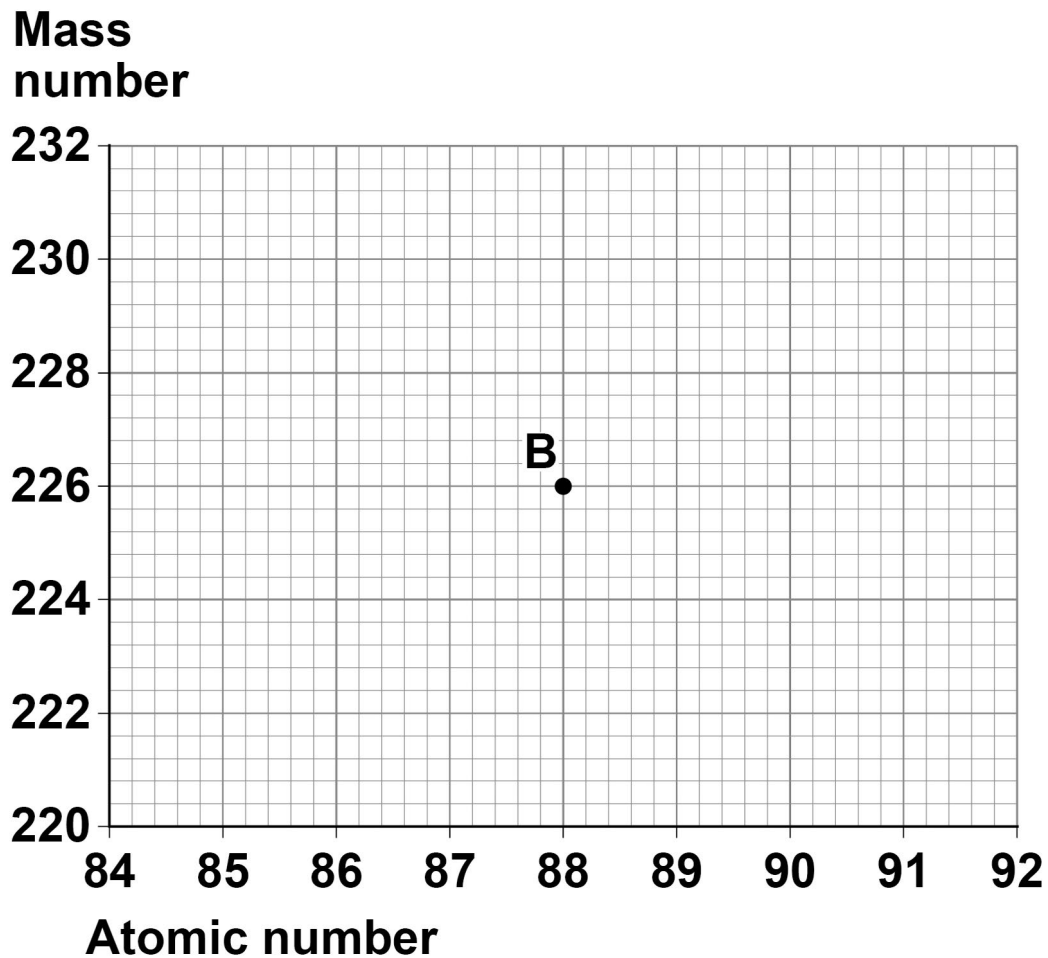
0 6 . 4

What is meant by the 'random nature of radioactive decay'? [1 mark]

_____

_____

_____

_____

[Turn over]

0	6	.	5

A polonium (Po) nucleus decays by emitting an alpha particle and forming a lead (Pb) nucleus.

Po $\longrightarrow$ Pb + α

The lead (Pb) nucleus then decays by emitting a beta particle and forms a bismuth (Bi) nucleus.

Pb $\longrightarrow$ Bi + β
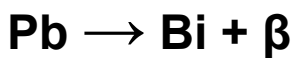
The bismuth (Bi) nucleus then decays by emitting a beta particle and forms a polonium (Po) nucleus.

Bi $\longrightarrow$ Po + β

Explain how these three decays result in a nucleus of the original element, polonium. [3 marks]

_____

_____

_____

_____

_____

[Turn over]

