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Cambridge International General Certificate of Secondary Education

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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.

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

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

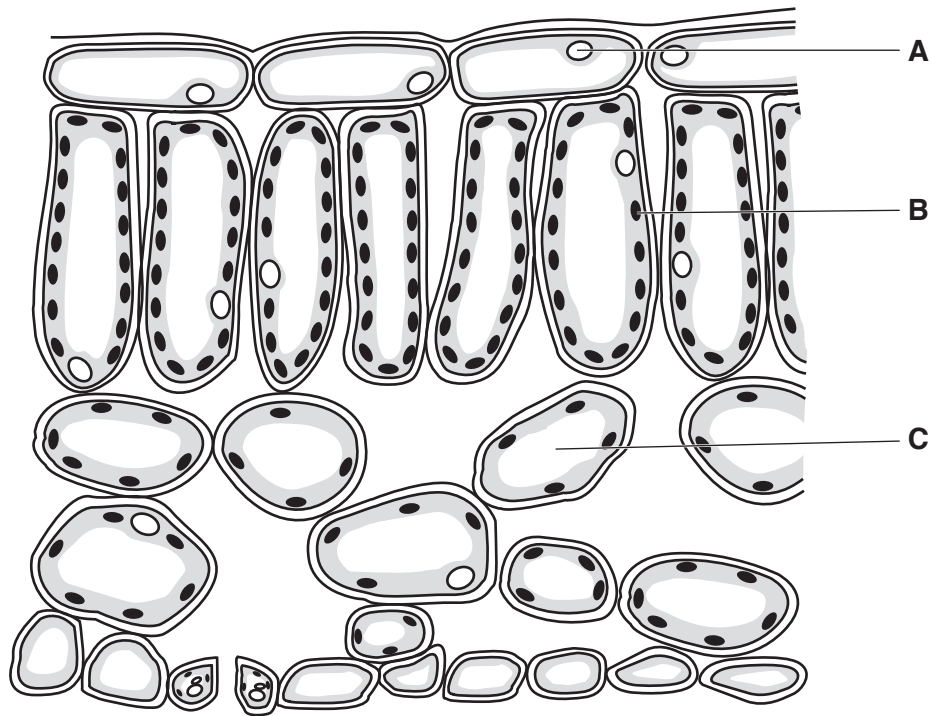


Fig. 1.1

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.

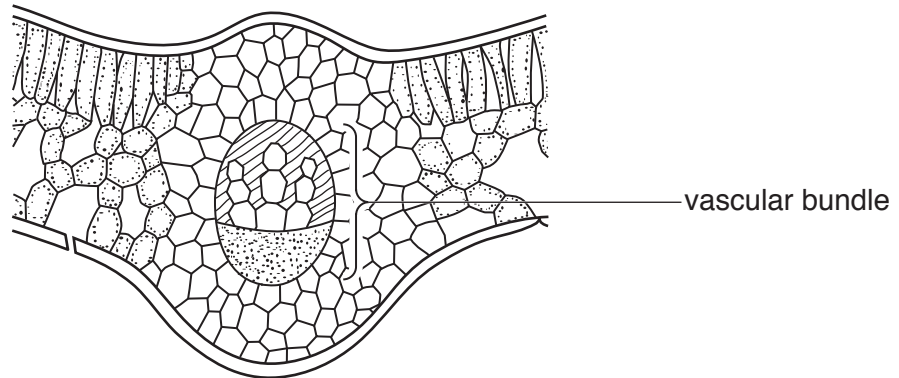


Fig. 1.2

- (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.

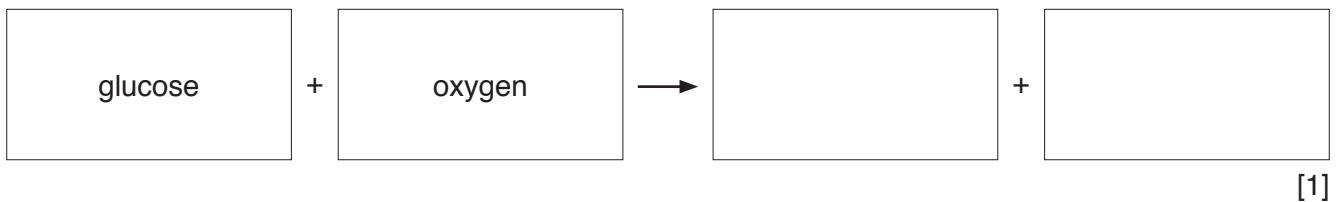
.....

