



# Cambridge IGCSE™

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**COMBINED SCIENCE**

**0653/31**

Paper 3 Theory (Core)

**October/November 2020**

**1 hour 15 minutes**

You must answer on the question paper.

No additional materials are needed.

## INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

## INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].
- The Periodic Table is printed in the question paper.

This document has **20** pages. Blank pages are indicated.



1 (a) Fig. 1.1 is a diagram of some parts of the body.

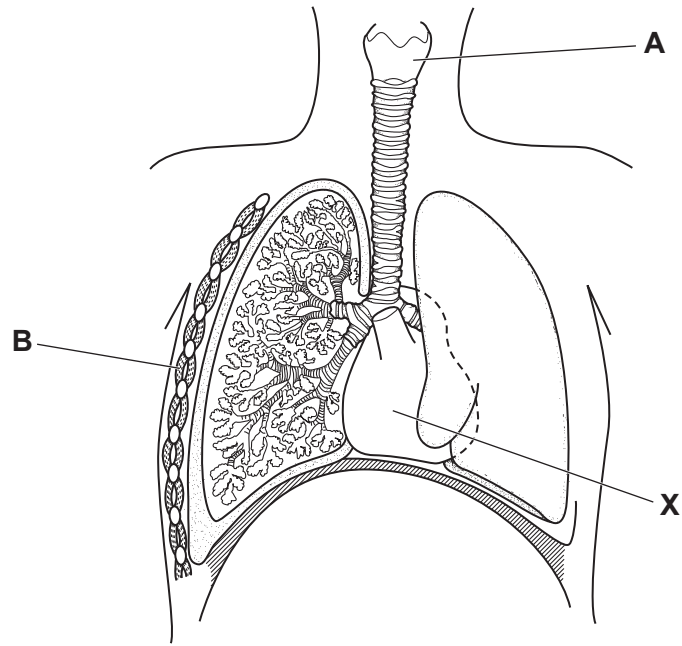


Fig. 1.1

(i) Identify parts **A** and **B** shown in Fig. 1.1.

**A** .....

**B** ..... [2]

(ii) Describe the function of part **X** shown in Fig. 1.1.

.....

..... [1]

(b) Fig. 1.2 shows the rate and depth of breathing of a person while at rest and during exercise.

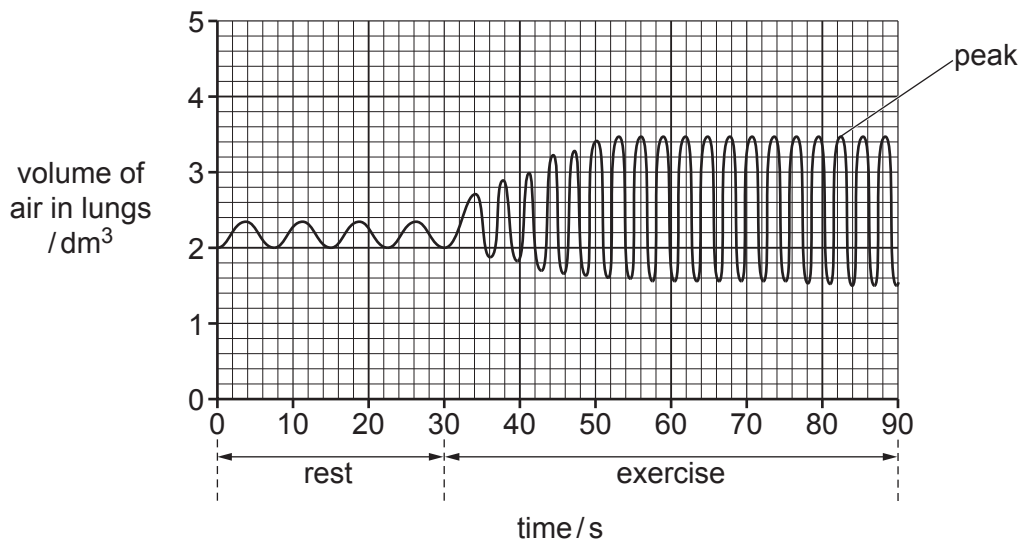


Fig. 1.2

Each time the line rises to a peak, the person is breathing in.

(i) Use Fig. 1.2 to determine the number of breaths the person takes while at rest.

number of breaths = ..... [1]

(ii) Describe how the rate and depth of breathing of the person change during exercise, as shown in Fig. 1.2.

