Cambridge IGCSE

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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*5014600928*

**COMBINED SCIENCE** **0653/32**

Paper 3 (Core) **February/March 2017**

**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 **20** printed pages.




CAMBRIDGE International Examinations

**1** **(a)** Use lines to connect the box on the left to different boxes on the right.

As an example one has been done for you. The sentence reads 'Human liver cells take in oxygen by diffusion'.

Draw **three** more lines to form three more correct sentences.

| | |
|---|---|
| | contain cytoplasm. |
| | build up starch molecules from glucose molecules. |
| | destroy hormones. |
| Human liver cells | contain chloroplasts. |
| | take in oxygen by diffusion. |
| | carry out cell respiration in the nucleus. |
| | have a cell membrane. |

[3]

**(b)** Fig. 1.1 shows a diagram of the human alimentary canal and associated organs.

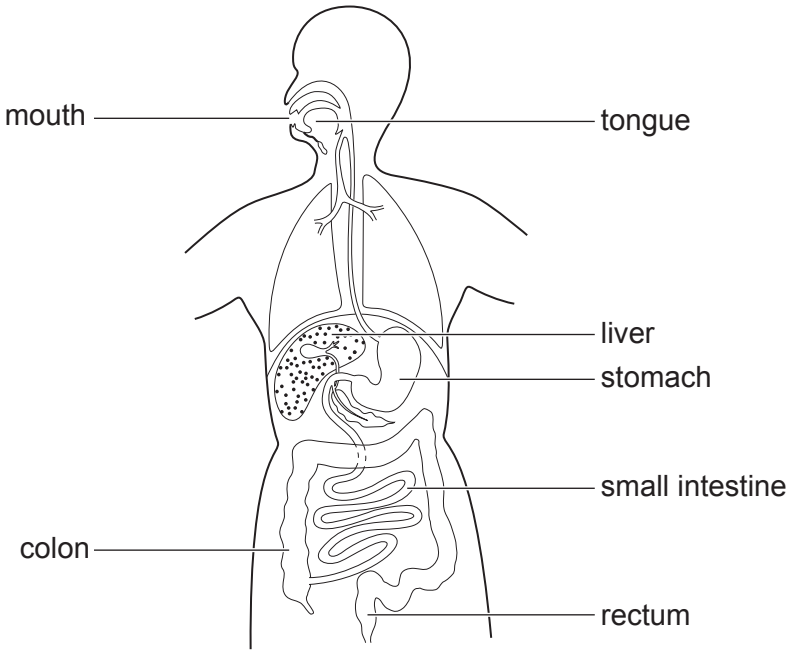



**Fig. 1.1**

On Fig. 1.1 label the **oesophagus** and the **gall bladder**. [2]

**(c)** A person has a disease of the small intestine which prevents the small intestine from working properly.

Choose **two** words or phrases from the list below to describe which two functions of the small intestine will be affected by this disease.

Explain the reasons for your choices.

**absorption** **chemical digestion** **destroying hormones**

**egestion** **ingestion** **producing bile**

function 1 .....

explanation .....

.....

.....

function 2 .....

explanation .....

.....

.....

[4]

**(d)** The pH of the mouth cavity varies during the day. After a sugary meal the pH of the mouth cavity becomes more acidic.

**(i)** Describe what causes the change in pH.

.....

.....

.....

.....[2]

**(ii)** Describe the effect of increased acidity on teeth.

.....

.....[1]

