Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **0653/31**

Paper 3 (Core) **May/June 2019**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 20.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **19** printed pages and **1** blank page.

Cambridge Assessment International Education

[Turn over

1 **(a)** Plants make their own food in leaves by the process of photosynthesis.

Fig. 1.1 shows a cross-section of a leaf.

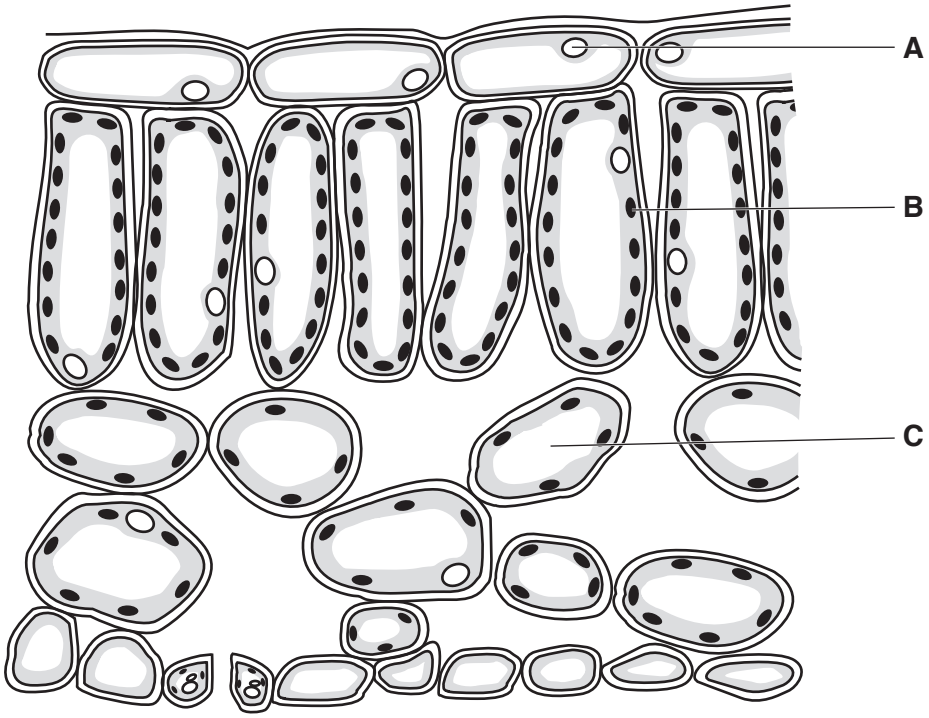

Fig. 1.1

Name cell parts **A**, **B** and **C** shown in Fig. 1.1.

A .....

B .....

C .....

[3]

(b) Fig. 1.2 shows a cross-section of the central structure of a leaf, known as the midrib.

The vascular bundle is shown in the middle of the midrib in Fig. 1.2.

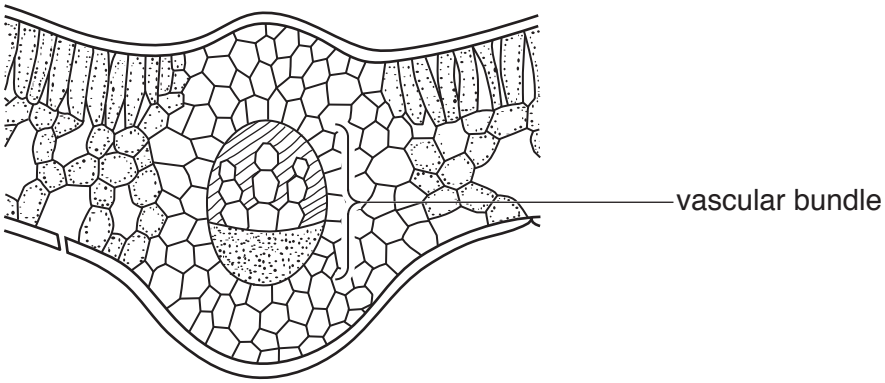

Fig. 1.2

(i) On Fig. 1.2 use a label line and the letter **X** to label any part of the xylem. [1]

(ii) On Fig. 1.2 use a label line and the letter **P** to label any part of the phloem. [1]

(iii) State the function of the phloem.