..... [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.



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

1.
2.
- [2]

[Total: 9]

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

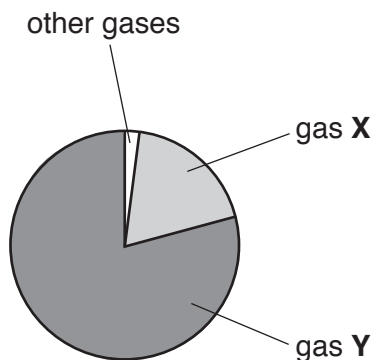


Fig. 2.1

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.

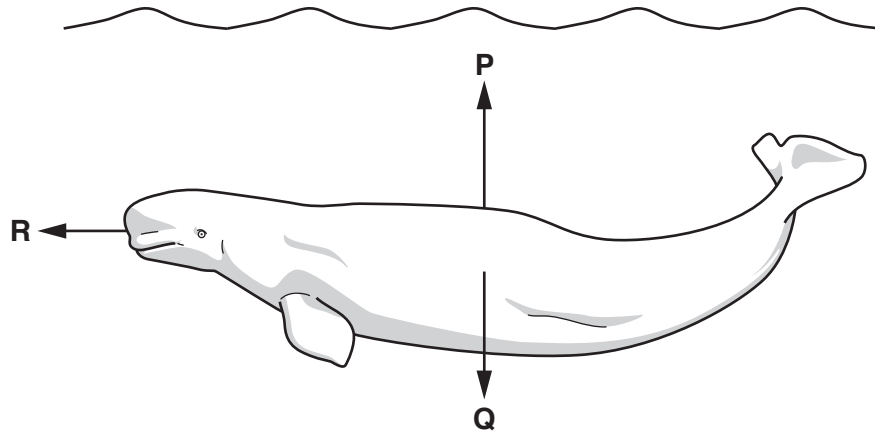


Fig. 3.1

- (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.

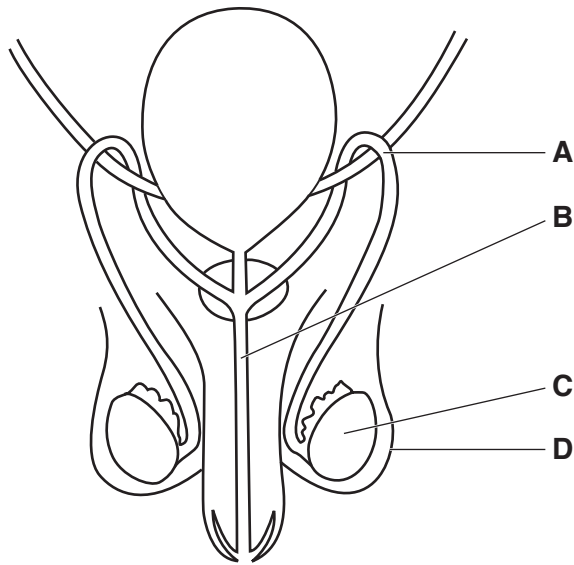


Fig. 4.1

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.

