Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6063184276

CO-ORDINATED SCIENCES **0654/33**

Paper 3 (Core) **October/November 2019**

2 hours

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 32.

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 **30** printed pages and **2** blank pages.

Cambridge Assessment International Education

1 **(a)** Fig. 1.1 is a diagram of a section through the heart and associated blood vessels.

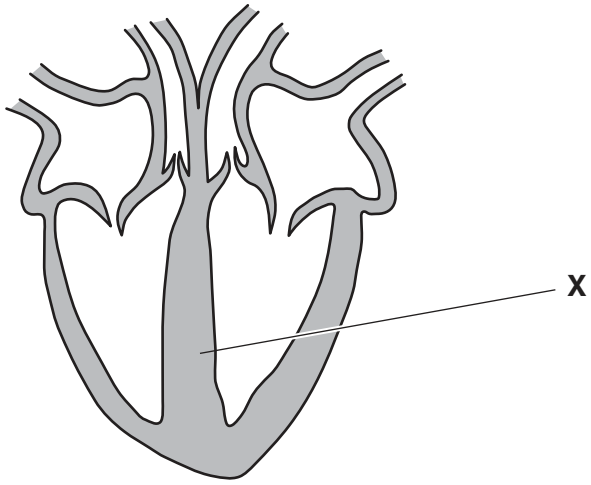

Fig. 1.1

(i) Name the structure labelled **X** in Fig. 1.1.

..... [1]

(ii) Name the structure shown in Fig. 1.1 that ensures one-way flow of blood.

..... [1]

(iii) Draw an arrow on Fig. 1.1 to show where blood enters the heart from the lungs. [1]

(b) Table 1.1 shows some of the functions of the components of blood.

Table 1.1

component of blood	function
.....	antibody production and phagocytosis
.....	promotes blood clotting
.....	transport of dissolved nutrients
.....	transport of oxygen

Complete Table 1.1 by adding the name of the component of blood which has each function. [4]

(c) Substances are transported around the body by blood in blood vessels.

Substances are also transported around plants in vessels.

Name the two vessels that transport substances in **plants**.

1 .....

2 .....
[2]

(d) Water is one of the substances transported through plants and is lost by the process of transpiration.

Complete the definition of the term *transpiration* using words or phrases from the list.

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

absorption	**diffusion**	**epidermis**	**evaporation**
palisade cells	**photosynthesis**	**roots**	**stomata**

Transpiration is defined as the loss of water vapour from plant leaves by ..... of water at the surfaces of the mesophyll cells followed by ..... of water vapour through the ..... . [3]

[Total: 12]

2 **(a)** Fig. 2.1 shows the symbols of six elements and six statements about these elements.

On Fig. 2.1 draw one straight line from each symbol to the correct statement.

One line has already been drawn for you.

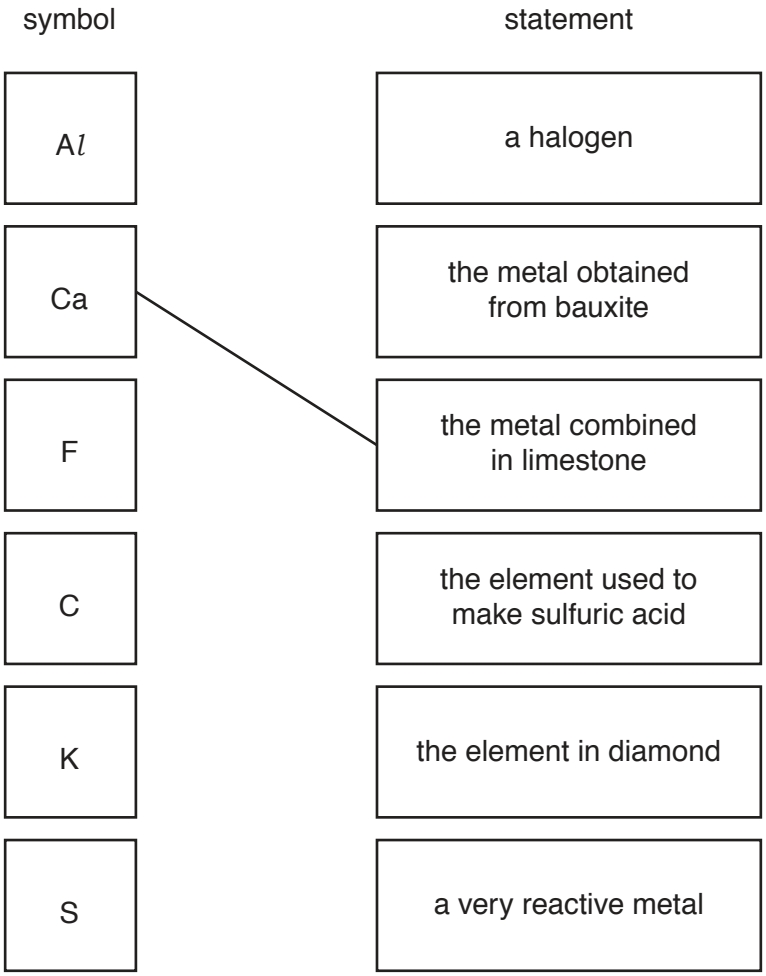

Fig. 2.1

[3]

(b) The chemical symbols of an atom of beryllium and an atom of boron are shown in Fig. 2.2.