.....

..... [1]

(c) Glucose and oxygen are produced by cells in the leaves during photosynthesis.

Plant cells can use these products to carry out respiration.

Complete the word equation for respiration.

glucose	+	oxygen	→		+	

[1]

(d) State **two** uses for the energy released by respiration in the bodies of humans.

1. .....

2. .....

[2]

[Total: 9]

[Turn over

2 **(a)** The composition of clean air is shown in Fig. 2.1.

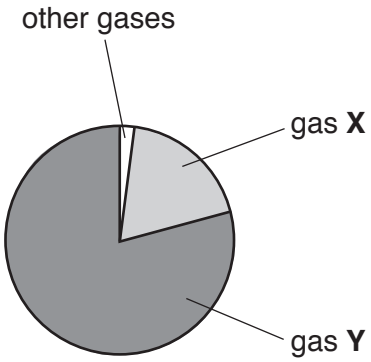

Fig. 2.1

Methane, carbon dioxide and water vapour are three of the other gases.

Identify gas **X** and gas **Y**.

gas **X** .....

gas **Y** .....
[2]

(b) Methane is the main constituent of a fossil fuel.

(i) Name this fossil fuel.

..... [1]

(ii) State the formula of methane. [1]

.....

(iii) State the name of the group of saturated hydrocarbons that includes methane.

..... [1]

(iv) Identify the products of the complete combustion of methane.

..... and ..... [1]

(c) Compound **X** contains only calcium, carbon and oxygen.

When it is heated it decomposes to form carbon dioxide and calcium oxide.

Identify compound **X**.

..... [1]

(d) Describe a chemical test for water and state the result that shows the presence of water.

test .....

result .....
[2]

[Total: 9]

3 Fig. 3.1 shows a whale swimming underwater.

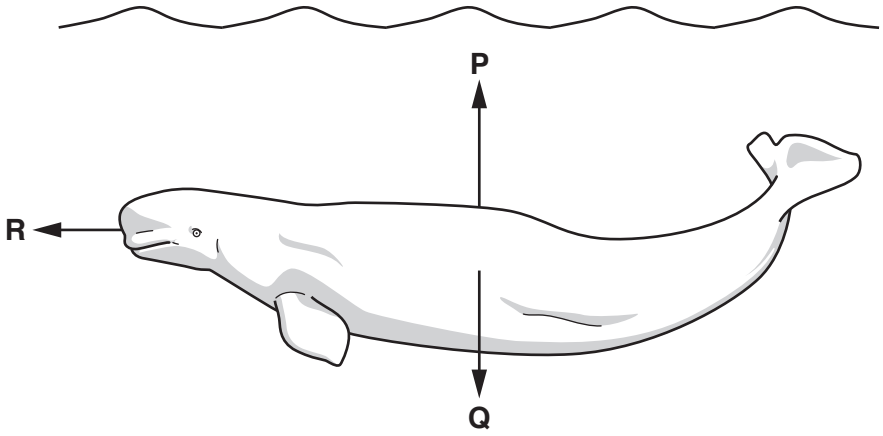

Fig. 3.1

(a) (i) The force arrows labelled **P** and **Q** show the vertical forces acting on the whale.

Name force **Q**.

..... [1]

(ii) The whale is swimming at constant depth, using a force **R** to push itself forward.

On Fig. 3.1 draw a force arrow to show the frictional force opposing the motion of the whale, and label it **S**. [1]

(iii) When force **R** is 500 N, the whale moves at a constant speed of 5.0 km / h.

State the value of force **S**.

force **S** = ... N [1]

(iv) Force **R** decreases to 400 N. Force **P** increases.

Describe how these **two** changes affect the motion of the whale.

.....

.....

..... [2]

(b) The whale does work against the friction of the water as it swims at a constant speed and a constant depth on a journey.

(i) State the **two** quantities needed to calculate the work done by the whale on its journey.

..... and ..... [2]

(ii) Complete the sequence of energy changes that occur on the whale's journey.

..... energy in the whale

to ..... energy of the whale

to .....thermal..... energy transferred to the water.

[2]

(c) The whale makes a sound to call to another whale 9000 m away.

The second whale hears the call 6.0 seconds later.