8

0 7

A student investigated how the current in a series circuit varied with the resistance of a variable resistor.
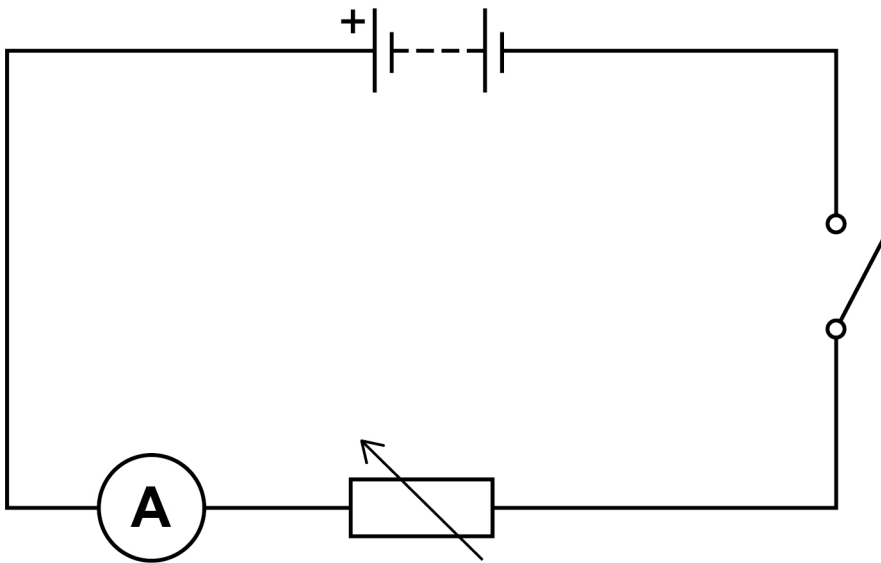
FIGURE 8 shows the circuit used.

