



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER



**COMBINED SCIENCE** **0653/32**  
Paper 3 (Core) **October/November 2018**  
**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) The boxes in Fig. 1.1 contain the names of cells, diagrams of these cells, and their functions.

Draw straight lines to connect each named cell with its correct diagram and function.  
One is done for you.

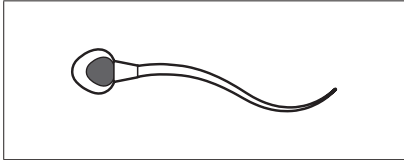
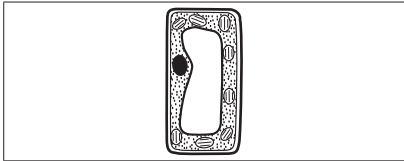
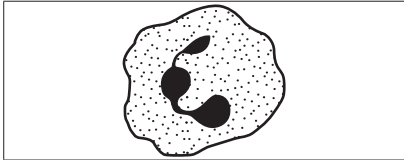
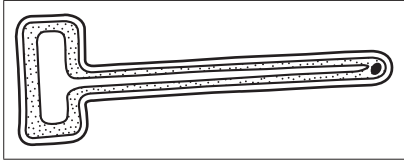
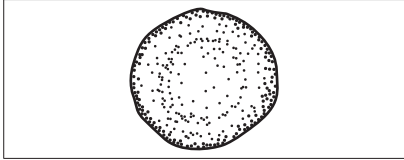
diagram (not to scale)	name of cell	function
	palisade cell	carries out photosynthesis
	red blood cell	defends against disease
	root hair cell	male gamete
	sperm cell	transports oxygen
	white blood cell	water uptake

Fig. 1.1

[4]

(b) One of the cells is shown in Fig. 1.2.

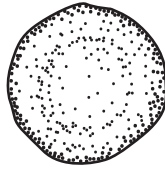


Fig. 1.2

The actual diameter of the cell is 0.0070 mm.

Calculate the magnification shown by the diagram.

magnification = ..... [2]

(c) The list shows some substances that are found in living organisms.

- amino acids      bile      carbon dioxide      enamel
- glycogen      platelets      starch

Draw a circle around **three** substances which are transported by the blood plasma. [2]

(d) (i) Describe the importance of chemical digestion in the body.

.....

.....

.....

.....

..... [3]

(ii) State **one** organ of the body which produces digestive enzymes.

..... [1]

2 (a) A student makes a salt using the apparatus shown in Fig. 2.1.

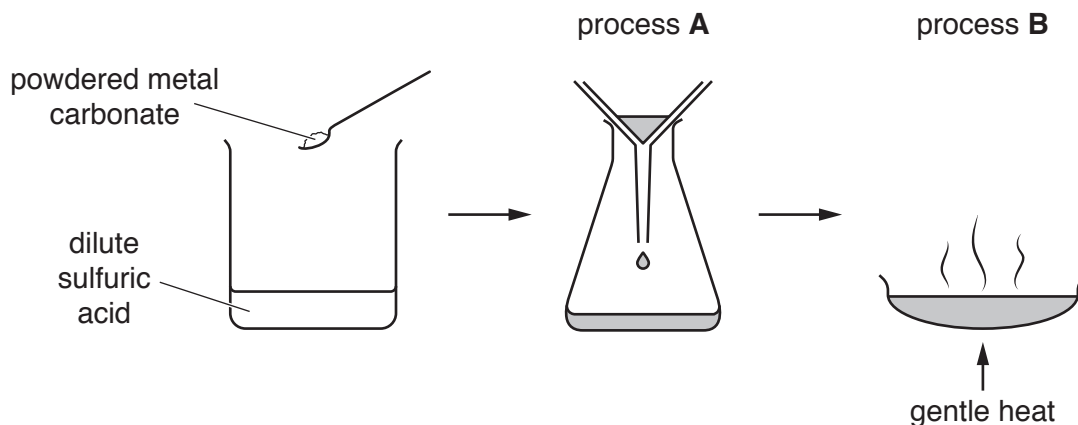


Fig. 2.1

(i) Name process **A** and process **B**.

process **A** .....

process **B** .....