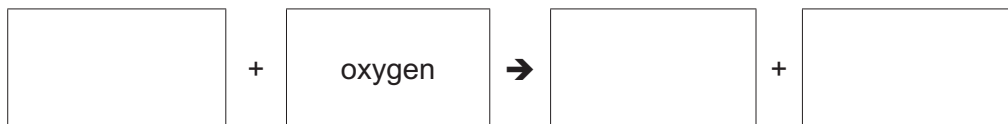
rate .....

depth .....

[2]

(c) The purpose of breathing is to obtain oxygen for respiration.

Complete the word equation for respiration.



[2]

[Total: 8]

- 2 (a) Copper is extracted from copper oxide by heating with carbon, as shown in Fig. 2.1.

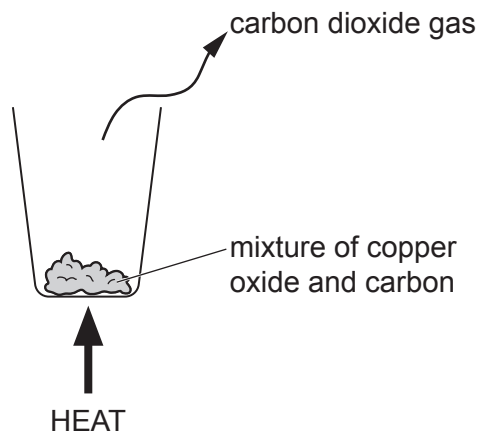
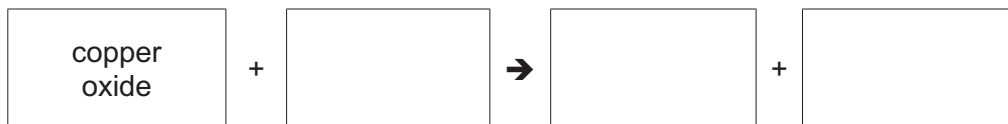


Fig. 2.1

Carbon dioxide is produced in this process.

- (i) Complete the word equation for this process.



[2]

- (ii) Use words from the list to describe substances involved in this process.

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

**atoms**

**compound**

**covalent**

**element**

**ionic**

**ions**

**solution**

Copper oxide is a ..... containing oppositely charged

.....

In carbon dioxide, each molecule contains three .....

chemically joined by ..... bonds.

[4]

- (iii) State whether the change from copper oxide to copper during this process is oxidation or reduction.

Explain your answer.

change .....

explanation .....

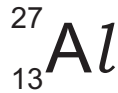
..... [1]

- (b) Aluminium is extracted from the ore bauxite.

- (i) State the method of extraction of aluminium from bauxite.

..... [1]

- (ii) An atom of aluminium is represented by the symbol shown.



Deduce the number of electrons and the number of neutrons in this atom.

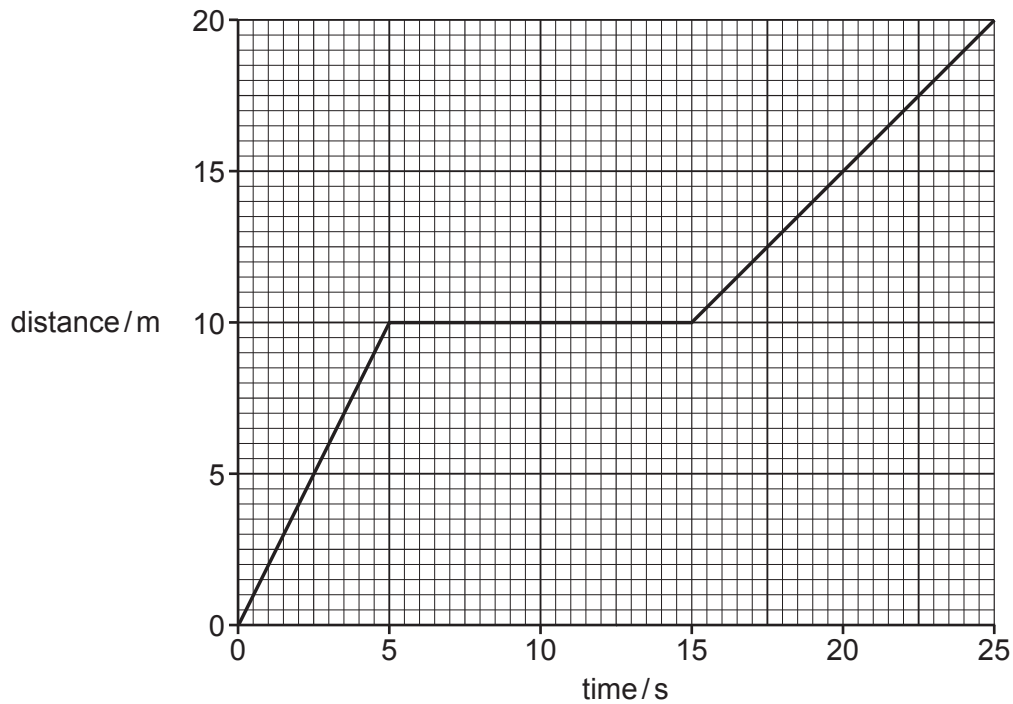
electrons .....