**2** A student reacts dilute hydrochloric acid with a solid metal carbonate, as shown in Fig. 2.1.

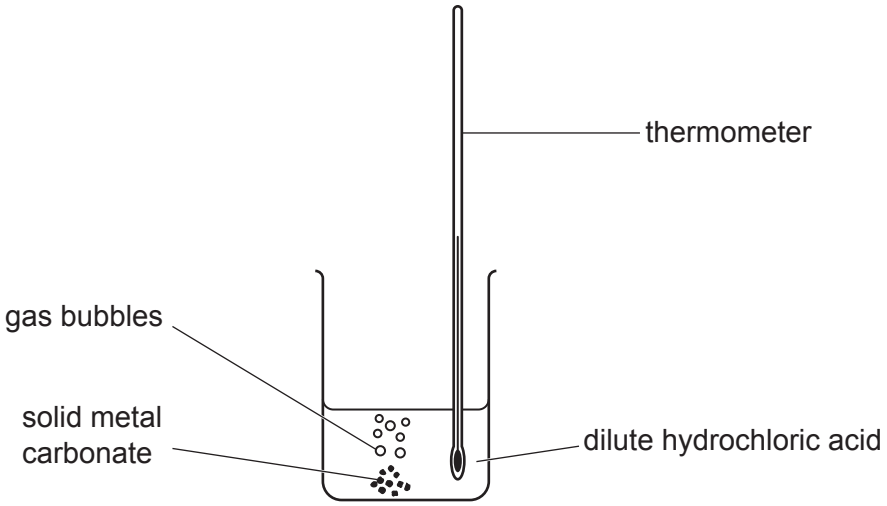



**Fig. 2.1**

**(a) (i)** Name the gas produced in this reaction.

.....[1]

**(ii)** The student observes that the temperature increases.

State the type of reaction that results in a temperature increase.

.....[1]

**(iii)** Describe the change in the pH number of the solution during the reaction.

.....[1]

**(iv)** The student records the time taken for the reaction to stop.

Suggest how she knows that the reaction has stopped.

.....

.....[1]

**(v)** Some solid metal carbonate is left over after the reaction has stopped.

State **one** method used to separate the unreacted solid metal carbonate from the mixture.

.....[1]

**(b)** The student changes the concentration of the acid and then repeats the reaction.

**(i)** Describe the effect of using acid with a lower concentration on the rate of the reaction.

.....[1]

**(ii)** Suggest **one** other way of changing the rate of the reaction.

.....[1]

**(c)** Describe a test to show that the acid used contains chloride ions.

State the change that is observed.

test .....

observation .....
[2]

**3** Fig. 3.1 shows an elevator (lift) which takes people to different floors in a tall building. The elevator travels up the lift shaft pulled by a long rope. There are no people in the elevator, which has stopped at the bottom floor.

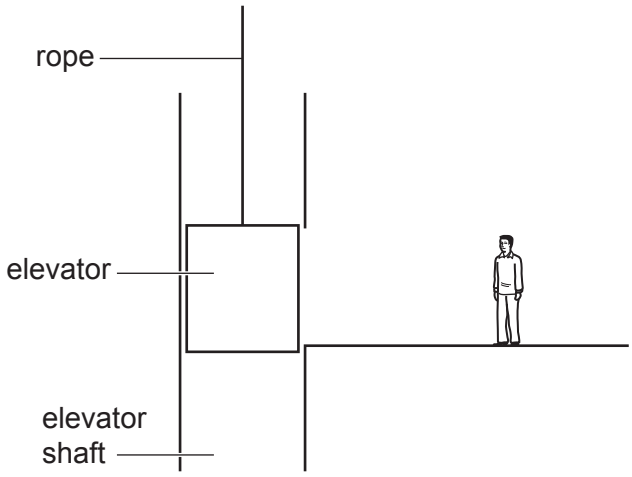



**Fig. 3.1**

**(a) (i)** On Fig. 3.1 draw two arrows to show the action of the two main forces acting on the elevator while it is stopped. [2]

**(ii)** One force is measured and found to be 5000 N.

State whether the other force is 5000 N or has a different value.

Give a reason for your answer.

.....

.....

.....[1]

**(iii)** The elevator begins to move upwards to the top floor.

Describe any changes in the two forces acting which are needed to make this happen.

.....

.....[1]

**(b)** The elevator moves upwards at an average speed of 2 m / s. It moves 30 m up the elevator shaft and stops at the top floor.

**(i)** Calculate the time taken by the elevator to travel from the bottom floor to the top floor.

State the formula that you use and show your working.

formula

working

time = ..... s [2]

**(ii)** State the type of energy gained by the elevator because it is moving.

.....[1]

**(iii)** State the type of energy gained by the elevator when it has stopped at the top floor.

.....[1]

**(c)** On Fig. 3.2 sketch the shape of the speed-time graph for the journey of the elevator from the bottom floor to the top floor.