[2]

(ii) The student uses 1 g of the powdered metal carbonate.

Describe the effect of using a single 1 g piece of the metal carbonate on the rate of this reaction.

.....[1]

(iii) Describe the effect of using the same volume of a more concentrated sulfuric acid on the rate of this reaction.

.....[1]

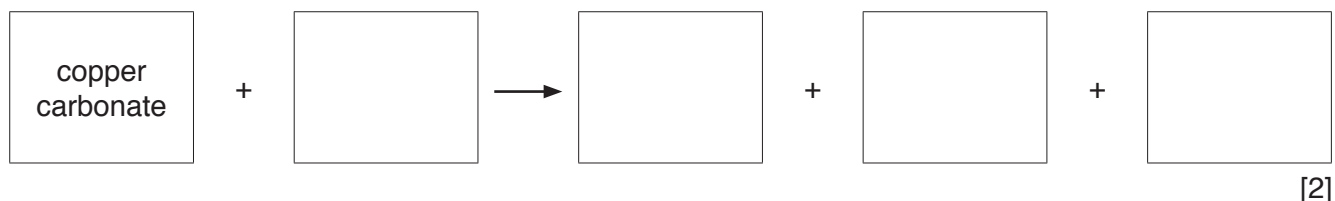
(iv) When the metal carbonate is mixed with dilute sulfuric acid, the temperature increases.

State the name given to chemical reactions that cause the temperature to increase.

.....[1]

(b) The student mixes copper carbonate with dilute sulfuric acid. Copper(II) sulfate and a colourless gas and a colourless liquid are formed.

(i) Complete the word equation for this reaction.



(ii) Describe a test for aqueous copper(II) ions.

State the observations that show copper(II) ions are present.

test .....

observations .....

.....

[2]

(iii) Copper is a transition metal. It forms coloured compounds.

Describe **one other** property of a **transition** metal.

.....[1]

3 Fig. 3.1 shows a farm tractor pulling a trailer.

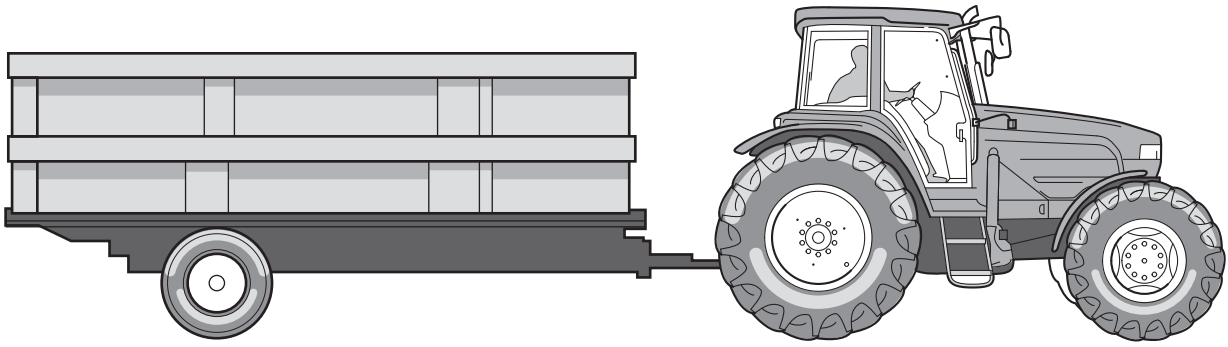


Fig. 3.1

(a) The tractor and trailer are moving across a level field. Fig. 3.2 shows the four forces **W**, **X**, **Y** and **Z** acting on the trailer.

