A

Surname ______

Other Names ______

Centre Number ______

Candidate Number ______

Candidate Signature ______

GCSE

COMBINED SCIENCE: TRILOGY

H

Higher Tier

Physics Paper 1H

8464/P/1H

Wednesday 23 May 2018 Afternoon

Time allowed: 1 hour 15 minutes

For this paper you must have:

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

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

[Turn over]

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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

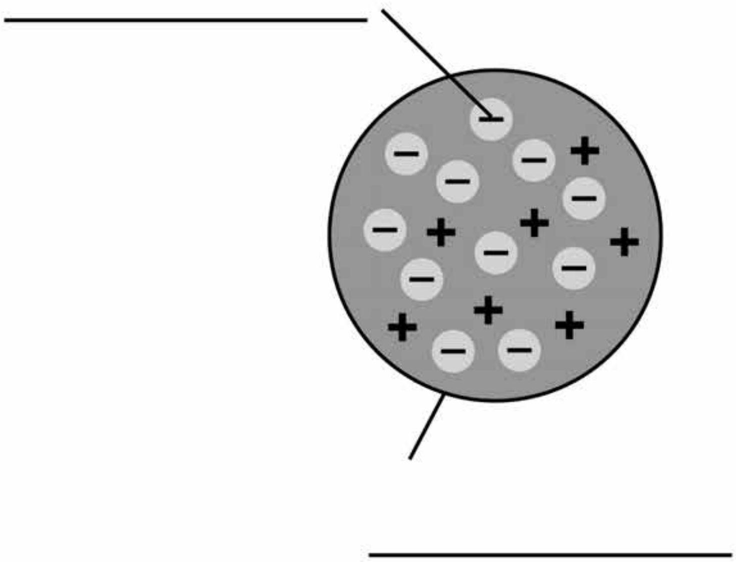
- **The maximum mark for this paper is 70.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

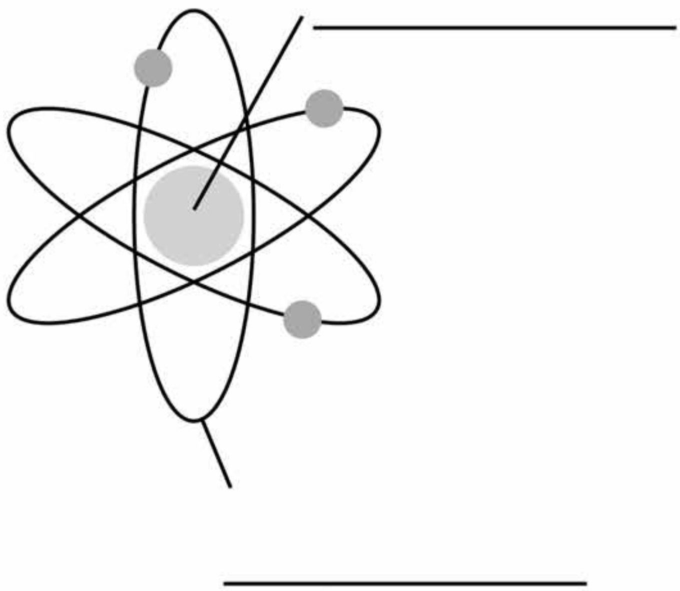
0 1 FIGURE 1 shows two models of the atom.

FIGURE 1

Plum pudding model



Nuclear model



0 1 . 1 **Write the labels on FIGURE 1**

Choose the answers from the list. [4 marks]

atom	**neutron**
electron	**orbit**
nucleus	**proton**

0 1 . 2 **Explain why the total positive charge in every atom of an element is always the same.**
[2 marks]

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[Turn over]

0 1 . 3 The results from the alpha particle scattering experiment led to the nuclear model.

Alpha particles were fired at a thin film of gold at a speed of 7% of the speed of light.

Determine the speed of the alpha particles.