neutrons .....

[2]

[Total: 10]

- 3 (a) Fig. 3.1 shows the distance–time graph for a man.



**Fig. 3.1**

- (i) Suggest what the man is doing between 5 s and 15 s.  
 ..... [1]
- (ii) On Fig. 3.1, draw an **X** on the graph to show when the man is moving fastest. [1]
- (iii) Use Fig. 3.1 to calculate the average speed of the man for the 25 s.

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

- (b) The weight of the man is 800 N.

The gravitational field strength  $g$  is 10 N/kg.

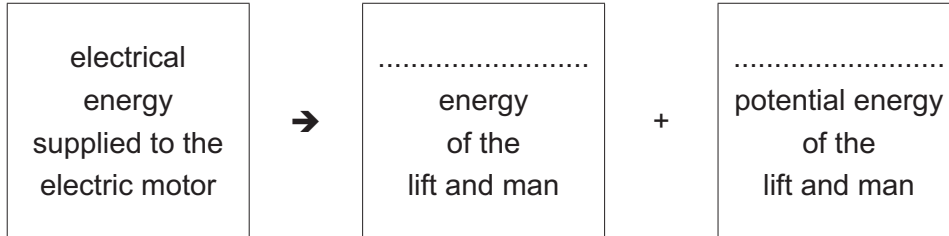
Calculate the mass of the man.

mass = ..... kg [1]

(c) (i) The man enters a lift (elevator). The lift moves the man vertically upwards.

The lift uses an electric motor.

Complete the useful energy transfers for the lift and man.



[2]

(ii) The amount of electrical energy supplied to the electric motor is actually greater than the useful work done in moving the lift and man up to the higher level.

Suggest why.

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

[Total: 9]

- 4 (a) Fig. 4.1 shows diagrams of a plant cell before and after the cell is immersed in concentrated sugar solution.

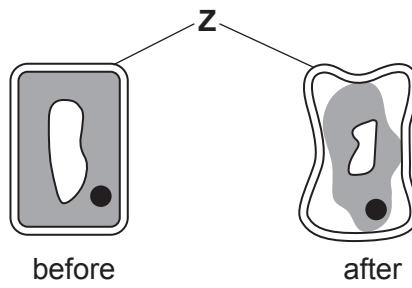


Fig. 4.1

- (i) Identify part Z shown in Fig. 4.1.

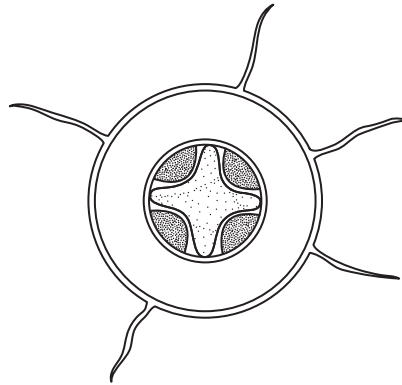
..... [1]

- (ii) Describe the effect of immersing the cell in concentrated sugar solution.

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



(b) Fig. 4.2 is a drawing of a cross-section of a plant root.



**Fig. 4.2**

(i) On Fig. 4.2, use a label line and the letter **X** to show the position of the xylem. [1]

(ii) State the function of root hair cells.

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

(iii) Water moves through xylem vessels to the leaves due to transpiration.

State the process by which water in the leaves is lost:

from the surface of the mesophyll cells .....  
 through the stomata. .... [2]

(c) Water is used in photosynthesis.

Photosynthesis is the process by which plants manufacture carbohydrates from raw materials using energy from light.

(i) State the name of the structures inside plant cells where photosynthesis takes place.

..... [1]

(ii) State the name of the gas produced in photosynthesis.

..... [1]

[Total: 9]

5 (a) Air is a mixture of different gases.