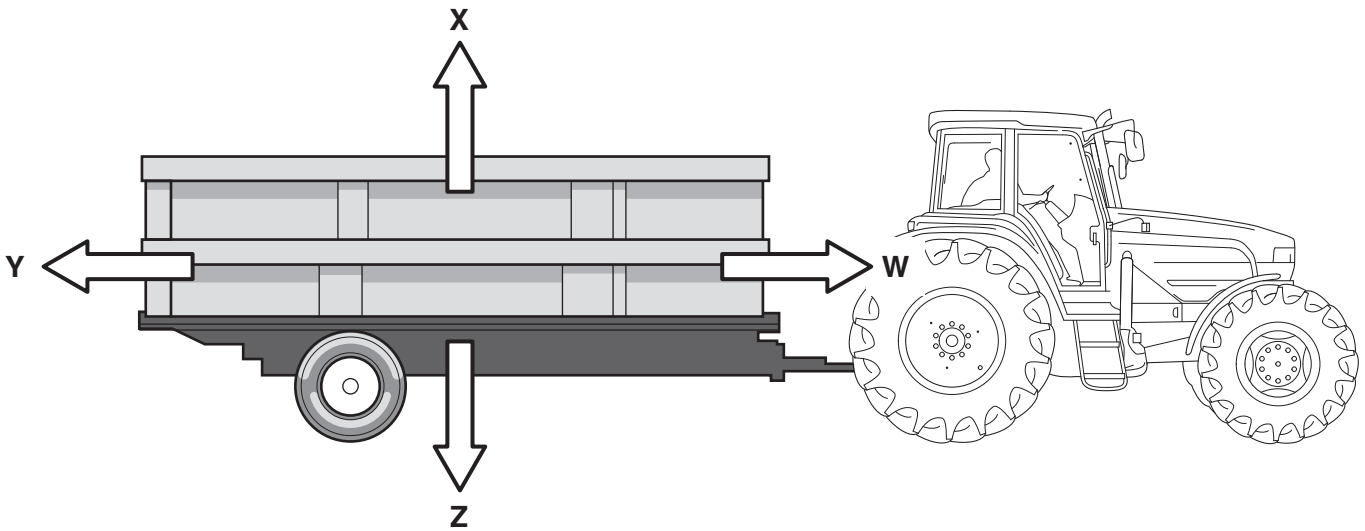


Fig. 3.2

(i) State the letter corresponding to the gravitational force acting on the trailer.

.....

[1]

(ii) The tractor and trailer are moving at a constant speed.

Force **W** has a value of 2000 N.

State the value of force **Y**. Explain your answer.

value of force **Y** = ..... N

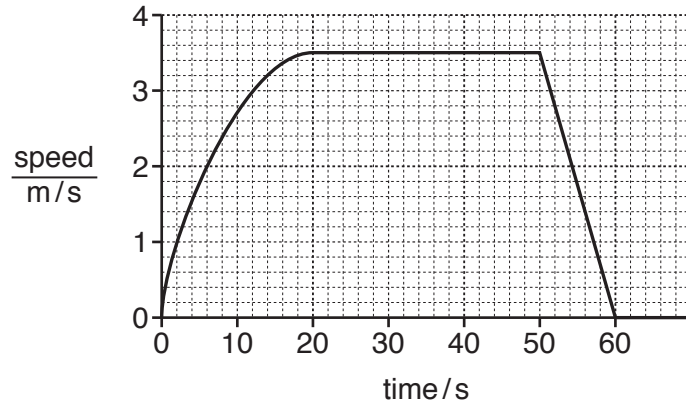
explanation .....

.....

[2]

(b) The tractor leaves the trailer in the field and drives to the farmyard.

Fig. 3.3 shows a speed–time graph of the tractor as it travels from the field to the farmyard.