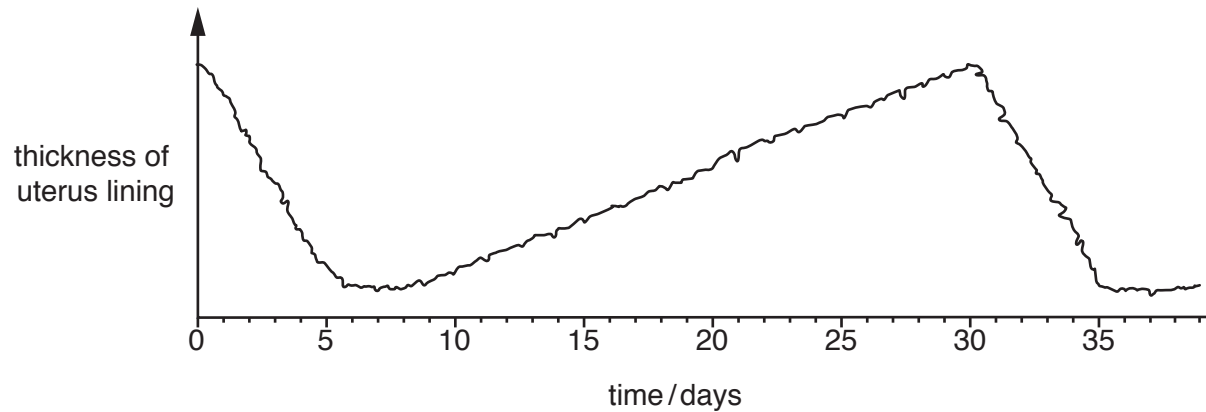


Fig. 4.2

(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]

- 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.

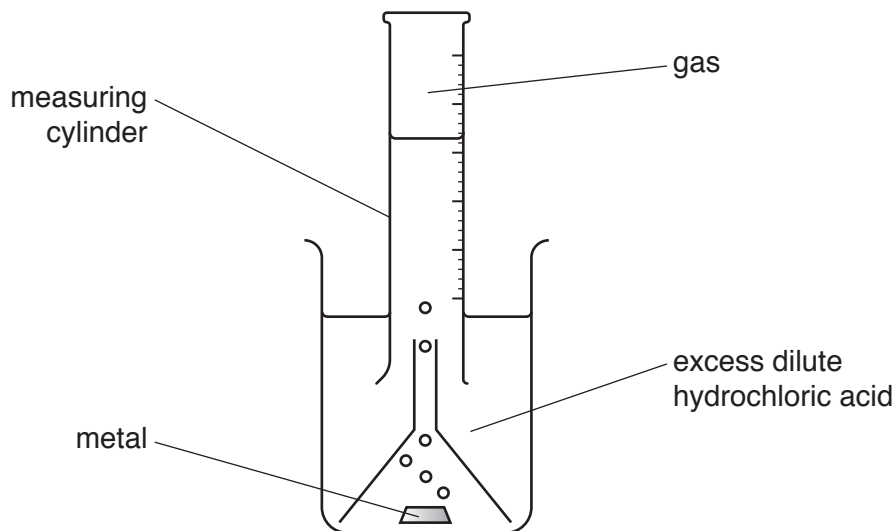


Fig. 5.1

The time taken to collect 20 cm³ 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.

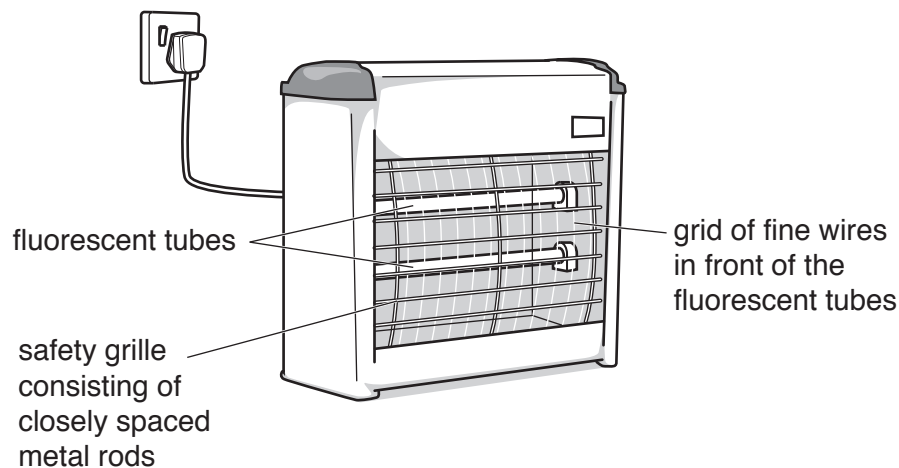


Fig. 6.1

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.