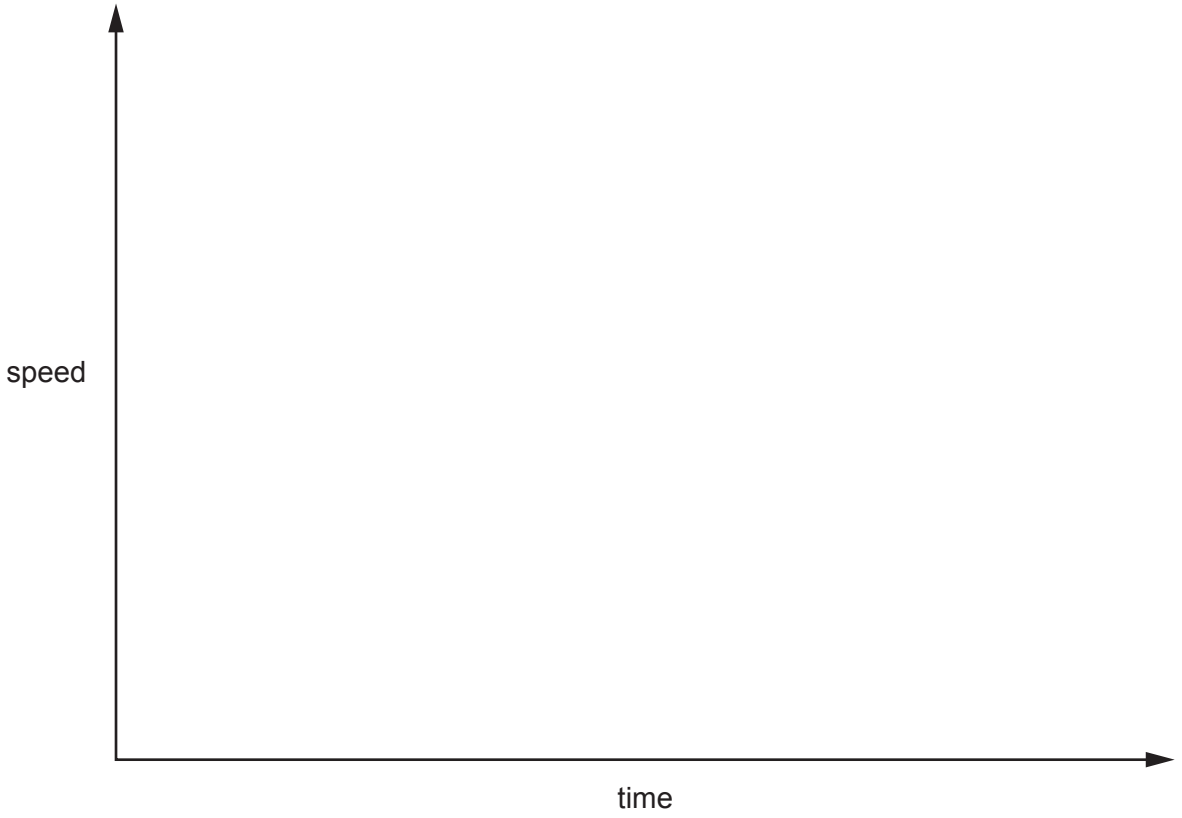



**Fig. 3.2**

[1]





**[Turn over**

**4** **(a)** Fig. 4.1 shows a diagram of part of the carbon cycle. The numbers show processes by which carbon is transferred between compounds in organisms and carbon dioxide in the atmosphere.

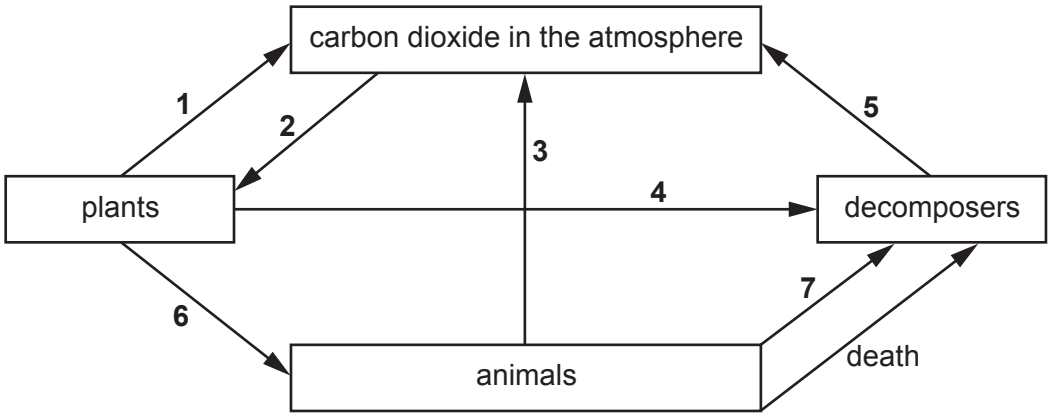



**Fig. 4.1**

Use Fig. 4.1 to answer the following questions.