**Fig. 3.3**

- (i) On Fig 3.3, label with a letter **C** a point in the journey when the tractor is travelling with changing speed. [1]
- (ii) The tractor travels 200 m from the field to the farmyard.

Use information from the graph to calculate the average speed of the tractor on this journey in m/s.

Show your working.

average speed = ..... m/s [2]

(c) (i) The tractor is powered by a diesel engine, which burns diesel oil.

Complete the energy transfer that occurs to move the tractor.

..... energy in the diesel oil  
 → ..... energy of the tractor. [2]

(ii) State the **original** source of the energy stored in diesel oil.  
 ..... [1]

(iii) To keep the tractor moving at constant speed for 30 s, an energy input of 300 000 J from diesel fuel is needed. Only 60 000 J is required to do the work against forces resisting the motion.

Describe what happens to most of the wasted energy.  
 .....  
 ..... [1]

- 4 (a) Fig. 4.1 shows a piece of potato in a solution of hydrogen peroxide. A reaction occurs and oxygen gas is produced.

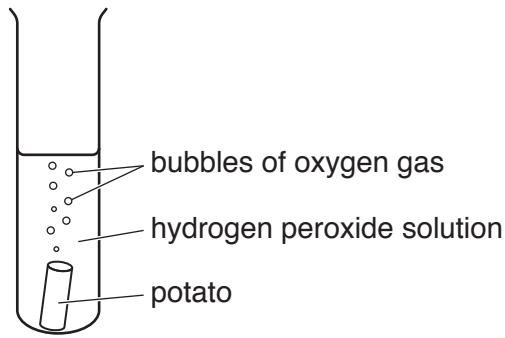


Fig. 4.1

The student thinks the reaction is caused by an enzyme in the potato. She repeats the experiment with potato that has been boiled first, and then allowed to cool.

Predict what the student sees if an enzyme in the potato is responsible for the reaction. Explain your prediction.

prediction .....

explanation .....

.....

[2]

- (b) A farmer has a field of potato plants near a river.

Some untreated human sewage is spilled into the river. The river overflows and deposits some of the sewage onto the potato field.

- (i) Explain why the potatoes in the field are now unsafe to eat.

.....

.....

..... [2]

- (ii) The concentration of oxygen in the river decreases after the sewage is spilled into the river.

Suggest how this affects the animals living in the river. Explain your answer.

.....

.....

..... [2]



5 (a) Natural gas and coal are fossil fuels.

(i) Name **one other** fossil fuel.

.....[1]

(ii) Name the main constituent of natural gas.

.....[1]

(b) Ethane, C<sub>2</sub>H<sub>6</sub>, is an alkane.

(i) Describe the chemical properties of alkanes.

.....

.....[1]

(ii) Complete the structure of a molecule of ethane.



[2]

(c) The atomic numbers and mass numbers of carbon and of hydrogen are shown in Table 5.1.

**Table 5.1**

	atomic number	mass number
carbon	6	12
hydrogen	1	1

(i) Define *atomic number*.

.....

.....[1]

(ii) Complete Table 5.2 to describe the particles in an atom.

**Table 5.2**

particle	position in atom	relative charge	relative mass
electron		-1	
neutron	in nucleus		
proton			1

[3]

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6 (a) (i) State **one** property that distinguishes a liquid from a solid.

.....[1]

(ii) Describe how this property is the result of the arrangement of molecules.

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

(b) When a liquid is heated, it expands.

Name a measuring instrument that makes use of this property of liquids.

.....[1]

(c) Fig. 6.1 shows a hot drink in a cup left to cool down.



Fig. 6.1

The statements below describe ways in which the drink loses thermal energy as it cools.

Put a tick (✓) in the box alongside any **correct** statement.

Put a cross (✗) in the box alongside any **incorrect** statement.

conduction through the sides and base of the cup

convection as air above the cup is heated and the warm air moves upwards

ultraviolet radiation in all directions

evaporation as the faster molecules escape from the surface of the liquid

[2]

(d) Astronomers use telescopes to study stars. Stars are extremely hot bodies that lose energy by emitting electromagnetic radiation into space.