Calculate the speed of sound in water.

Show your working.

speed = ... m/s [2]

[Total: 11]

4 **(a)** Fig. 4.1 is a diagram of the male reproductive system.

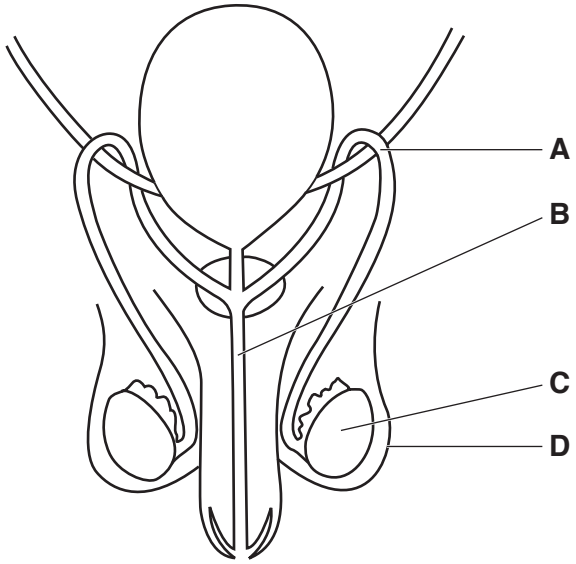

Fig. 4.1

Complete Table 4.1 to show the names and the functions of parts **A**, **B**, **C** and **D** shown in Fig. 4.1.

Table 4.1

letter of structure	name of part	function
A	sperm duct	
B		carries urine and semen out of the body
C		production of male gametes (sperm)
D	scrotum	

[4]

(b) Fig. 4.2 shows the changes to the thickness of the uterus lining during the menstrual cycle.

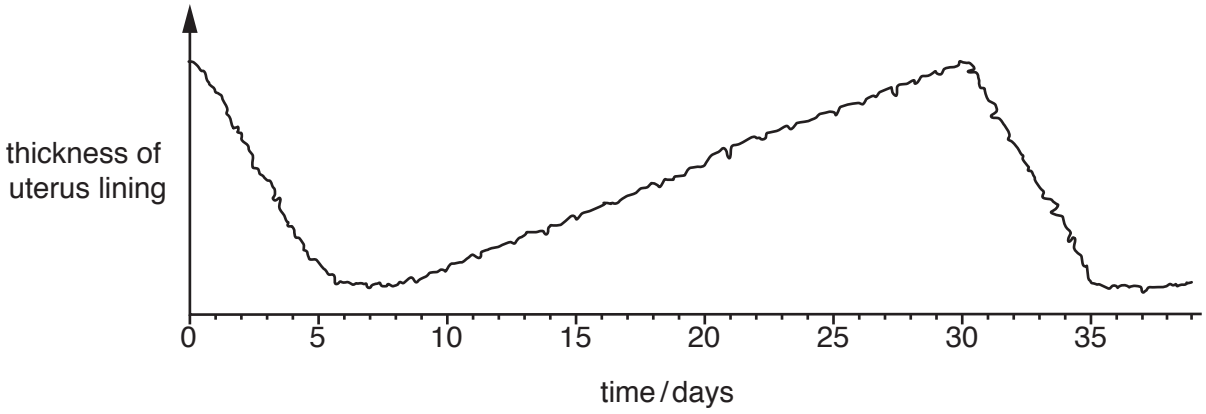

Fig. 4.2

(i) State what happens to the uterus lining during the first five days.

..... [1]

(ii) Use Fig. 4.2 to determine the number of days in a complete menstrual cycle.

number of days = ... [1]

(iii) Suggest why the uterus lining becomes thicker between days 7 and 30.

.....

..... [1]

(c) Describe the process of fertilisation of a sperm cell and an egg cell.

.....

..... [2]

[Total: 9]

[Turn over

5 A student investigates the reactivities of four metals, calcium, magnesium, tin and zinc.

She reacts 1 g pieces of each metal separately with excess dilute hydrochloric acid.

She collects and measures the gas from each reaction using a measuring cylinder, as shown in Fig. 5.1.