FIGURE 8
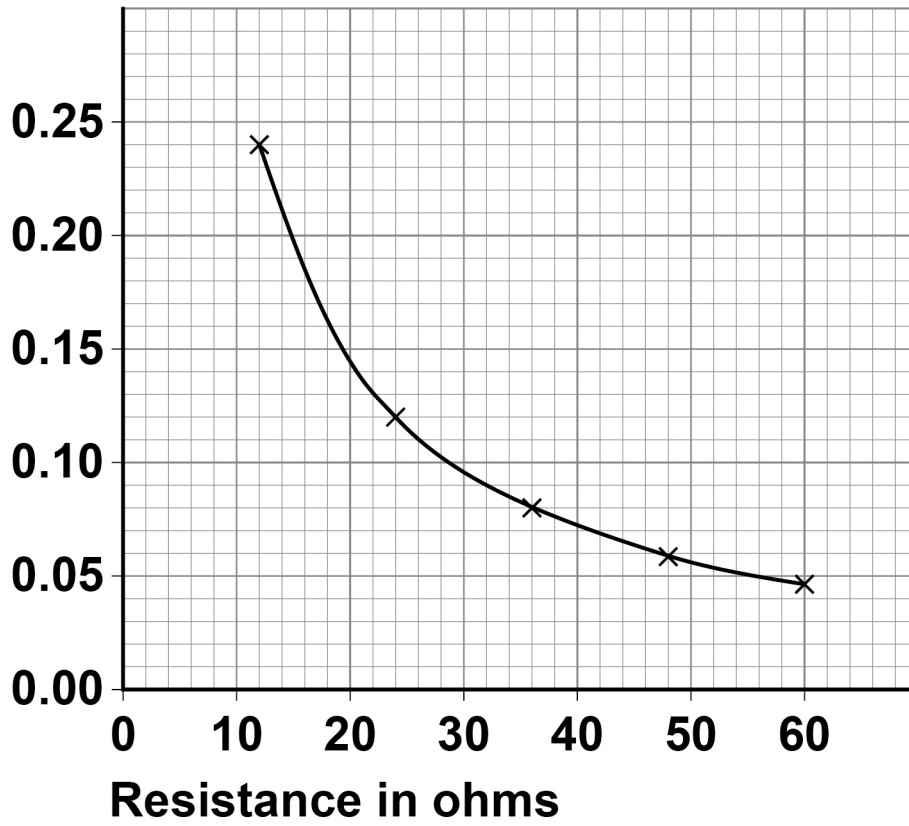

FIGURE 9, on page 38, shows the results.
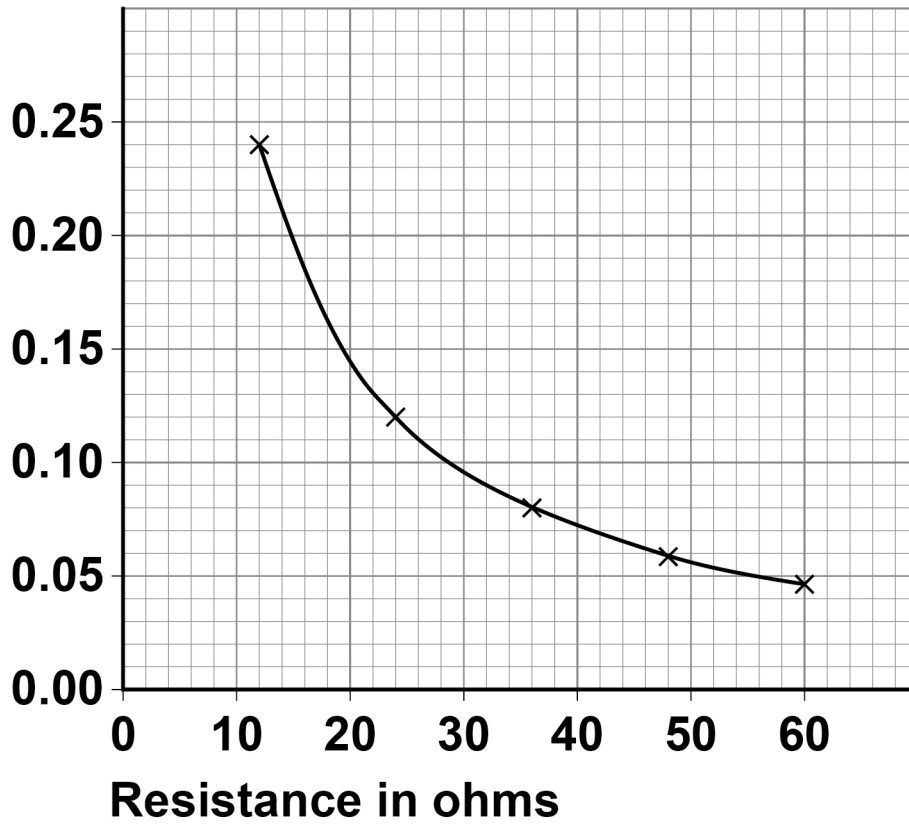
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[Turn over]

FIGURE 9

Current in amps vs **Resistance in ohms**

0 7 . 1

The battery had a power output of 230 mW when the resistance of the variable resistor was 36 Ω.

**Determine the potential difference across the battery.
[4 marks]**

_____

_____

_____

_____

_____

_____

_____

Potential difference = _____ V

[Turn over]

REPEAT OF FIGURE 9

07.**2**

The student concluded:

'the current in the circuit was inversely proportional to the resistance of the variable resistor.'

Explain how FIGURE 9 shows that the student is correct. [2 marks]

_____

_____

_____

_____

_____

[Turn over]

0	7	.	3

FIGURE 10 shows a circuit with a switch connected incorrectly.

FIGURE 10
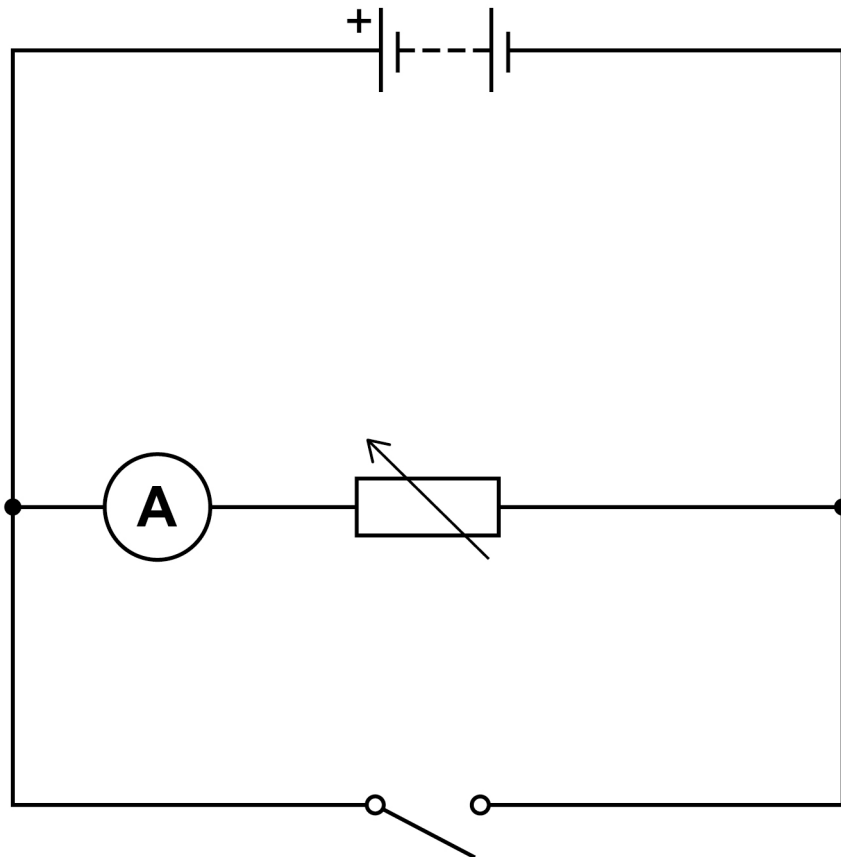
Explain how closing the switch would affect the current in the variable resistor. [2 marks]