**(i)** State the number which shows photosynthesis.

..... . [1]

**(ii)** State the numbers which show respiration.

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

**(iii)** Name process **6**.

.....[1]

**(b)** Bacteria and fungi in the soil are decomposers. They obtain their energy and nutrients from dead organisms and their waste products.

Name process **7** and describe how carbon is transferred from animals to decomposers.

.....

.....

.....

.....[2]

**(c)** Over millions of years some carbon becomes trapped underground in fossil fuels. When these fossil fuels are burned, carbon dioxide is released to the atmosphere.

The carbon dioxide released by burning fossil fuels contributes to global warming.

State **two** harmful effects of global warming.

1. .....

2. .....

[2]

**5** **(a)** Natural gas and petroleum (crude oil) are fossil fuels.

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

.....[1]

**(ii)** Name the main constituent of natural gas.

.....[1]

**(iii)** Name the gas in air that reacts with fuels when they burn.

.....[1]

**(b)** Petroleum is a mixture of hydrocarbons.

Fig. 5.1 shows the industrial apparatus used to separate petroleum into useful products.

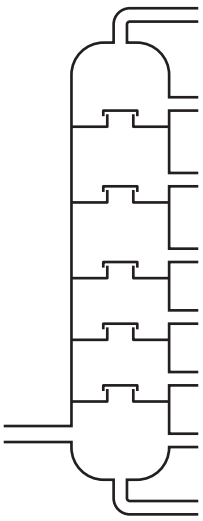


**Fig. 5.1**

**(i)** Name the process used to separate petroleum into useful products.

.....[1]

**(ii)** State the meaning of the term *hydrocarbon*.

.....

.....

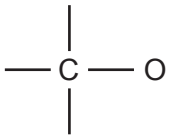
.....[2]

**(c)** Ethanol, $C_2H_5OH$, and hydrocarbons burn to form carbon dioxide and one other product during complete combustion.

**(i)** Name the other product.

.....[1]

**(ii)** Complete the diagram to show the structure of a molecule of ethanol.




[2]

**6** Fig. 6.1 shows a boat sailing near a lighthouse at night. The light from the lighthouse warns passing boats to beware of dangerous rocks nearby.

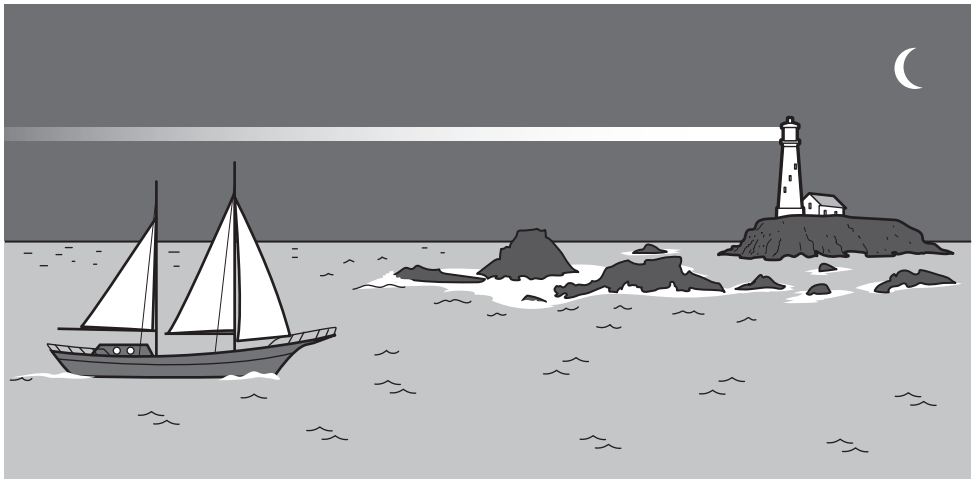


**Fig. 6.1**

**(a)** The lighthouse has a very bright lamp placed at the principal focus of a converging lens.

Fig. 6.2 shows one ray from the lamp passing through the lens. Two more rays are shown coming from the same point in the lamp. On Fig. 6.2 complete these rays to show how the lens produces a narrow parallel beam of light.