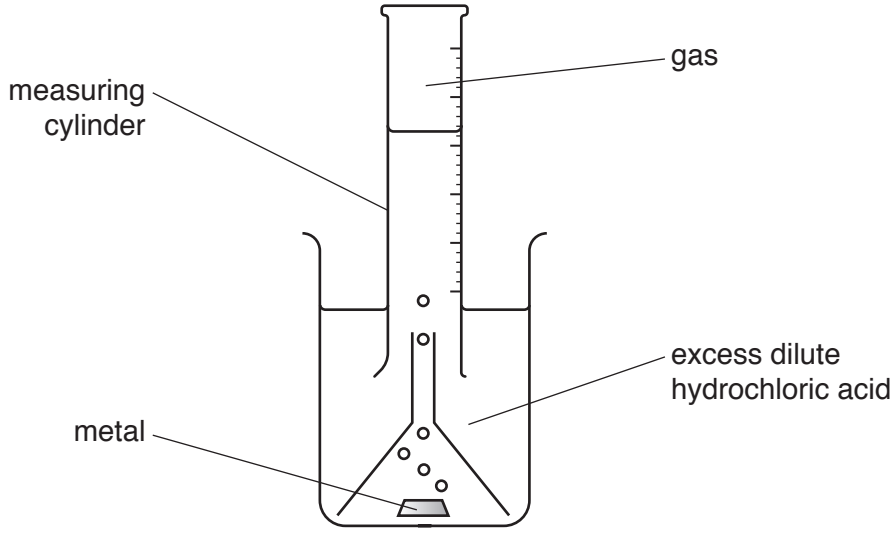

Fig. 5.1

The time taken to collect 20 cm^3 of gas in each experiment is recorded in Table 5.1.

Table 5.1

metal	time taken / s
calcium	20
magnesium	55
tin	more than 300
zinc	100

(a) (i) Deduce the order of reactivity of the four metals, calcium, magnesium, tin and zinc, from most reactive to least reactive.

..... most reactive

.....

.....

..... least reactive

[2]

(ii) Suggest **two** changes that can be made to increase the rate of reaction of a metal with hydrochloric acid.

1. .....

2. .....
[2]

(b) (i) Identify the gas produced when zinc reacts with dilute hydrochloric acid.

..... [1]

(ii) Fig. 5.2 shows some gases and tests for gases.

The boxes on the left show the gases. The boxes on the right show the tests.

gas	test
ammonia	glowing splint
carbon dioxide	damp red litmus paper
oxygen	limewater

Fig. 5.2

On Fig. 5.2 draw **one** line from each gas to the test used for the gas. [2]

(c) The four metals, calcium, magnesium, tin and zinc, have high melting points and high boiling points.

Suggest **two** other physical properties of these metals.

1. .....

2. .....
[2]

[Total: 9]

6 Fig. 6.1 shows an electrical device used in kitchens to kill insects. Insects can spread disease by contaminating food.

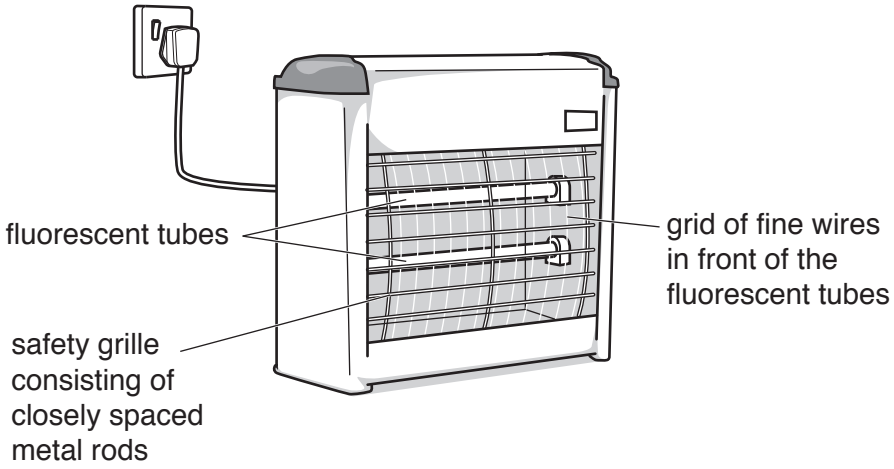

Fig. 6.1

The device is connected to the electricity supply.