_____

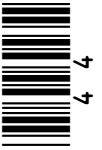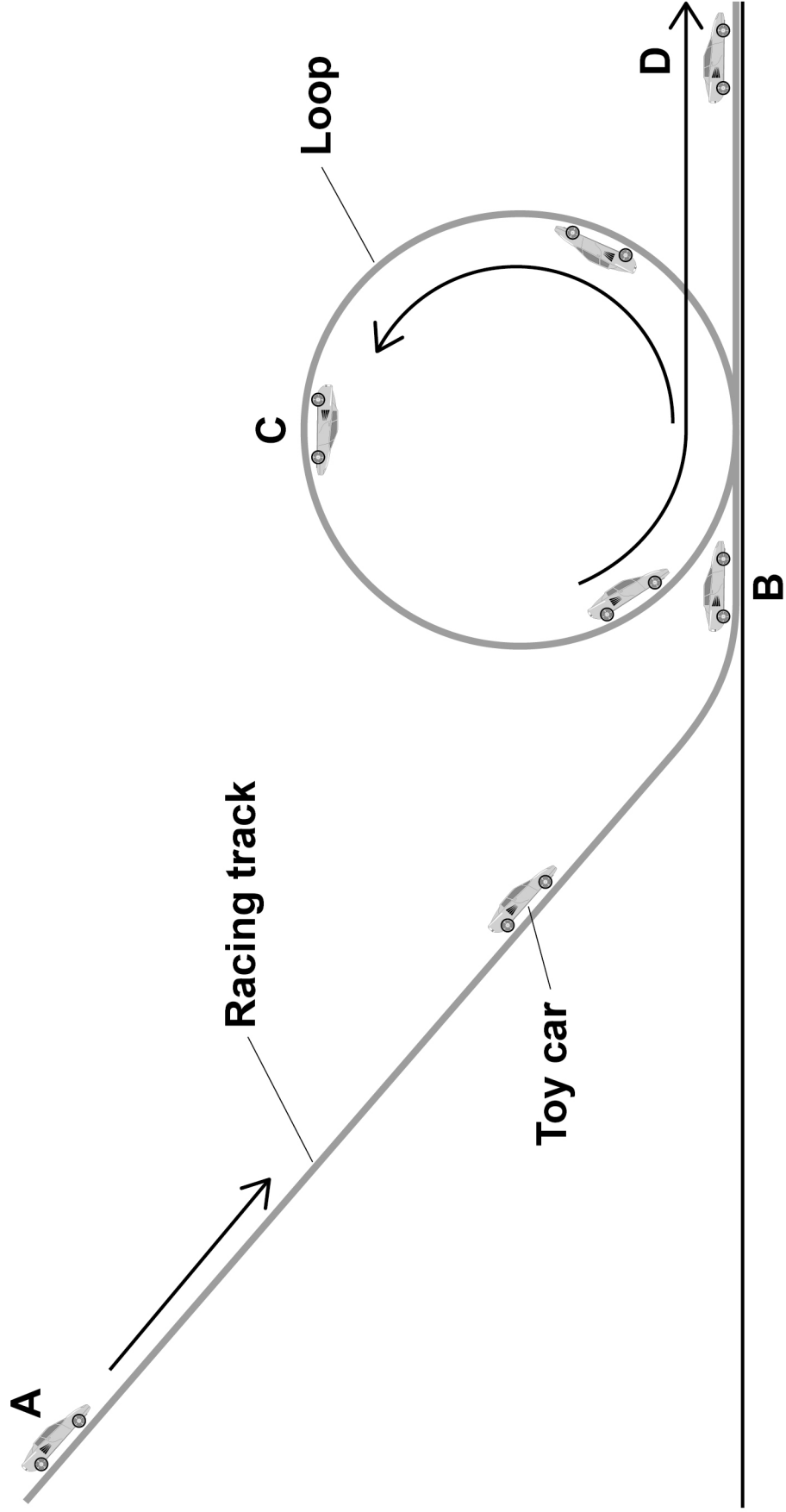_____

_____

[Turn over]

8

0	8

FIGURE 11 shows a toy car in different positions on a racing track.

FIGURE 11

0 8 . 1

The toy car and racing track can be modelled as a closed system.

Why can the toy car and racing track be considered 'a closed system'? [1 mark]

Tick (✓) ONE box.

☐ The racing track and the car both have gravitational potential energy.

☐ The racing track and the car are always in contact with each other.

☐ The total energy of the racing track and the car is constant.