Fig. 2.2

Complete Table 2.1 to show the numbers of neutrons and electrons in these atoms.

Table 2.1

	neutrons	electrons
Be		
B		

[2]

(c) Sodium and chlorine combine to form sodium chloride.

Fig. 2.3 shows the electronic structure of an atom of sodium and of an atom of chlorine.

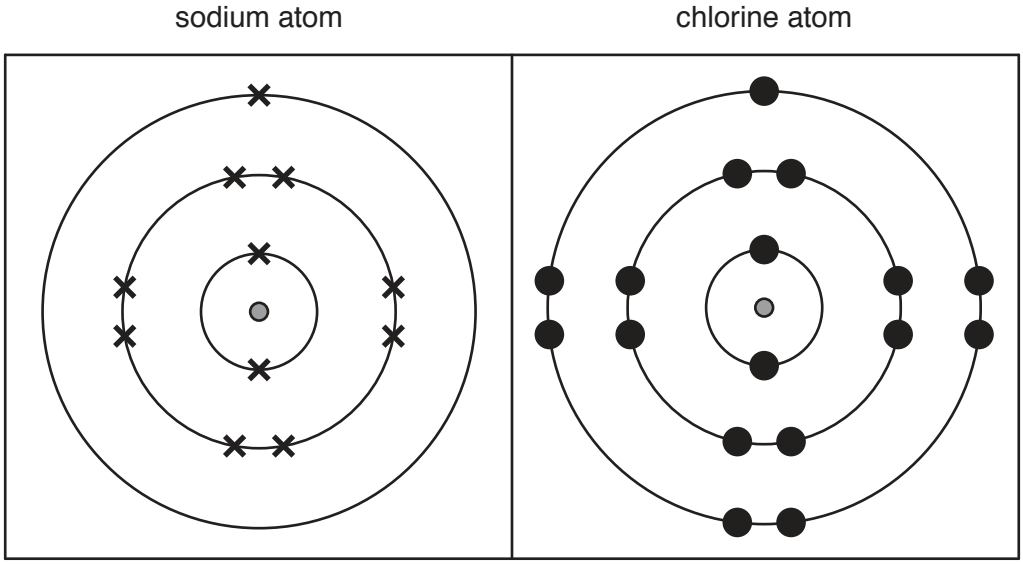

Fig. 2.3

Complete Fig. 2.4 to show the electronic structures of the ions that form from these atoms.

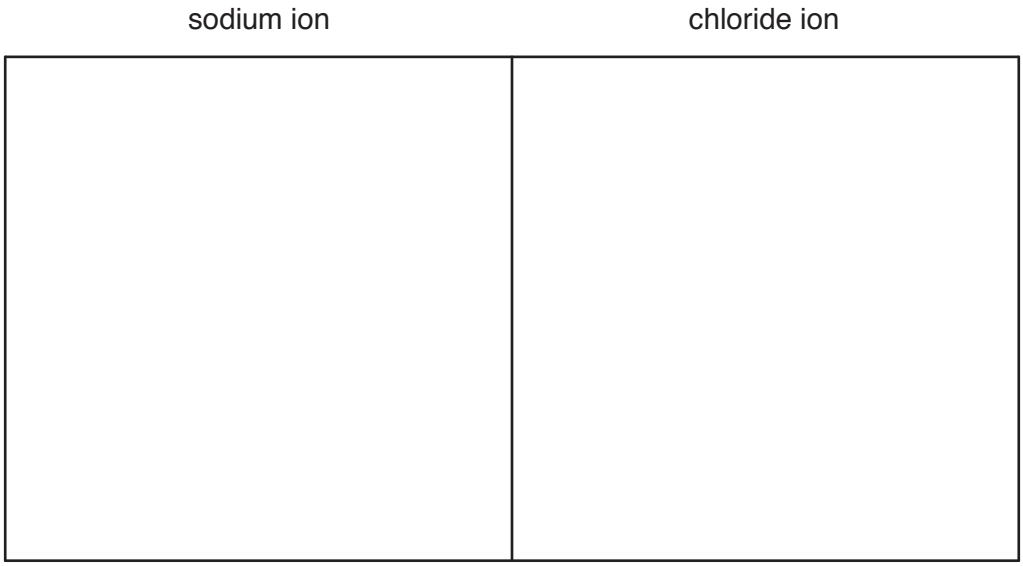

Fig. 2.4

[2]

(d) Fig. 2.5 shows apparatus a student uses to produce a neutral solution of sodium chloride.