Speed of light = 300 000 000 m/s

[2 marks]

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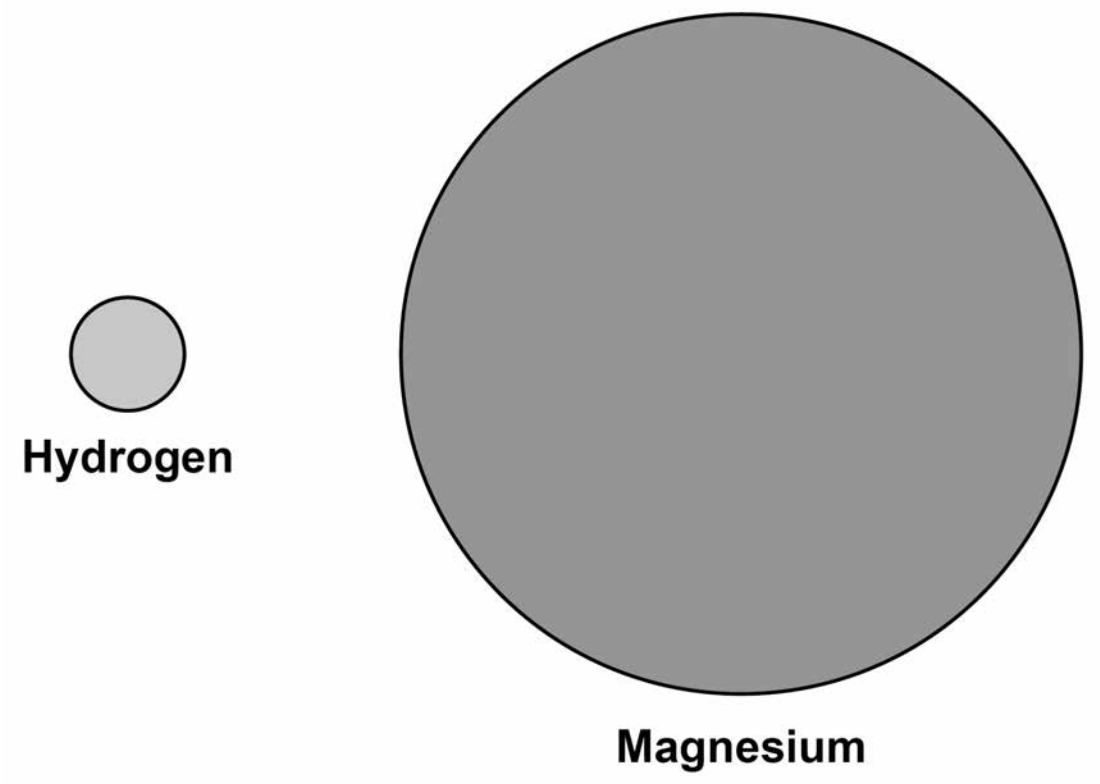
Speed = ______________________ m/s

0 1 . 4 FIGURE 2 shows two atoms represented as solid spheres.

FIGURE 2



A hydrogen atom has a radius of 2.5×10^{-11} m

Determine the radius of a magnesium atom.
[2 marks]

Take the radius of the atoms as measured on FIGURE 2 to be:

Hydrogen atom 6 mm

Magnesium atom 36 mm

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Radius = ______________________ m

[Turn over]

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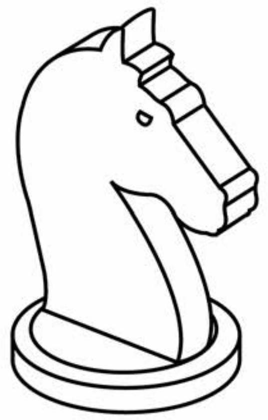
0 2 A student wanted to determine the density of the irregular shaped object shown in FIGURE 3

FIGURE 3



0 2 . 1 Plan an experiment that would allow the student to determine the density of the object.
[6 marks]

[Turn over]

0 2 . 2 **Another student did a similar experiment.**

He determined the density of five common plastic materials.