[Turn over]

0 8 . 2

The car is released from rest at position A and accelerates due to gravity down the track to position B.

mass of toy car = 0.040 kg

vertical height between position A and position B = 90 cm

gravitational field strength = 9.8 N/kg

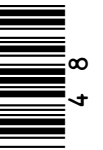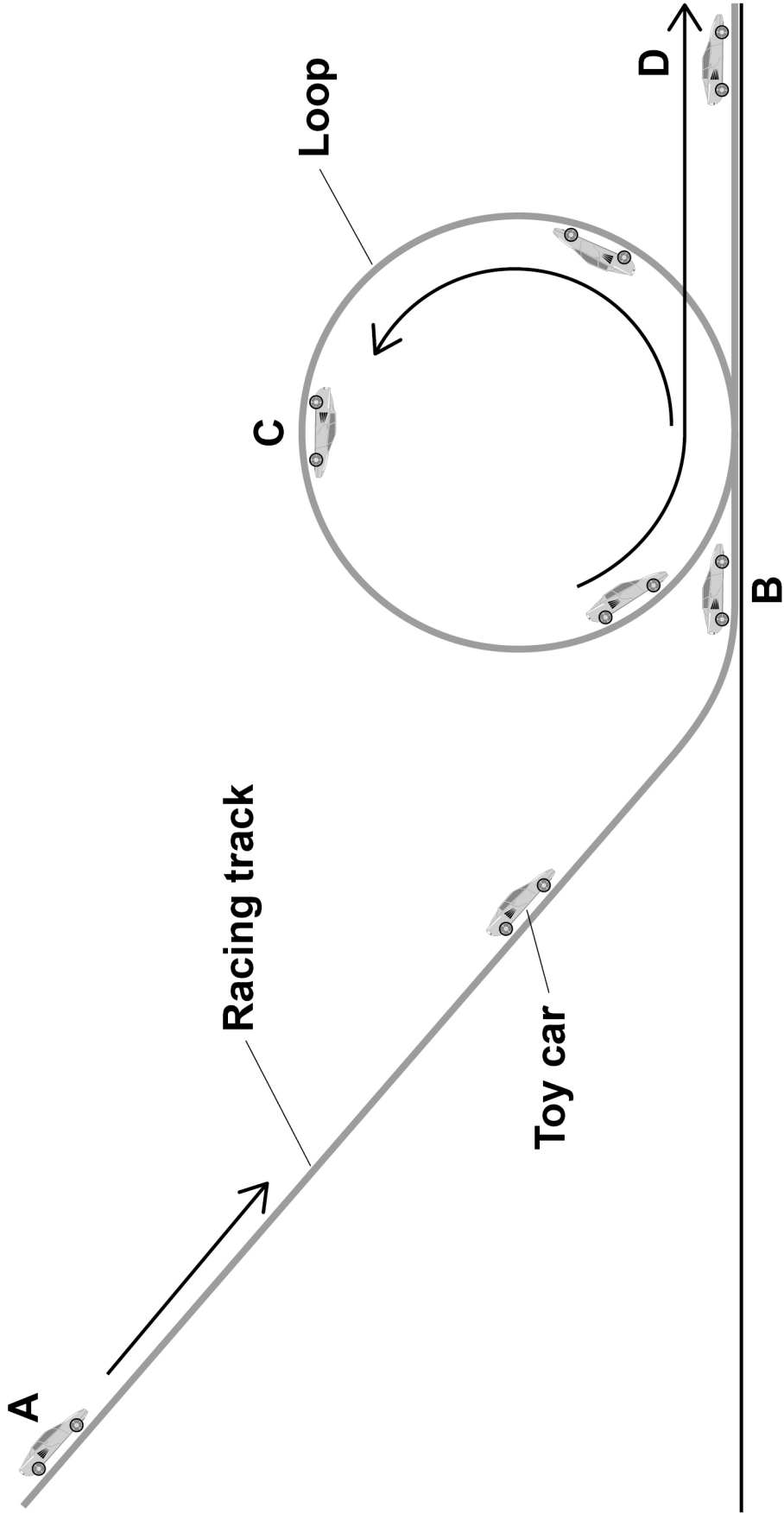Calculate the maximum possible speed of the toy car when it reaches position B.
[5 marks]

_____

_____

_____

_____

Speed = _____ **m/s**

FIGURE 11 is repeated below.

FIGURE 11

Racing track

Toy car

Loop

| 0 | 8 | . | 3 |

At position C the car's gravitational potential energy is 0.20 J greater than at position B.

How much kinetic energy does the car need at position B to complete the loop of the track?

Give a reason for your answer, on page 50. **[2 marks]**

Tick (✓) ONE box.