(i) Name the gas that makes up 78% of clean air.

..... [1]

(ii) Name the gas that must be present for iron to rust.

..... [1]

(iii) Name **one** common air pollutant and describe **one** adverse effect that is caused by this pollutant.

pollutant .....

adverse effect .....

[2]

(iv) State the formulae of **two** greenhouse gases.

1 .....

2 .....

[2]

(b) Fig. 5.1 is an incomplete dot-and-cross diagram of a molecule of water.

On Fig. 5.1, draw dots and crosses to show **all** of the outer shell electrons in a molecule of water.

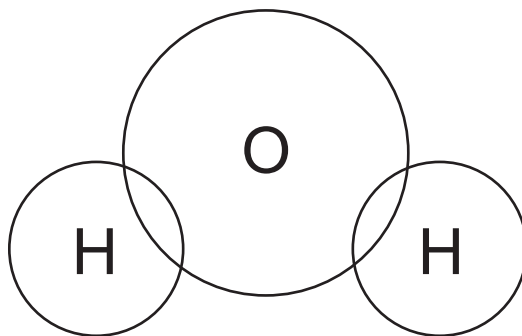


Fig. 5.1

[3]

(c) Describe the effect of water on blue cobalt(II) chloride.

..... [1]

[Total: 10]

6 Fig. 6.1 shows a girl using a bicycle pump to add air to a bicycle tyre.

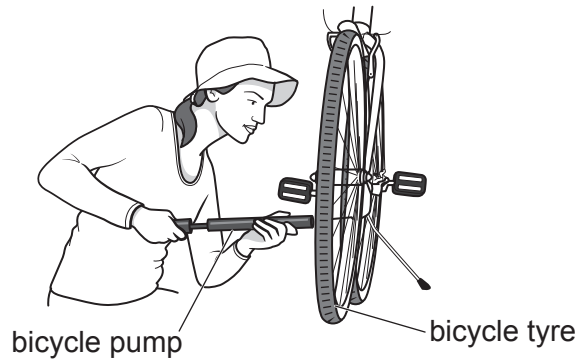


Fig. 6.1

(a) Fig. 6.2 shows the arrangement of molecules in the air inside the bicycle tyre.

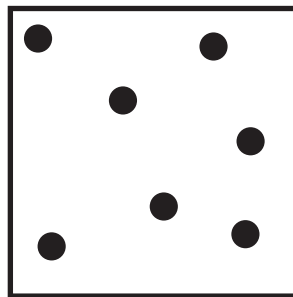


Fig. 6.2

(i) Suggest what happens to the separation of the molecules as the girl pumps more air into the tyre.

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

(ii) The temperature of the air in the tyre increases.

Describe how the movement of the molecules changes as this happens.

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

(b) Fig. 6.3 shows the girl wearing a cotton hat on a sunny day.

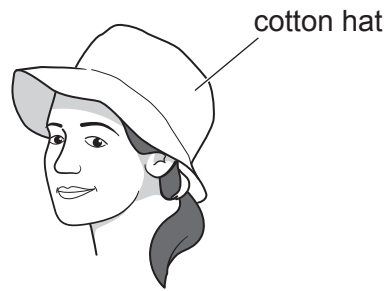


Fig. 6.3

(i) State the method of energy transfer from the Sun to the Earth.

..... [1]

(ii) Suggest **two** ways the cotton hat reduces energy transfer from the Sun to the girl's head.

1 .....

.....

2 .....

.....

[2]

(iii) The girl puts a sunscreen cream on the skin of her face.

Suggest how this precaution helps reduce the risk of sunburn.

.....

.....

..... [2]

(c) Fig. 6.4 shows a bell fixed on the handlebars of the bicycle.

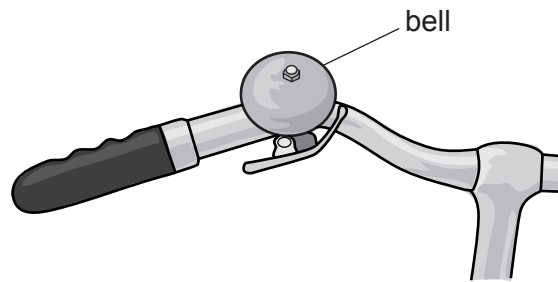


Fig. 6.4

(i) Fig. 6.5 represents the sound wave produced when the girl rings the bell.