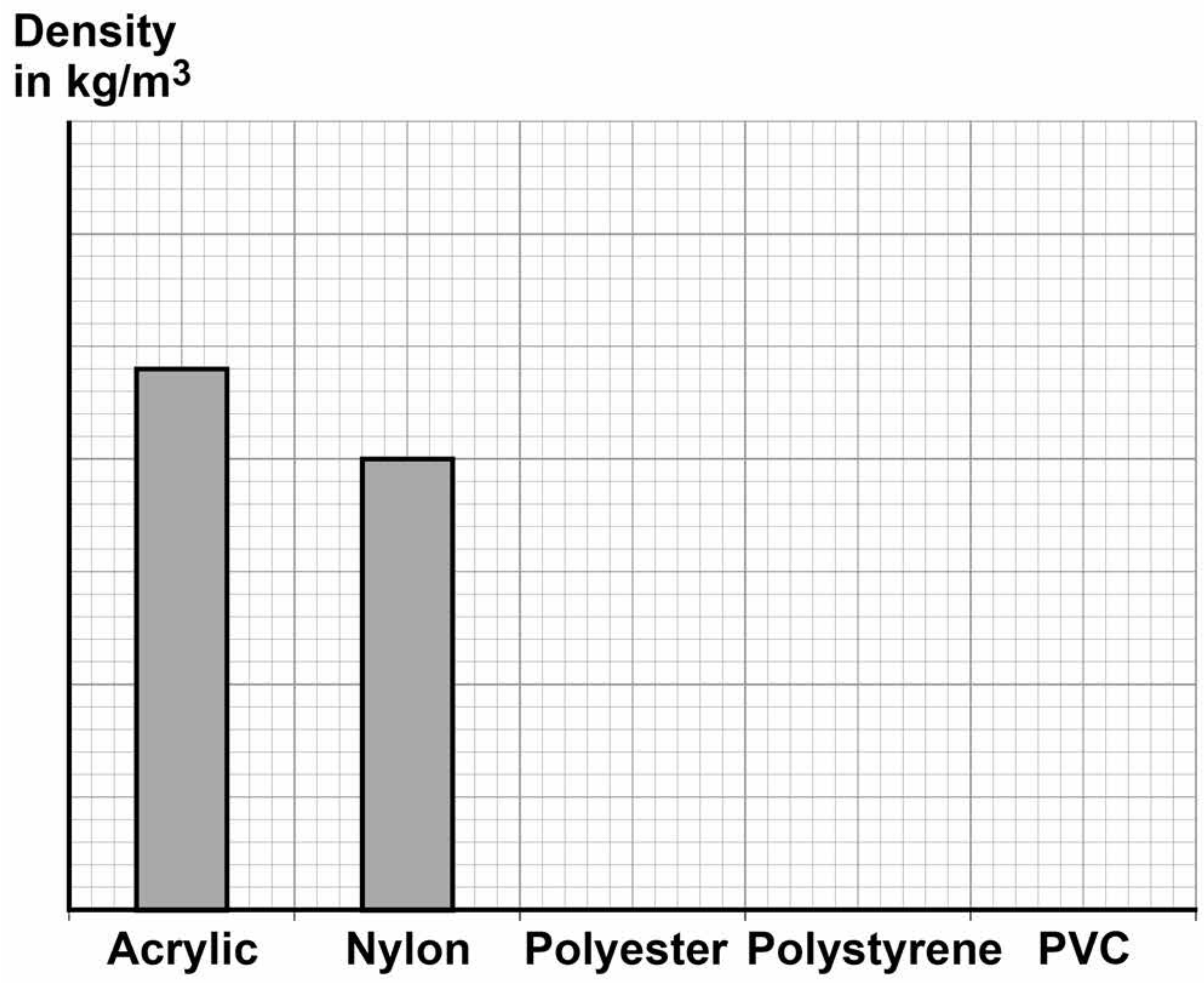
TABLE 1 shows the results.

TABLE 1

Plastic material	Density in kg/m^3
Acrylic	1200
Nylon	1000
Polyester	1380
Polystyrene	1040
PVC	1100

FIGURE 4 shows the results plotted in a bar chart.

FIGURE 4



Complete FIGURE 4

You should:

- Write the correct scale on the y-axis.
- Draw the bars for polyester, polystyrene and PVC.

[4 marks]

0 2 . 3 **The student is given a piece of a different plastic material.**

The student determined the density of the material three times.

TABLE 2 shows the results.

TABLE 2

	Density in kg/m^3
1	960
2	1120
3	1040

Determine the uncertainty in the student's results. [2 marks]