(i) Explain why stars can only lose energy by radiation, and not by conduction or convection.

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

(ii) Some stars can emit gamma radiation.

Fig. 6.2 shows an incomplete electromagnetic spectrum.

On Fig. 6.2 place gamma radiation in the correct box.

		ultra-violet		infra-red	microwaves	
--	--	--------------	--	-----------	------------	--

Fig. 6.2

[1]

(iii) Some telescopes use converging lenses. Light from a distant star arrives at a telescope as a beam of parallel rays.

On Fig. 6.3 complete the ray diagram to show how a clear image of the star is formed on the screen by a converging lens.

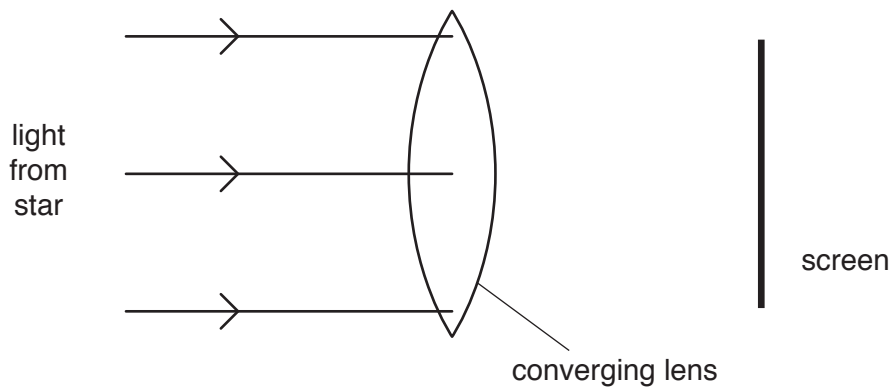


Fig. 6.3

[1]

(iv) On your ray diagram in Fig. 6.3, mark and label the focal length of the lens. [1]

7 (a) Fig. 7.1 shows cross-sections through a root and a stem of a flowering plant.

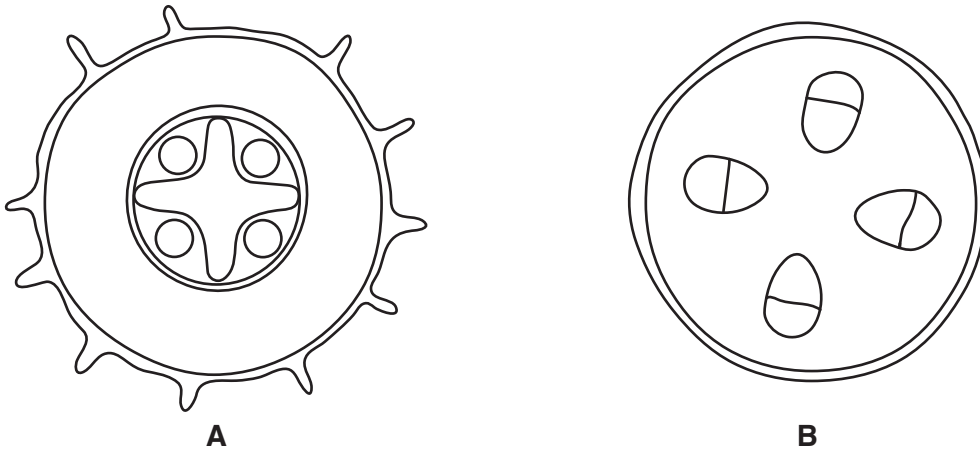


Fig. 7.1

(i) State which diagram, **A** or **B**, represents the root.

Give **two** reasons for your answer.

The root is diagram .....

reason 1 .....

.....

reason 2 .....

.....