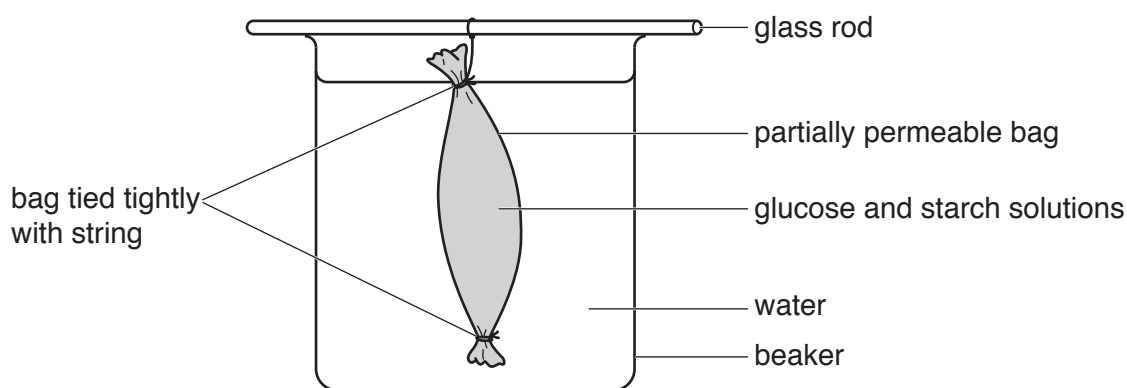


Fig. 7.1

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:



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.

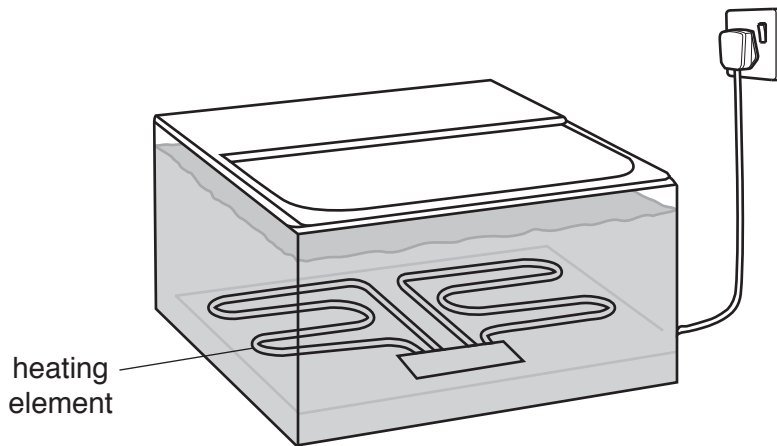


Fig. 9.1

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.

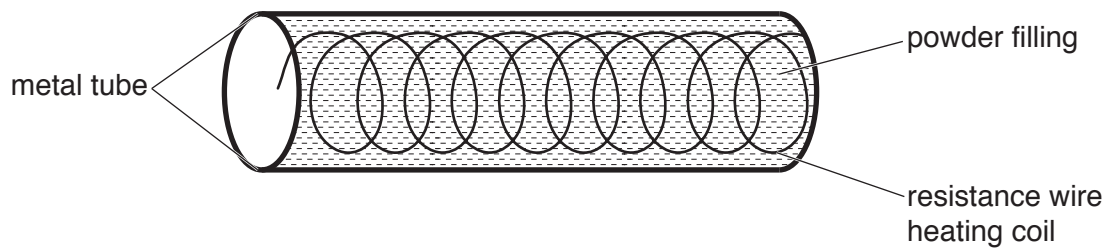


Fig. 9.2

- (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.

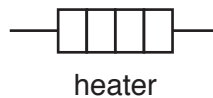
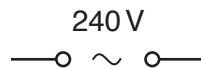


Fig. 9.3

[2]

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

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

.....

..... [1]

[Total: 7]

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[illegible]

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	europtium	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	yterbium	173	71	Lu	lutetium	175	
	actinoids	89	Ac	actinium	227	90	Th	thorium	232	91	Pa	protactinium	231	92	U	uranium	238	93	Np	neptunium	237	94	Pu	plutonium	244	95	Am	americium	243	96	Cm	curium	247	97	Bk	berkelium	247	98	Cf	californium	251	99	Es	einsteinium	252	100	Fm	fermium	257	101	Md	mendelevium	258	102	No	nobelium	259	103	Lr	lawrencium	262

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