____

____

____

Uncertainty = ______________________ **kg/m^3**

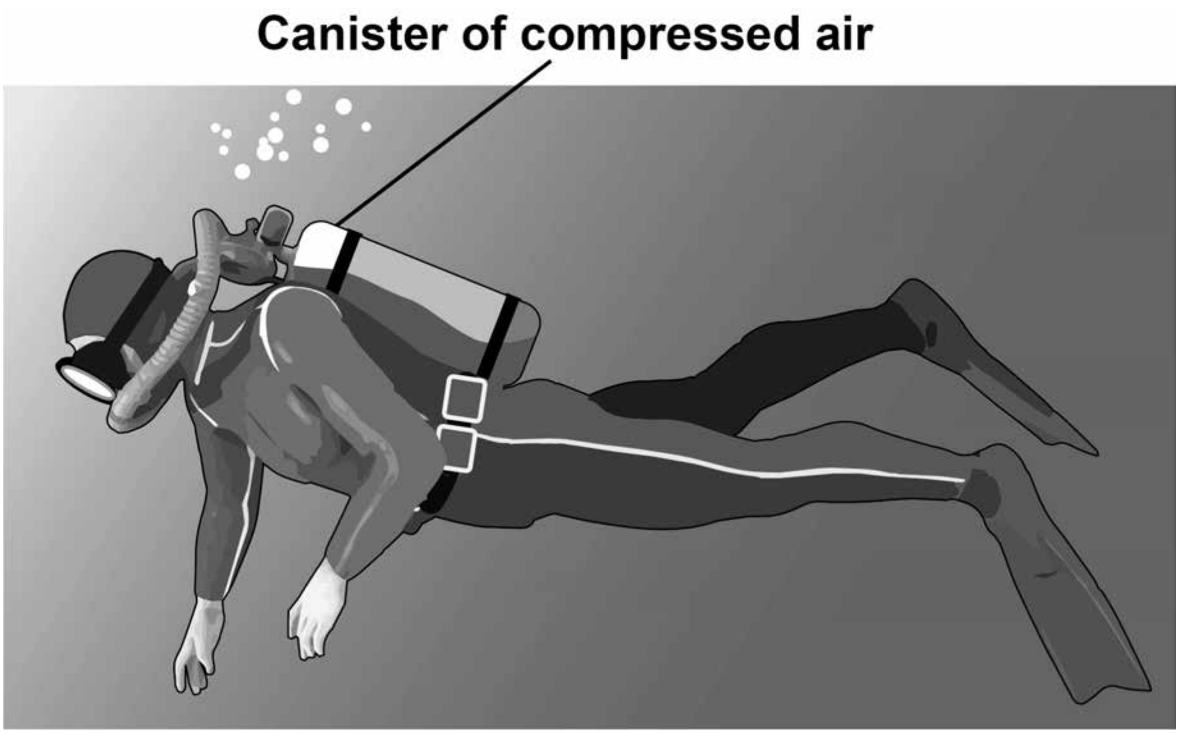
12

[Turn over]

0 3 **FIGURE 5 shows a diver.**

The diver is using a canister of compressed air so that he can breathe underwater.

FIGURE 5



0 3 . 1 **Which TWO sentences describe the movement of the air particles in the canister? [2 marks]**

Tick TWO boxes.

☐ **They vibrate about a fixed position.**

☐ **They move in random directions.**

☐ **The motion of all the particles is predictable.**

☐ **They move with a range of different speeds.**

☐ **They move in circular paths.**

[Turn over]

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0 3 . 2 **The temperature of the air inside the canister increases.**

What happens to the movement of the air particles? [1 mark]

0 3 . 3 **It could be dangerous if the temperature of the air inside the canister increased by a large amount.**

Explain why. [2 marks]

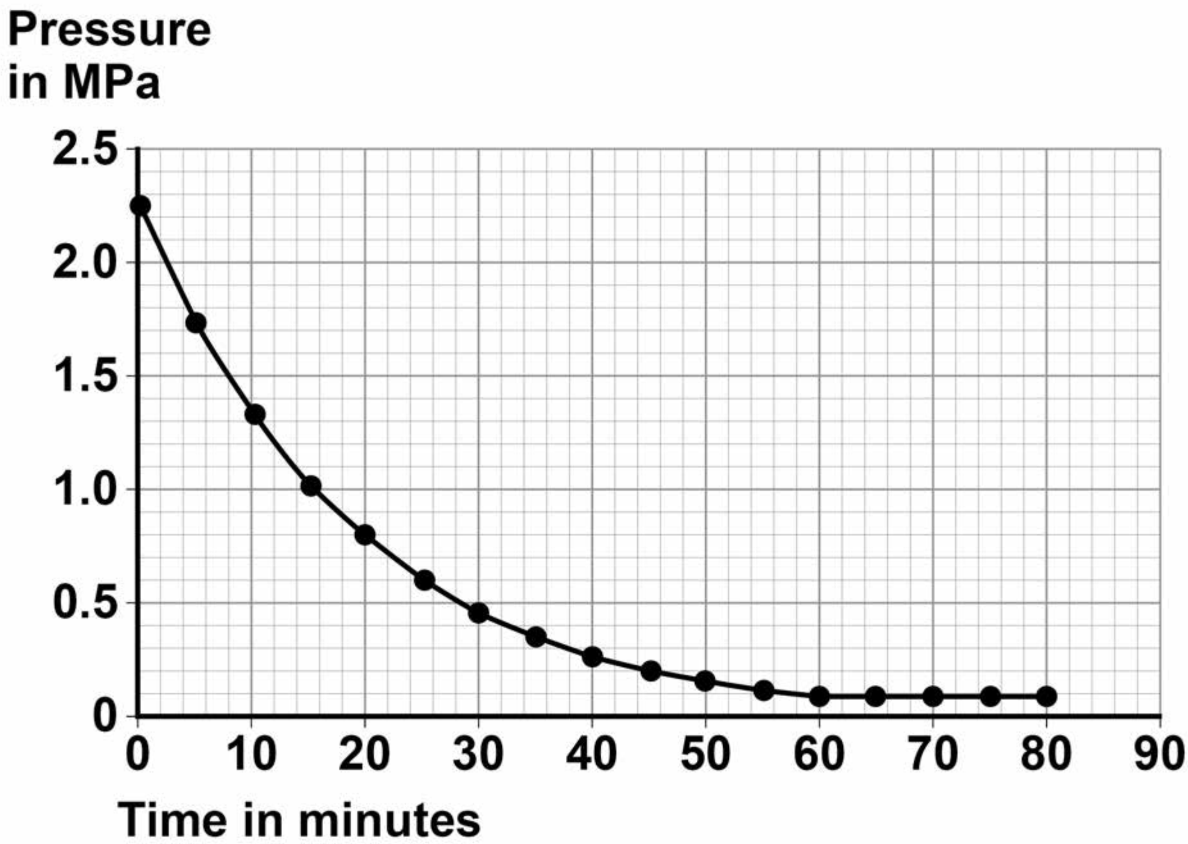
[Turn over]