(a) The two fluorescent tubes emit both visible light and ultraviolet radiation. This attracts insects to the device.

(i) Fig. 6.2 shows an incomplete electromagnetic spectrum.

	X-rays				micro-waves	radio waves

Fig. 6.2

On Fig. 6.2 place visible light and ultraviolet radiation in their correct boxes in the spectrum. [2]

(ii) The level of ultraviolet radiation emitted by the device is kept as low as possible when the device is used where people are present.

Explain why this precaution is needed.

.....

.....

..... [2]

(b) Fig. 6.1 shows a grid of fine wires in front of the two fluorescent tubes. The insects have to fly between the wires as they go towards the light.

A potential difference of 2000 V exists between each pair of wires.

When an insect touches a pair of wires, an electrical circuit is completed. An electric current flows through the insect.

(i) State what is meant by *electric current*.

..... [1]

(ii) The current in the wires when an insect touches them and completes the circuit is 0.5 A.

Calculate the resistance of the insect.

Show your working and state the unit of your answer.

resistance = ... unit ..... [3]

(c) Suggest one safety hazard when operating any electrical device in a kitchen.

.....

..... [1]

[Total: 9]

7 **(a)** Cell membranes are partially permeable. They allow small molecules to pass through by diffusion, but not large molecules.

Underline **one** molecule from the list of molecules which can diffuse across a cell membrane.

cellulose **fat** **glycogen** **oxygen** **protein**

[1]

(b) Fig. 7.1 shows a bag which acts like a cell membrane. It is partially permeable.

The bag contains a mixture of glucose and starch solutions. The bag is placed in a beaker of water.

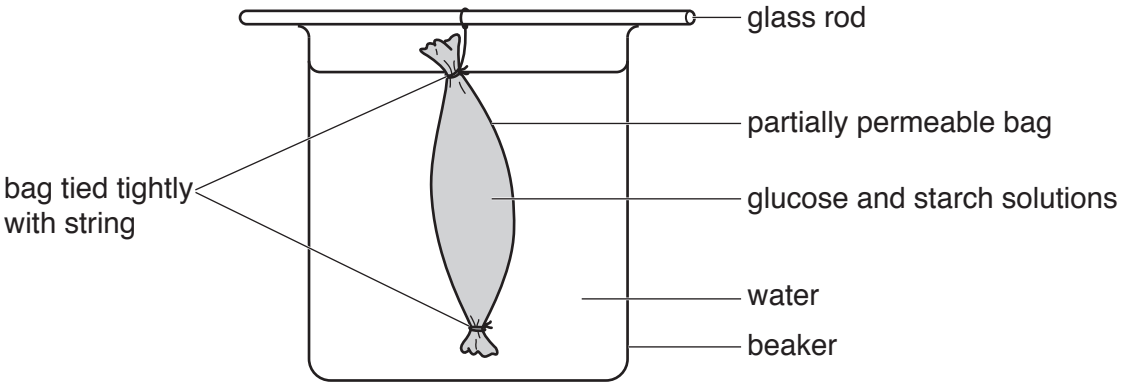

Fig. 7.1

After 30 minutes the water in the beaker is tested for starch and glucose.

The results of these tests are shown in Table 7.1.

Table 7.1

test solution	molecule tested for	result	final colour of test solution
iodine solution	starch	negative	
Benedict's solution	glucose	positive	

(i) Complete Table 7.1 with the final colour of the test solutions. [2]

(ii) State where the starch molecules are at the end of the experiment.

..... [1]

(iii) Describe what has happened to the glucose molecules during the experiment.

.....

.....

..... [2]

(iv) Use the information in Table 7.1 to compare the sizes of the glucose molecule and the starch molecule.

Explain your answer.

sizes of molecules .....

explanation .....

.....

.....

[2]

(c) The plasma is the component of blood which carries soluble nutrients around the body.

Name **one** other substance that is transported by the plasma.

..... [1]

[Total: 9]

8 **(a)** An atom of aluminium is represented by the symbol:

$$^{27}_{13}Al$$

State the number of protons and the number of neutrons in this atom.

protons .....

neutrons .....

[2]

(b) Aluminium is extracted from aluminium oxide.