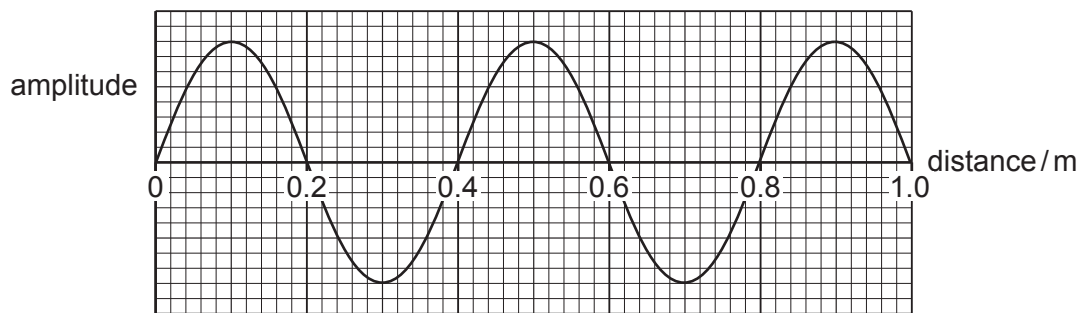


Fig. 6.5

Use Fig. 6.5 to find the wavelength of the sound wave produced by the bell.

wavelength = ..... m [1]

(ii) The girl makes the bell ring louder.

Describe the difference this makes to the sound wave produced.

..... [1]

[Total: 9]

- 7 (a) The boxes on the left show some parts of the male reproductive system in humans. The boxes on the right show the function of each part.

Draw **one** straight line from each part to its function.

part	function
penis	production of sperm
prostate gland	secretion of fluid for sperm to swim in
testes	transfer of semen to vagina during sexual intercourse

[2]

- (b) Fig. 7.1 is a diagram of the female reproductive system in humans.

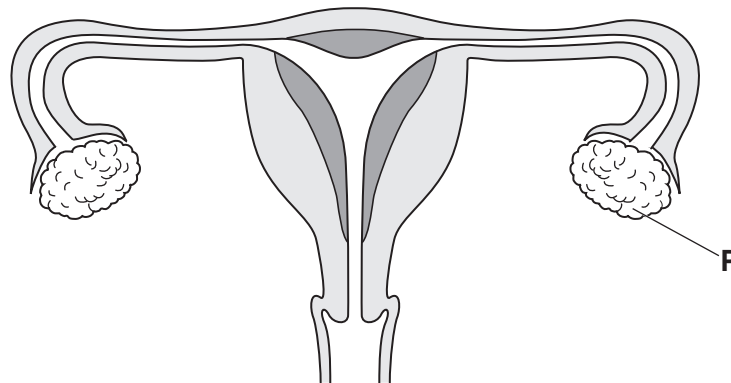


Fig. 7.1

- (i) On Fig. 7.1, use a label line and the letter **F** to show where fertilisation occurs.

[1]

(ii) Describe the changes that occur in structure **P** during the menstrual cycle.

.....

.....

.....

..... [2]

(iii) Fig. 7.2 shows the process of human fertilisation and early development of an embryo.

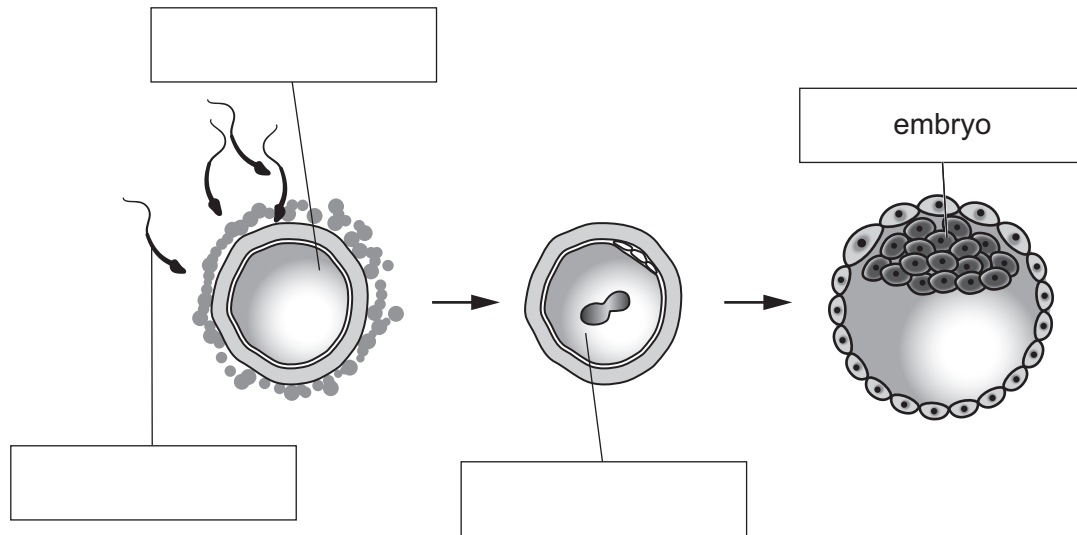


Fig. 7.2

Complete Fig. 7.2 using words from the list.