A canister of air was tested to find out how the pressure changed when it was used by a diver.

- Air was allowed to escape from the canister.
- The pressure of the air in the canister was recorded every 5 minutes for 80 minutes.

FIGURE 6 shows the results.

FIGURE 6



0 3 . 4 **Estimate the atmospheric pressure.**

Use FIGURE 6 [1 mark]

Atmospheric pressure = _______________ MPa

0 3 . 5 **Divers can safely stay underwater until the pressure of the air in the canister has reduced to 25% of its original value.**

Determine the maximum time the diver can safely stay underwater.

Use FIGURE 6 [3 marks]

____

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Time = ____________________ minutes

0 3 . 6 **What happens to the volume of the air when it is released from the canister? [1 mark]**

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____

0 4 The Chernobyl disaster was a nuclear accident that happened in 1986

Radioactive isotopes were released into the environment.

The radioactive isotopes emitted alpha, beta and gamma radiation.

0 4 . 1 What is an alpha particle? [1 mark]

Tick ONE box.

- [ ] 2 charged particles and 2 neutral particles.
- [ ] 2 charged particles and 4 neutral particles.
- [ ] 4 charged particles and 2 neutral particles.
- [ ] 4 charged particles and 4 neutral particles.

0 4 . 2 **Which statement about beta radiation is true?**
[1 mark]

Tick ONE box.

☐ **It is the fastest moving type of radiation.**

☐ **It is the type of radiation with a negative charge.**

☐ **It is the type of radiation with the greatest mass.**

☐ **It is the type of radiation with the greatest range in air.**

[Turn over]

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0 4 . 3 **Which statement about gamma radiation is true?**
[1 mark]

Tick ONE box.

- [ ] **It is a low frequency electromagnetic wave.**
- [ ] **It causes the charge of the nucleus to change.**
- [ ] **It causes the mass of the nucleus to change.**
- [ ] **It has a very long range in air.**

[Turn over]

TABLE 3 shows the half-lives of two of the radioactive isotopes that contaminated the environment.

TABLE 3

Isotope	Half-life
Caesium–137	30 years
Iodine–131	8 days

0 4 . 4 **A soil sample was taken from the area around Chernobyl in 1986**

The soil sample was contaminated with equal amounts of caesium–137 and iodine–131

Explain how the risk linked to each isotope has changed between 1986 and 2018

Both isotopes emit the same type of radiation.
[4 marks]

0 4 . 5 **Determine the year when the activity of the caesium–137 in the soil sample will be 1/32 of its original value. [3 marks]**