Less than 0.20 J

Exactly 0.20 J

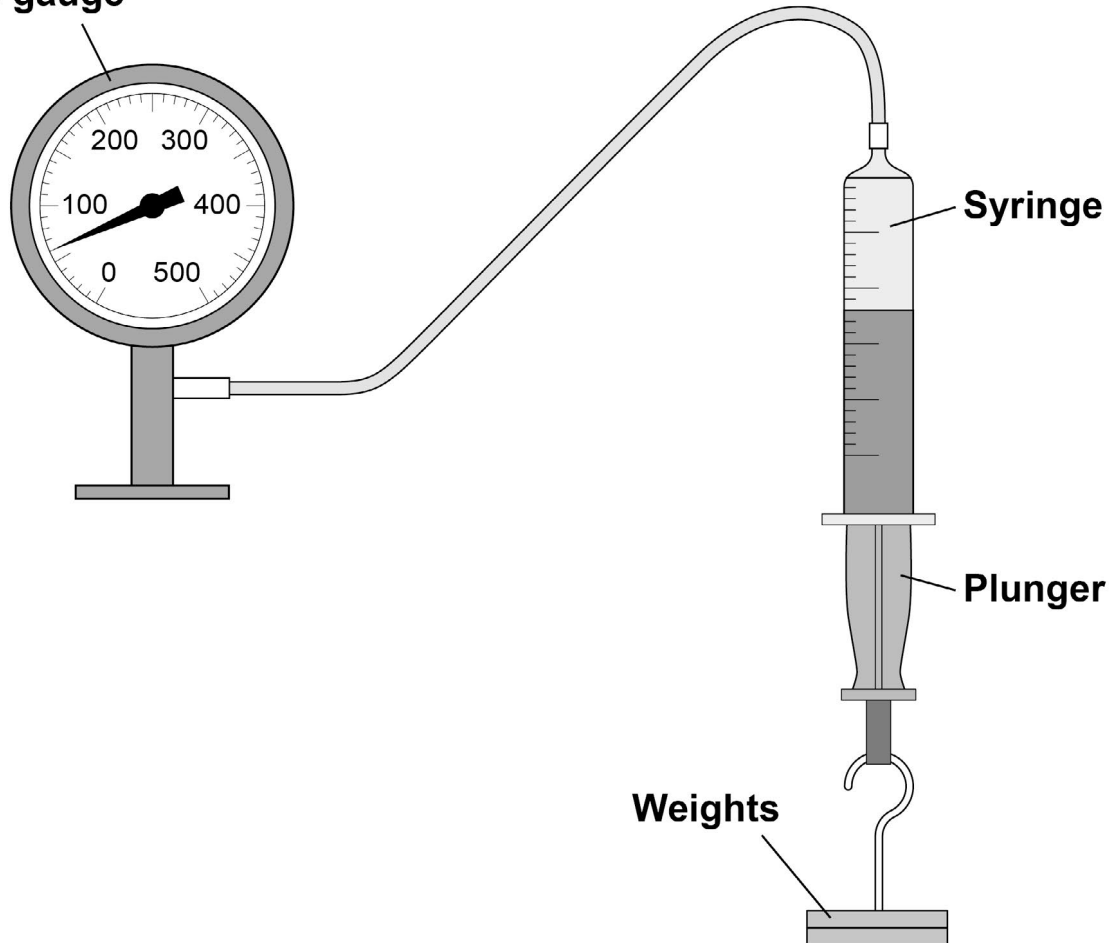More than 0.20 J

[Turn over]

Reason

8

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0 9

A teacher demonstrated the relationship between the pressure in a gas and the volume of the gas.

FIGURE 12 shows the equipment used.

Pressure gauge

This is the method used.

1. Record the initial volume of gas in the syringe and the pressure reading before any weights are attached.

2. Attach a 2.0 N weight to the syringe.

3. Record the volume of the gas and the reading on the pressure gauge.

4. Repeat steps 2 and 3 until a weight of 12.0 N is attached to the syringe.

| 0 | 9 | . | 1 |

What was the range of force used? [1 mark]

From _____ N to _____ N

| 0 | 9 | . | 2 |

Give ONE control variable in the investigation. [1 mark]

_____

_____

[Turn over]

0 9 . 3

When the volume of gas in the syringe was 45 cm^3, the pressure gauge showed a value of 60 kPa.

Calculate the pressure in the gas when the volume of gas in the syringe was 40 cm^3. [4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

Pressure = _____ kPa

0 9 . 4

When the volume of gas in the syringe increased, the pressure on the inside walls of the syringe decreased.

Explain why. [3 marks]

_____

_____

_____

_____

_____

_____

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_____

_____

_____

[Turn over]

9

1	0

FIGURE 13 shows some overhead power cables in the National Grid.