Aluminium oxide is obtained from the ore bauxite.

(i) State the method of extraction used.

..... [1]

(ii) State the type of bonding in aluminium oxide.

..... [1]

(iii) Suggest **one** reason, other than cost, why aluminium is recycled.

.....

..... [1]

(c) Copper forms coloured compounds, but aluminium does not.

Explain this observation.

.....

..... [1]

(d) Copper is extracted from copper oxide by heating with a non-metallic element.

(i) Name this non-metallic element.

..... [1]

(ii) State whether the copper oxide is oxidised or reduced during this process.

Explain your answer.

copper oxide is .....

explanation .....

.....

[1]

[Total: 8]

9 Fig. 9.1 shows a laboratory water-bath used to keep experiments at a constant temperature.

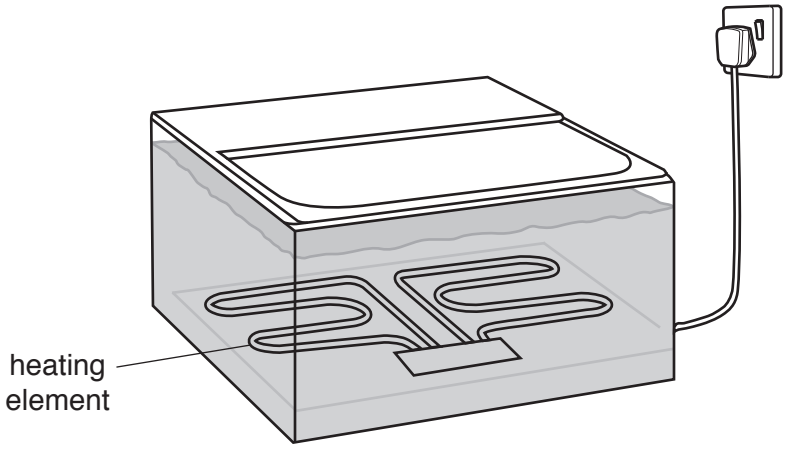

Fig. 9.1

The water is heated by an electric heating element at the bottom of the water-bath.

Fig. 9.2 shows the structure inside the tube of the heating element.

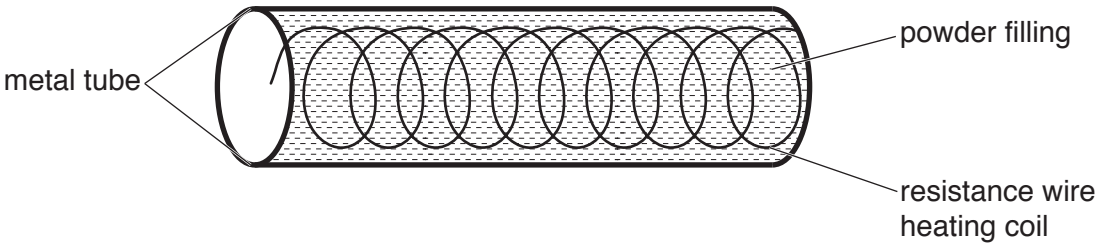

Fig. 9.2

(a) The water-bath is filled with cold water at 10 °C. The heating element is turned on to heat the water to 40 °C.

(i) State the electrical property that the powder surrounding the hot resistance wire should have.

..... [1]

(ii) Explain why the powder filling must be a good thermal conductor.

.....

.....

..... [1]

(iii) Describe how the thermal energy is transferred by the water to raise the water temperature to 40 °C.

.....

.....

.....

.....

..... [2]

(b) The electrical circuit in the water-bath contains a switch, a heater and a fuse.

(i) On Fig. 9.3 complete the circuit diagram for the water-bath, including the symbols for a switch and a fuse.

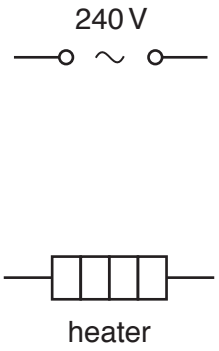

Fig. 9.3

[2]

(ii) The current through the heater when switched on is 3 A. A 5 A fuse is used in the circuit.

Explain why a 3 A fuse would **not** be suitable for use in this circuit.

.....

..... [1]

[Total: 7]

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).