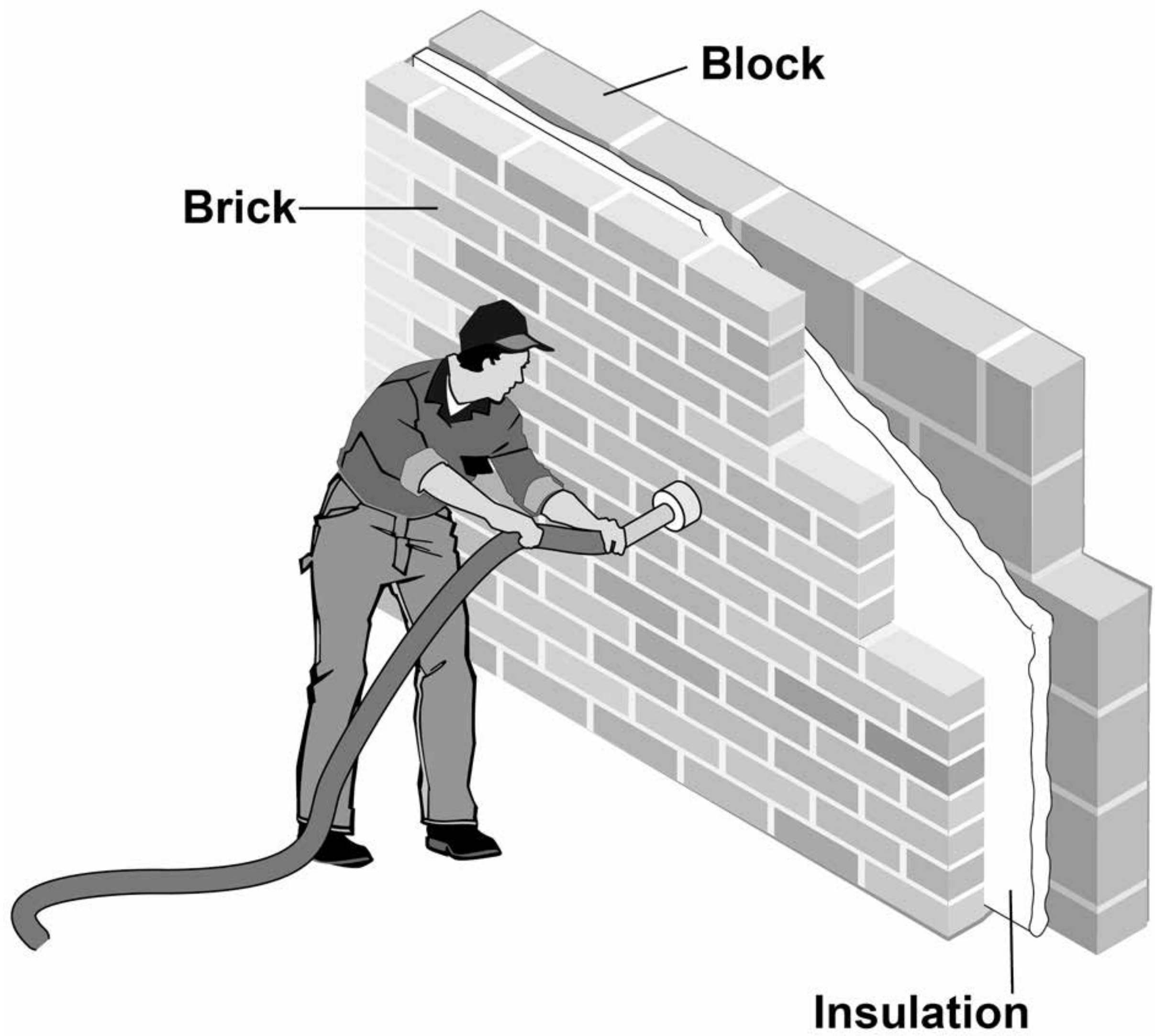
Year = ______________________

[Turn over]

10

0 5 FIGURE 7 shows cavity wall insulation being installed in the wall of a house.

FIGURE 7



0 5 . 1 **Explain how the wall reduces unwanted energy transfers. [3 marks]**

[Turn over]

0 5 . 2 **The cavity insulation was tested.**

- **The heating inside the house was switched off.**
- **The temperature inside the house was measured every 20 minutes for 2 hours.**

TABLE 4 shows the results.