FIGURE 13
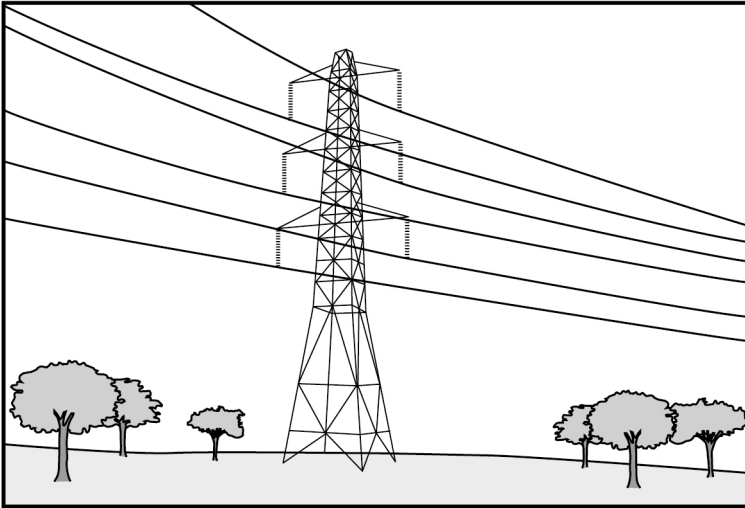
1	0	.	1

Explain the advantage of transmitting electricity at a very high potential difference. [3 marks]

_____

_____

_____

_____

10 . 2

It is dangerous for a person to fly a kite near an overhead power cable.

FIGURE 14 shows a person flying a kite.

FIGURE 14

The person could receive a fatal electric shock if the kite was very close to, but not touching the power cable.
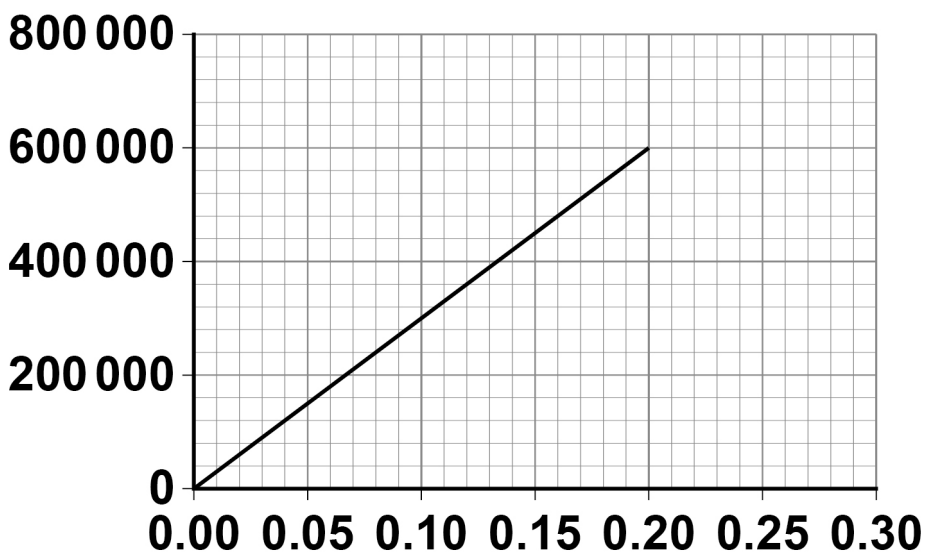
Explain why. [3 marks]

_____

_____

[Turn over]

A scientist investigated how the potential difference needed for air to conduct charge varies with the distance between a cable and earth.

FIGURE 15 shows the results.

FIGURE 15

Potential difference in volts vs **Distance between cable and earth in metres**

1 0 . **3**

The data in FIGURE 15, on the opposite page, gives the relationship between potential difference and distance when the air is dry.

When the humidity of air increases the air becomes a better conductor of electricity.

Draw a line on FIGURE 15, on the opposite page, to show how the potential difference changes with distance if the humidity of the air increases. [2 marks]
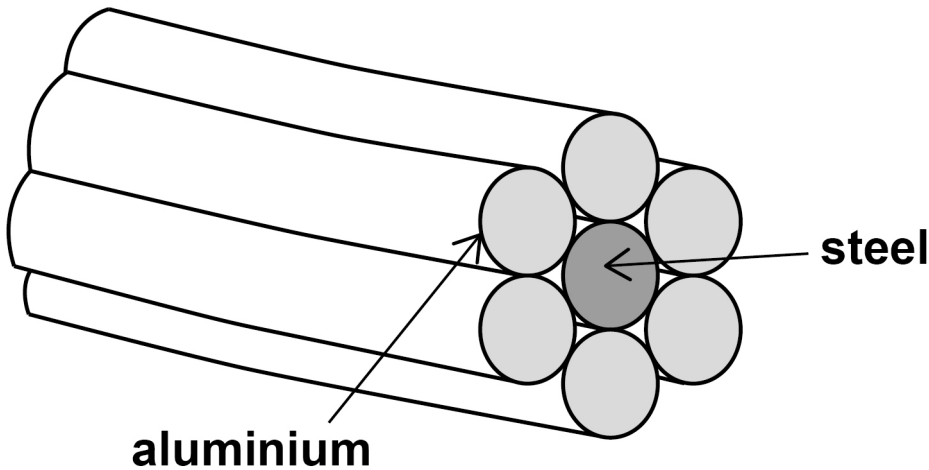
[Turn over]

| 1 | 0 | . | 4 |

FIGURE 16 shows a cross-section through a power cable.