[2]

(ii) On diagram **B**, in Fig. 7.1, shade in **one** area where the xylem is found.

[1]

(b) Use the words or phrases to complete the sentences about transpiration.

Each word may be used once, more than once or not at all.

- cuticle      diffuses      dissolves      guard cells      higher      lower  
 mesophyll cells      stomata      similar      xylem

Water evaporates from the surfaces of ..... inside the leaf.

This gives the air inside the leaf a ..... concentration of water vapour

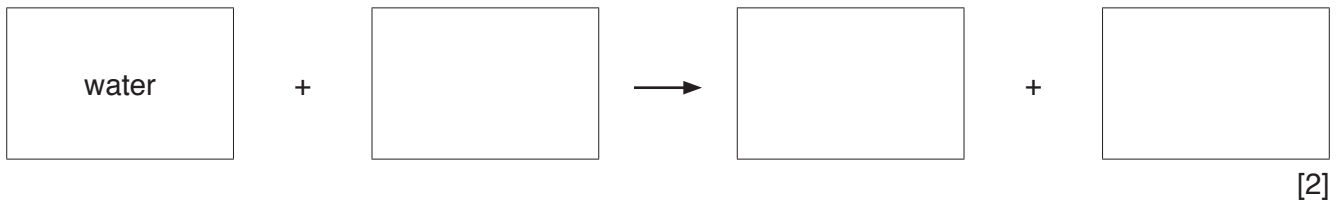
than the atmosphere. As a result the water vapour ..... out of the

leaves through tiny holes called the .....

[4]

(c) Water is one of the raw materials for photosynthesis.

Complete the word equation for photosynthesis.



- 8 (a) A teacher uses the apparatus shown in Fig. 8.1 to demonstrate the electrolysis of lead(II) bromide.

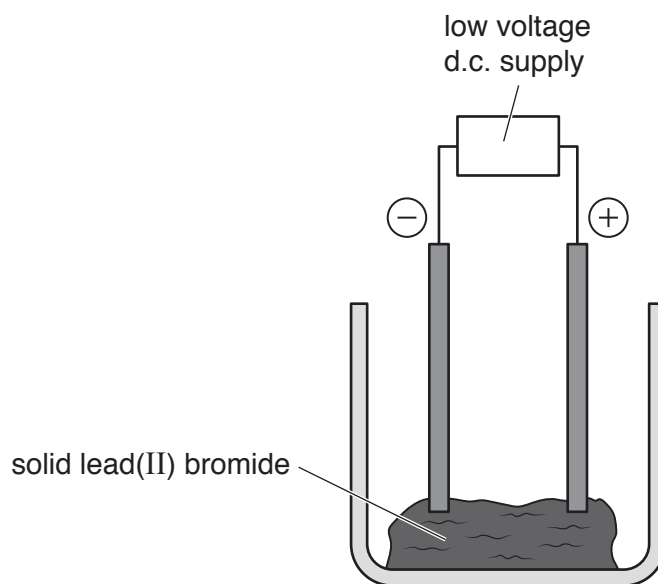


Fig. 8.1

Predict whether this electrolysis works.

Explain your answer.

prediction .....

explanation .....

.....

.....

[1]



(b) A student electrolyses aqueous copper chloride using the apparatus shown in Fig. 8.2.

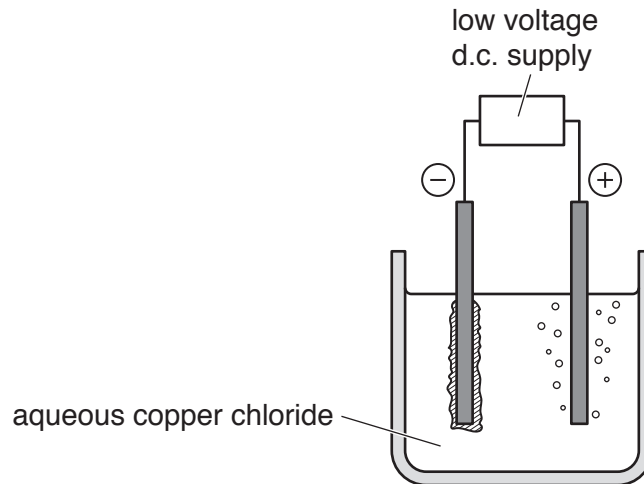


Fig. 8.2

Copper forms on the negative electrode.