TABLE 4

Time in minutes	Temperature in °C
0	25.0
20	20.8
40	17.4
60	14.5
80	12.1
100	10.0
120	8.4

Determine the temperature inside the house after 30 minutes. [2 marks]

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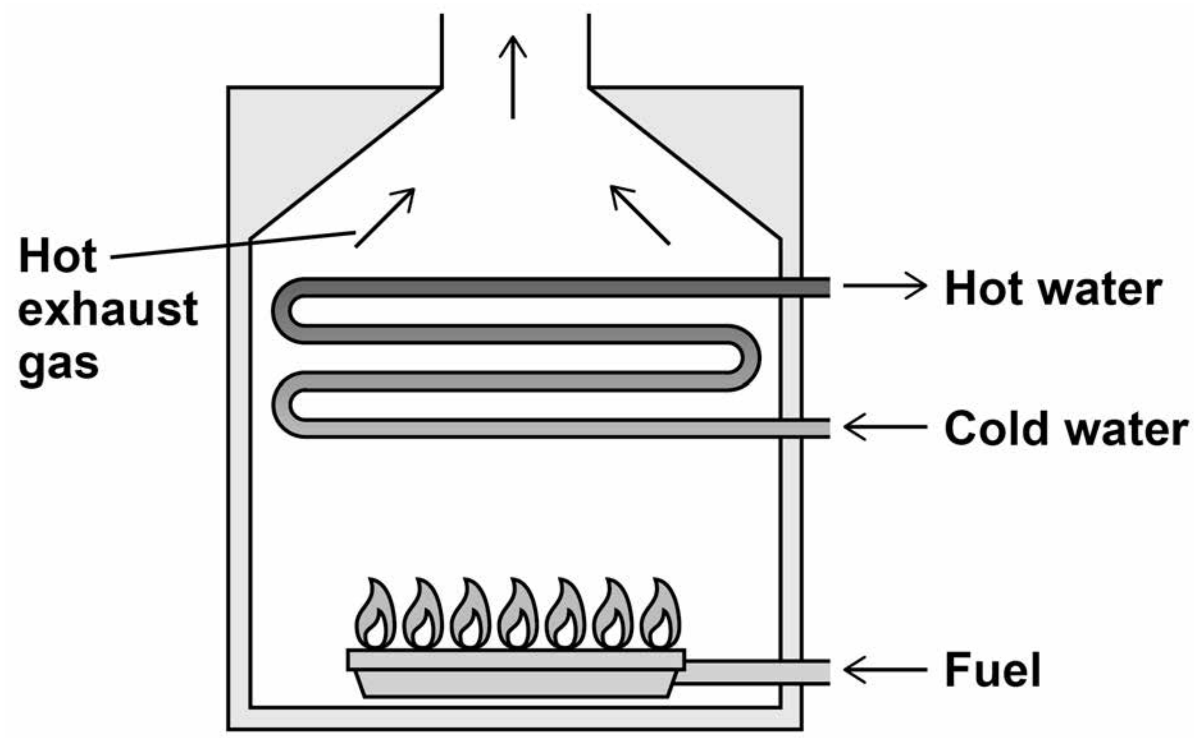
Temperature = ______________________ °C

[Turn over]

0 5 . 3 **FIGURE 8 shows the gas boiler used to heat the house.**

FIGURE 8



Describe how different energy stores are changed by the boiler. [3 marks]

____

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0 5 . 4 **To heat the house, the boiler transfers 15 MJ of energy in 10 minutes.**

Calculate the power of the boiler.

Write any equation that you use. [4 marks]

Power = ____________________ W

[Turn over]