FIGURE 16

aluminium   steel

A 1 metre length of a single aluminium wire is a better conductor than a 1 metre length of the steel wire.

The individual wires behave as if they are resistors connected in parallel.

Explain why the current in the steel wire is different to the current in a single aluminium wire. [2 marks]

_____

_____

_____

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_____

_____

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_____

[Turn over]

10

1 1

A student investigated how the temperature of a lump of ice varied as the ice was heated.
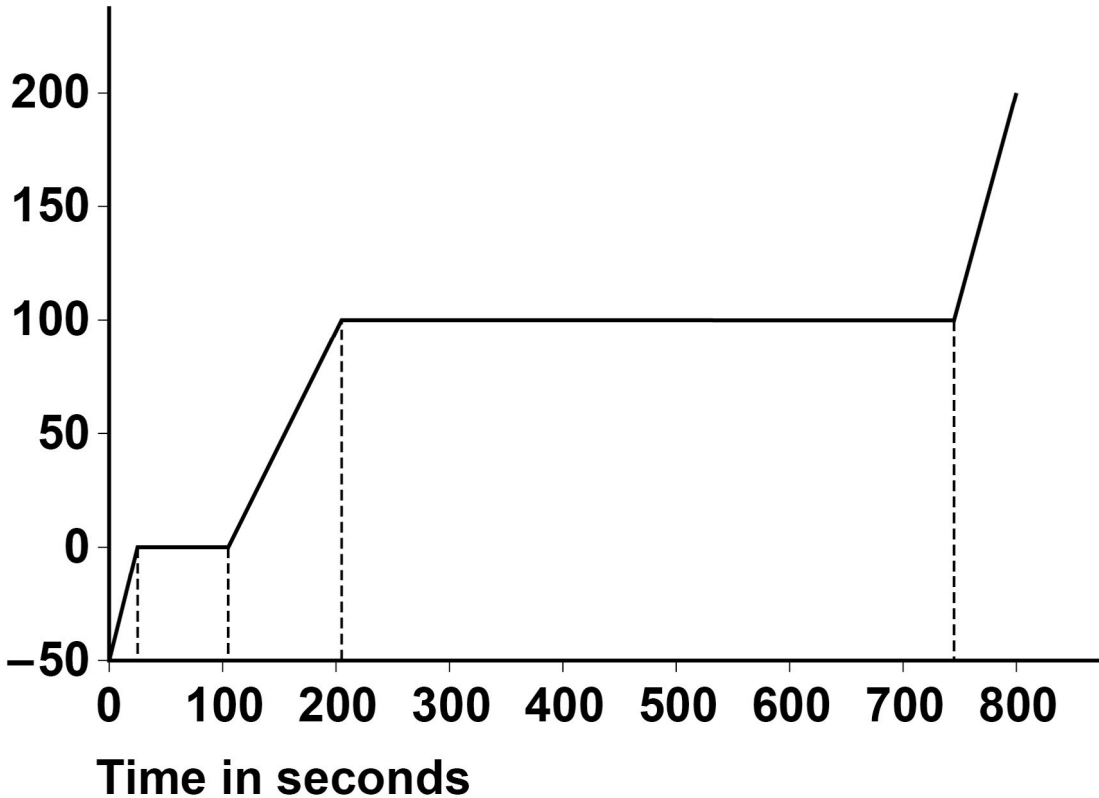
The student recorded the temperature until the ice melted and then the water produced boiled.

FIGURE 17 shows the student's results.

The power output of the heater was constant.

FIGURE 17

1 1 . 1

The specific heat capacity of ice is less than the specific heat capacity of water.

Explain how FIGURE 17 shows this. [2 marks]

_____

_____

_____

_____

_____

[Turn over]

1 1 . 2

The specific latent heat of fusion of ice is less than the specific latent heat of vaporisation of water.

Explain how FIGURE 17, on page 64, shows this.
[2 marks]

_____

_____

_____

_____

_____

1 1 . 3

A second student did the same investigation and recorded the temperature until the water produced boiled.

In the second student's investigation more thermal energy was transferred to the surroundings.

Describe TWO ways the results of the experiment in FIGURE 17, on page 64, would have been different.
[2 marks]

1 _____

_____

_____

_____

_____

2 _____

_____

_____

_____

_____

[Turn over]

1 1 . 4

When the water was boiling, 0.030 kg of water turned into steam.

The energy transferred to the water was 69 kJ.

Calculate the specific latent heat of vaporisation of water.

Give the unit. [5 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Specific latent heat of vaporisation =

_____

Unit _____

END OF QUESTIONS

11

Additional page, if required.
Write the question numbers in the left-hand margin.

Additional page, if required.
Write the question numbers in the left-hand margin.

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