A gas forms at the positive electrode. The student tests this gas with damp litmus paper.

Name the gas and predict its effect on the colour of the litmus paper.

name .....

effect .....

[2]

(c) Copper can be extracted by heating copper oxide with carbon.

The equation for this reaction is:



Identify one substance which is oxidised and one substance which is reduced during this reaction.

oxidised .....

reduced .....

[2]

(d) Carbon dioxide is present in clean air in small quantities.

(i) Name **one other** gas which is present in clean air in small quantities.

..... [1]

(ii) Name **two** substances present in clean air which cause rusting.

1. ....

2. ....

[1]

- 9 Fig. 9.1 shows a circuit diagram for an investigation of how the resistance of a lamp changes with the current in the lamp.

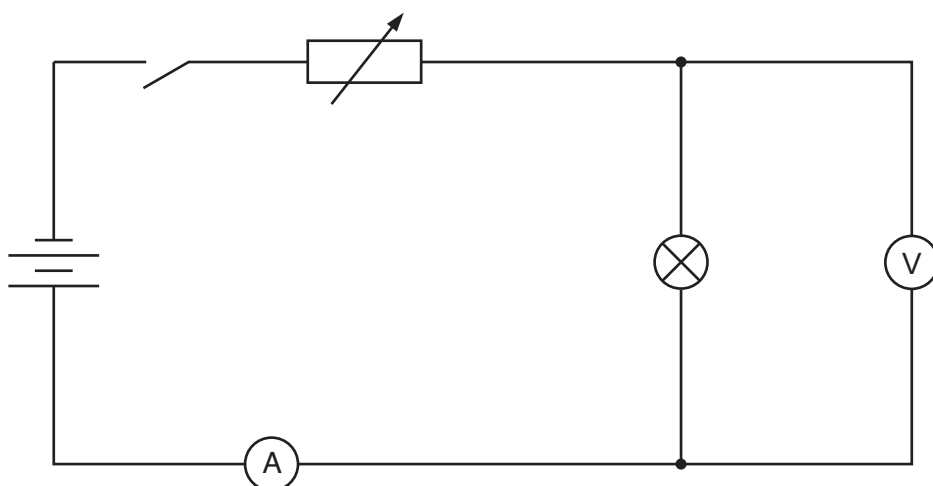
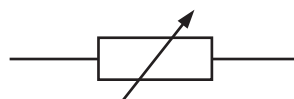


Fig. 9.1

- (a) Name the circuit component with the symbol



.....[1]

- (b) Table 9.1 shows some results from the investigation.

Table 9.1

experiment number	voltmeter reading /V	ammeter reading /A	resistance of lamp / $\Omega$
1	6.0	0.54	11
2	4.0	0.46	8.7
3	3.0	0.40	
4	2.0	0.32	6.3

- (i) Complete Table 9.1 by calculating the missing resistance value.

State the formula you use and show your working.

formula

working

[2]

- (ii) Suggest what happens to the lamp as the experiments are carried out in turn from experiment 1 to experiment 4.

.....[1]

- (c) (i) On Fig. 9.1 add a second identical lamp in parallel with the first lamp. [1]

- (ii) Experiment 1 is now repeated with the second lamp in the circuit in parallel with the first lamp.

Suggest how the ammeter reading will compare with the reading in the original experiment 1.

Give a reason for your answer.

effect on ammeter reading .....

reason .....