- fetus                  nucleus                  ovum**
- sperm                  uterus                  zygote**

[3]

(c) Human immunodeficiency virus (HIV) is a sexually transmitted infection.

State **two** ways of preventing the transmission of HIV.

1 .....

2 .....

[2]

[Total: 10]

- 8 (a) Sodium chloride is made when aqueous sodium hydroxide is mixed with dilute hydrochloric acid.

State what happens to the pH of the mixture as the aqueous sodium hydroxide is added to the dilute hydrochloric acid.

..... [1]

- (b) Sodium is in Group I of the Periodic Table, and chlorine is in Group VII.

- (i) Describe the change in character of elements across a period in the Periodic Table from left to right.

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

- (ii) Describe the trend in reactivity of Group I metals from lithium to potassium.

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

- (iii) Describe the trend in physical state of Group VII elements from fluorine to iodine.

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

- (c) Aqueous bromine reacts with alkenes.

- (i) State the colour change that occurs during this reaction.

..... [1]

- (ii) Name the reaction that produces alkenes from larger alkane molecules.

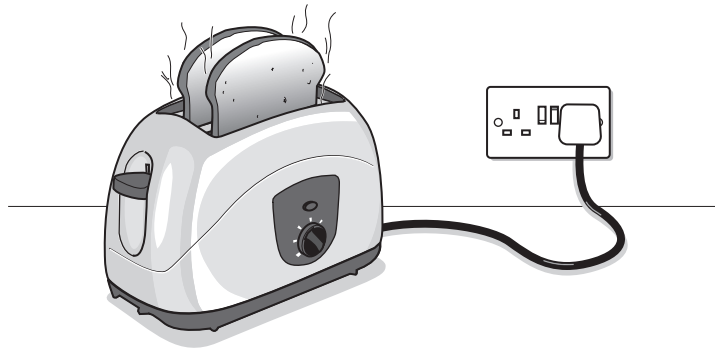
..... [1]

[Total: 6]



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9 Fig. 9.1 shows an electric toaster that is used for toasting slices of bread.



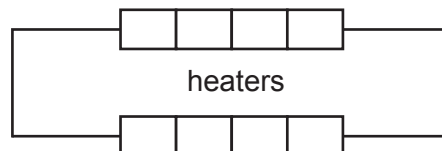
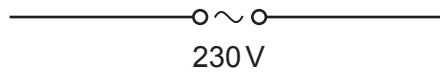
**Fig. 9.1**

(a) The toaster uses a 230V mains electricity supply as a source of energy.

The toaster contains:

- two heaters connected in parallel
- one switch to turn both heaters on and off
- a fuse to protect the circuit.

On Fig. 9.2, complete the circuit diagram for the toaster.



**Fig. 9.2**

[4]

(b) A wire in one of the heaters breaks, and that heater stops working. The fuse is not affected.

(i) Explain why the other heater continues to work.

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

(ii) The potential difference (p.d.) across the working heater is 230V.

The current in the working heater is 2.5A.

Calculate the resistance of the heater.

Give the unit of your answer.

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

(c) The fuse in the circuit now needs replacing. The current from the source when both heaters are working is 5.0A.

Circle the most appropriate fuse rating for the replacement fuse. Give a reason for your choice.

**1A      5A      13A**

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

[Total: 9]

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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	<div style="display: flex; justify-content: space-between;"> <div style="border: 1px solid black; padding: 5px;">           1 <b>H</b> hydrogen 1         </div> <div style="border: 1px solid black; padding: 5px;"> <b>Key</b> atomic number atomic symbol name relative atomic mass         </div> </div>										2 <b>He</b> helium 4					
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24	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	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	36 <b>Kr</b> krypton 84
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 —	114 <b>Fl</b> flerovium —	116 <b>Lv</b> livermorium —	—	—	—	—

lanthanoids	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
actinoids	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 —

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