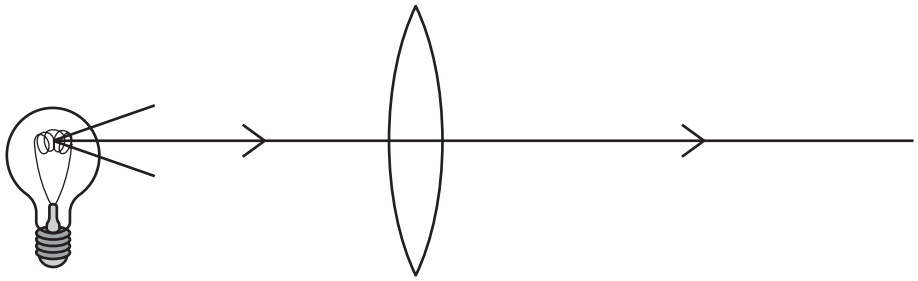


**Fig. 6.2**

[2]

**(b)** The lamp is switched on at night by a radio signal sent from a long distance away.

Both visible light and radio waves are part of the electromagnetic spectrum.

On Fig. 6.3, put visible light and radio waves in their correct places in the incomplete electromagnetic spectrum.

| | | | | | | |
|---|---|---|---|---|---|---|
| gamma radiation | | ultra-violet | | | micro-waves | |

[2]

**Fig. 6.3**

**(c)** Fog at sea is caused by water vapour in the air condensing to form tiny water droplets.

Water vapour in the air comes from water in the sea.

**(i)** Name the process by which water in the sea escapes to form water vapour in the air.

.....[1]

**(ii)** Describe in terms of water molecules how the process named in **(i)** happens.

.....

.....

.....[2]

**(d)** When there is fog at sea, it is difficult for sailors to see the rocks. A fog-horn at the lighthouse produces a very loud sound to warn sailors about the rocks.

The sound produced by a fog-horn has a frequency of 50 Hz.

Describe the pitch and amplitude of the sound produced.

pitch .....

amplitude .....
[2]

**(e)** Climate change across the world is causing the average temperature of sea water to increase. One effect of this temperature change is to increase the process named in **(c)(i)**.

Describe another effect of an increase in temperature on a liquid such as sea water.

.....[1]





**[Turn over**

**7** Transpiration occurs when water vapour is lost from the leaves of plants through the stomata.

**(a)** Describe the path taken by water in the plant from the soil to the leaves.

.....

.....

.....

.....[3]

**(b)** A student carries out an experiment to investigate the rate of transpiration in a leafy shoot. Fig. 7.1 shows the apparatus he uses.

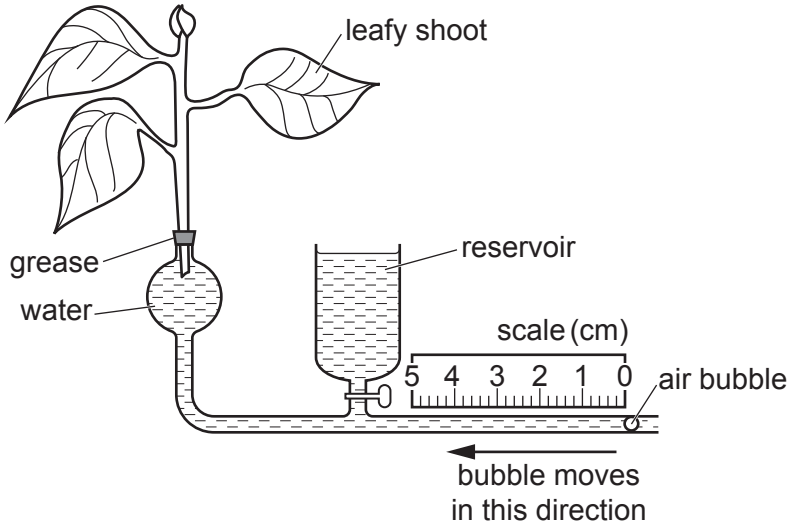



**Fig. 7.1**

Transpiration from the leafy shoot causes water to be taken into the shoot from the apparatus and the air bubble moves to the left. The faster the rate of transpiration, the faster the air bubble moves.