.....[2]

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The Periodic Table of Elements

		Group																																	
I	II											III	IV	V	VI	VII	VIII																		
3 <b>Li</b> lithium 7	4 <b>Be</b> beryllium 9	<p style="text-align: center;"><b>Key</b></p> <p style="text-align: center;">atomic number atomic symbol name relative atomic mass</p>										5 <b>B</b> boron 11	6 <b>C</b> carbon 12	7 <b>N</b> nitrogen 14	8 <b>O</b> oxygen 16	9 <b>F</b> fluorine 19	10 <b>Ne</b> neon 20																		
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24											1 <b>H</b> hydrogen 1	13 <b>Al</b> aluminium 27	14 <b>Si</b> silicon 28	15 <b>P</b> phosphorus 31	16 <b>S</b> sulfur 32	17 <b>Cl</b> chlorine 35.5	18 <b>Ar</b> argon 40	19 <b>K</b> potassium 39	20 <b>Ca</b> calcium 40	21 <b>Sc</b> scandium 45	22 <b>Ti</b> titanium 48	23 <b>V</b> vanadium 51	24 <b>Cr</b> chromium 52	25 <b>Mn</b> manganese 55	26 <b>Fe</b> iron 56	27 <b>Co</b> cobalt 59	28 <b>Ni</b> nickel 59	29 <b>Cu</b> copper 64	30 <b>Zn</b> zinc 65	31 <b>Ga</b> gallium 70	32 <b>Ge</b> germanium 73	33 <b>As</b> arsenic 75	34 <b>Se</b> selenium 79	35 <b>Br</b> bromine 80
37 <b>Rb</b> rubidium 85	38 <b>Sr</b> strontium 88	39 <b>Y</b> yttrium 89	40 <b>Zr</b> zirconium 91	41 <b>Nb</b> niobium 93	42 <b>Mo</b> molybdenum 96	43 <b>Tc</b> technetium —	44 <b>Ru</b> ruthenium 101	45 <b>Rh</b> rhodium 103	46 <b>Pd</b> palladium 106	47 <b>Ag</b> silver 108	48 <b>Cd</b> cadmium 112	49 <b>In</b> indium 115	50 <b>Sn</b> tin 119	51 <b>Sb</b> antimony 122	52 <b>Te</b> tellurium 128	53 <b>I</b> iodine 127	54 <b>Xe</b> xenon 131	55 <b>Cs</b> caesium 133	56 <b>Ba</b> barium 137	57–71 lanthanoids	72 <b>Hf</b> hafnium 178	73 <b>Ta</b> tantalum 181	74 <b>W</b> tungsten 184	75 <b>Re</b> rhenium 186	76 <b>Os</b> osmium 190	77 <b>Ir</b> iridium 192	78 <b>Pt</b> platinum 195	79 <b>Au</b> gold 197	80 <b>Hg</b> mercury 201	81 <b>Tl</b> thallium 204	82 <b>Pb</b> lead 207	83 <b>Bi</b> bismuth 209	84 <b>Po</b> polonium —	85 <b>At</b> astatine —	86 <b>Rn</b> radon —
87 <b>Fr</b> francium —	88 <b>Ra</b> radium —	89–103 actinoids	104 <b>Rf</b> rutherfordium —	105 <b>Db</b> dubnium —	106 <b>Sg</b> seaborgium —	107 <b>Bh</b> bohrium —	108 <b>Hs</b> hassium —	109 <b>Mt</b> meitnerium —	110 <b>Ds</b> darmstadtium —	111 <b>Rg</b> roentgenium —	112 <b>Cn</b> copernicium —	113 <b>Nh</b> nihonium —	114 <b>Fl</b> flerovium —	115 <b>Mc</b> moscovium —	116 <b>Lv</b> livermorium —	117 <b>Ts</b> tennessine —	118 <b>Og</b> oganesson —																		

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

lanthanoids

actinoids

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