12

06 A student built a circuit using filament lamps.

06.1 Sketch a current potential difference graph for a filament lamp on FIGURE 9 [2 marks]

FIGURE 9

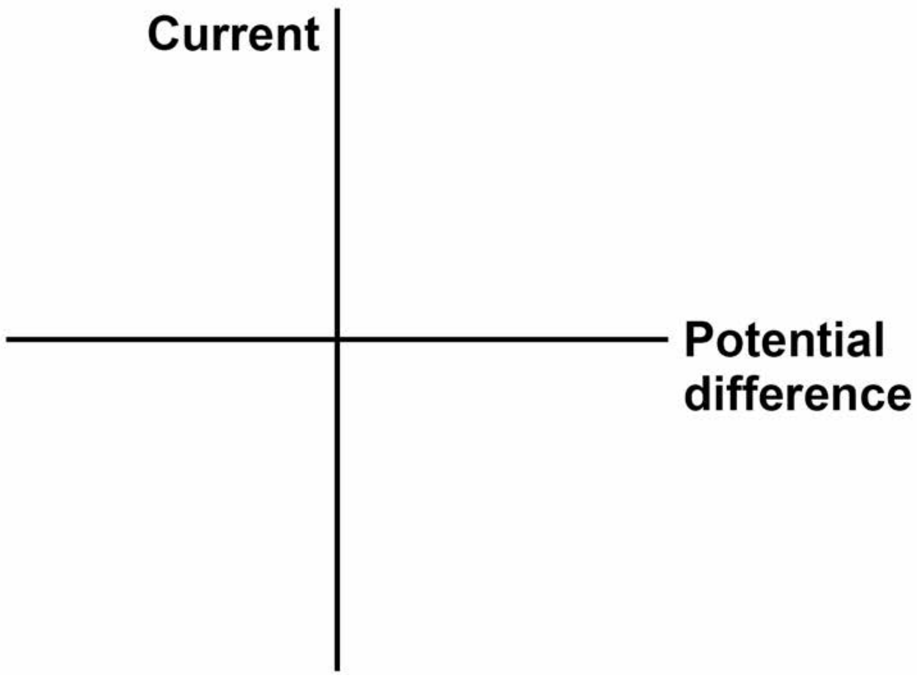
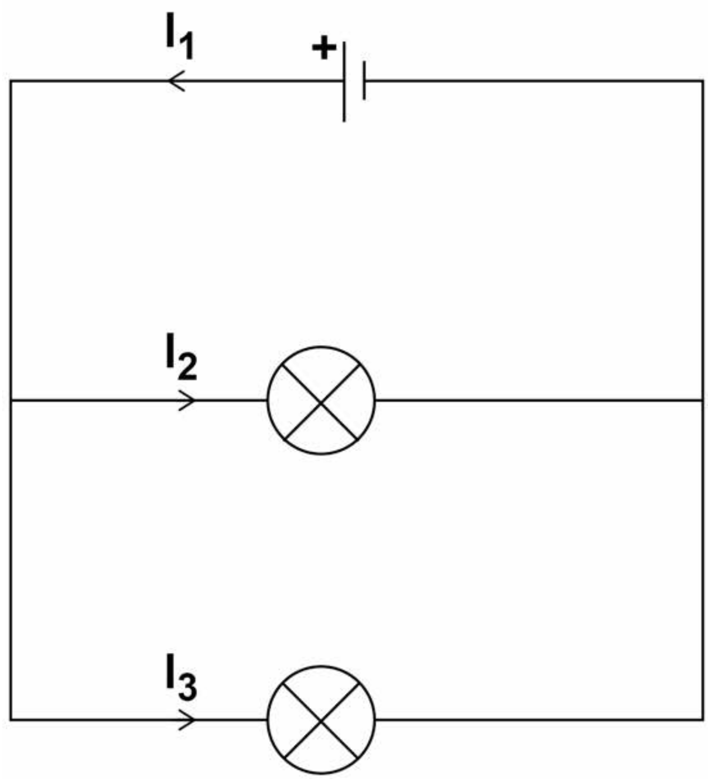


FIGURE 10 shows the circuit with two identical filament lamps.

FIGURE 10



0 6 . 2 **Compare the currents I_1, I_2 and I_3 [2 marks]**

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0 6 . 3 **Calculate the charge that flows through the cell in 1 minute.**

Each filament lamp has a power of 3 W and a resistance of 12 Ω

Write any equations that you use.

Give the unit. [6 marks]

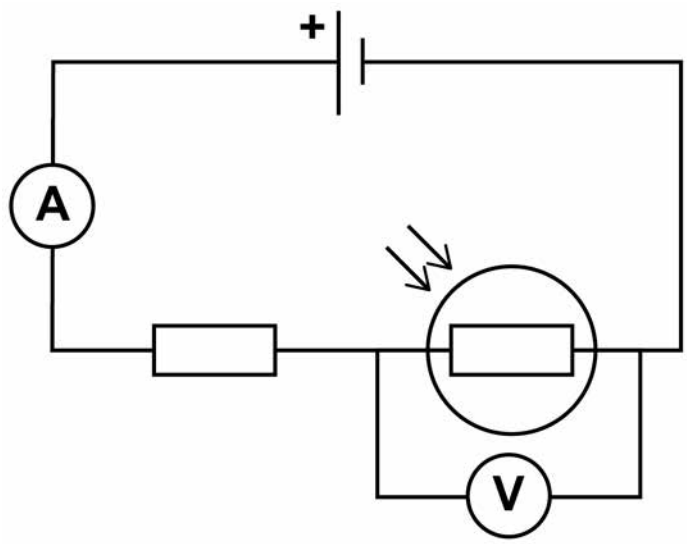
Charge = ____________________

Unit = ____________________

0 6 . 4 **The student builds a different circuit.**

FIGURE 11 shows the circuit.

FIGURE 11



Explain how the readings on both meters change when the environmental conditions change. [6 marks]

END OF QUESTIONS

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For Examiner's Use	
Question	Mark
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2	
3	
4	
5	
6	
TOTAL	

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