The student uses the apparatus to do three tests in different conditions. The average distances moved by the air bubble in one minute are shown in Table 7.1.

**Table 7.1**

| test number | conditions | average distance moved by the bubble in one minute / cm |
|---|---|---|
| **1** | on the laboratory bench | 1.2 |
| **2** | on the same bench with a lamp shining next to the apparatus | 2.8 |
| **3** | in a crowded classroom | |

**(i)** State **two** reasons to explain why the air bubble moved more quickly in test **2** compared with test **1**.

1. .....

.....

.....

2. .....

.....

.....

[3]

**(ii)** For test **3** the student takes the apparatus into a crowded classroom. There is an increase in the humidity of the air in the classroom.

Suggest a value for the average distance moved by the air bubble in one minute in the crowded classroom.

value = ..... cm / minute

Explain your answer.

.....

.....

.....

.....[2]

**8** **(a)** A student observes what happens when a piece of sodium is added to water, as shown in Fig. 8.1.

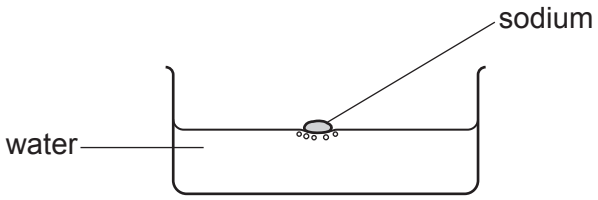



**Fig. 8.1**

During the reaction the student observes that the sodium floats and melts.

The student is told that sodium hydroxide solution is formed and hydrogen gas is given off.

**(i)** State which information above shows that sodium has a low density.

.....[1]

**(ii)** Complete the **word** equation for this reaction.

[ ] + [ ] → [ ] + [ ]

[2]

**(iii)** The student makes different observations when a piece of copper is added to water.

Describe these different observations.

1. .....

2. .....

[2]

**(b)** The Periodic Table contains groups and collections of elements.

**(i)** Name the collection of metals which often act as catalysts.

.....[1]

**(ii)** Describe the reactivity of the noble gases.

.....[1]

**(iii)** Chlorine, C*l*, is in Group VII of the Periodic Table.

An atom of chlorine is represented as:

$$^{35}_{17}Cl$$

The mass number is 35, and the atomic number is 17.

Explain what is meant by

mass number, .....

.....

atomic number. .....

.....

[2]

**9** Fig. 9.1 shows a simple circuit set up to investigate the electrical properties of a lamp.

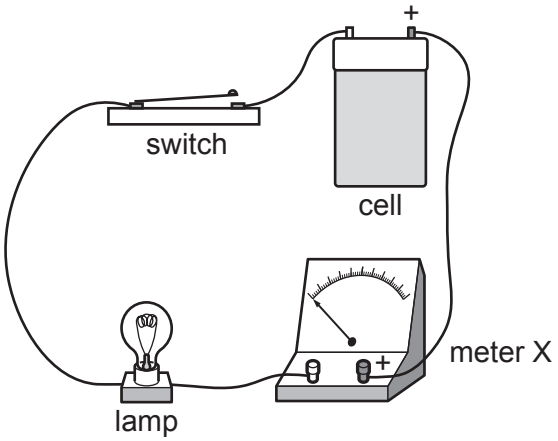



**Fig. 9.1**

**(a) (i)** On Fig. 9.2 use the correct circuit symbols to complete the circuit diagram for the circuit shown in Fig. 9.1.

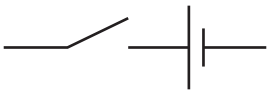


**Fig. 9.2**

[2]

**(ii)** On Fig. 9.2 using the correct circuit symbol, connect a meter into the circuit that can measure the potential difference across the lamp. [2]

**(b)** The cell has a voltage of 1.5 V, and the reading on the ammeter is 0.6 A for the circuit shown in Fig. 9.1.

**(i)** Show by calculation that the resistance of the lamp is 2.5 Ω.

State the formula that you use and show your working.

formula

working

[1]

**(ii)** A second identical lamp is added in series with the lamp in the circuit in Fig. 9.1.

Suggest what happens to the reading on the ammeter.

Explain why this happens.

.....

.....

.....

.....[2]

## The Periodic Table of Elements

Group

| I | II | | | | | | | | | | | | III | IV | V | VI | VII | VIII |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | 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.)