Apparatus **F** contains a dilute acid which is added slowly to an alkaline solution contained in the beaker.

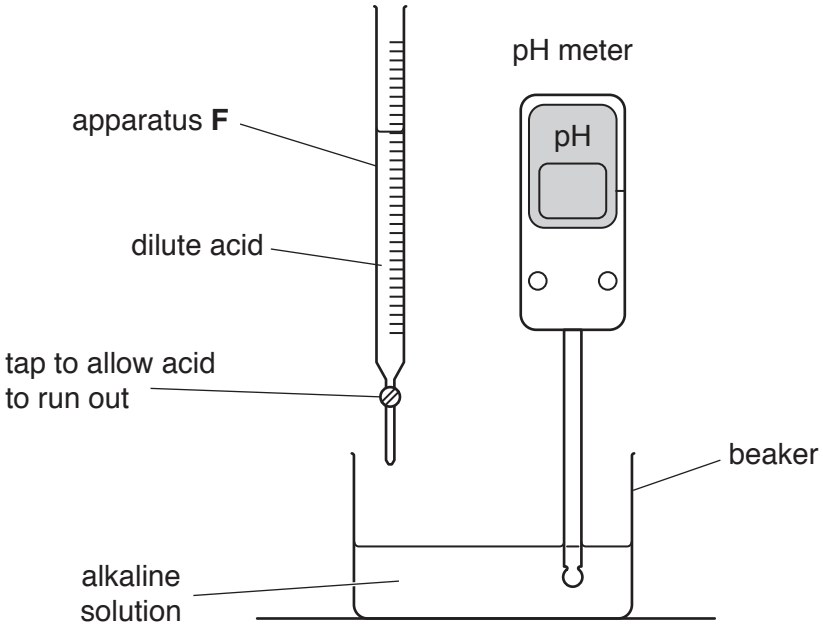

Fig. 2.5

(i) Name apparatus **F**.

..... [1]

(ii) State the alkaline solution and the dilute acid that react to produce sodium chloride.

alkaline solution .....

dilute acid .....
[2]

(iii) Suggest a value of the pH of the solution in the beaker before any acid is added.

pH = ... [1]

[Total: 11]

3 **(a)** A girl is on a bridge over a river.

(i) Complete the sentences by choosing the correct words or phrases from the list.

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

chemical constant decreasing friction gravitational potential increasing joules kinetic newtons weight

The girl picks up a stone and drops it over the side of the bridge.

The stone loses ..... energy and gains

..... energy.

The stone falls with ..... acceleration due to gravity.

The vertical force acting upwards on the stone as it falls is called

..... and is due to air resistance.

[3]

(ii) The river is 30 m below the bridge.

After 1.7 s the stone hits the surface of the water.

Calculate the average speed of the falling stone.

speed = ... m/s [2]

(iii) State the source of the gravitational field that is accelerating the stone vertically downwards.

..... [1]

(b) The stone enters the water.

(i) Describe how the force of water acting on the stone affects the downwards motion of the stone.

..... [1]

(ii) The stone enters the water with 450 J of kinetic energy.

200 J is transferred to kinetic energy of the water.

100 J is transferred to thermal energy of the water.

2 J is transferred to sound energy.

Determine the remaining kinetic energy of the stone.

remaining kinetic energy = ... J [1]

(c) A hydroelectric power station is being built in the river valley.

(i) Describe how electrical energy is obtained from the water behind a hydroelectric dam.

.....

.....

..... [2]

(ii) The power cables from the power station are supported by pylons.

Fig. 3.1 shows the arrangement of the cables between the pylons.

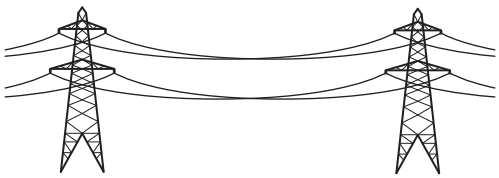

Fig. 3.1

Describe the effect of cold weather on the length of the cables between the pylons.

..... [1]

(iii) The pylons are spaced equally so that the weight of the cables on each side of the pylon balance.

This means the pylons are in equilibrium.

State the resultant turning effect on the pylons.

..... [1]

[Total: 12]

4 **(a)** A student investigates the conditions needed for germination of cress seeds.

She puts the same number of cress seeds into four test-tubes, **A**, **B**, **C** and **D**.

The test-tubes are left in different conditions for five days.

Table 4.1 shows the conditions of each test-tube and the results after five days.

Table 4.1

condition	test-tube			
	A	**B**	**C**	**D**
given water	yes	no	yes	yes
temperature / °C	4	21	21	21
kept in light / dark	light	light	light	dark
seeds germinated	no	no	yes	yes

(i) Explain why the cress seeds in test-tubes **A** and **B** did not germinate.

A .....

B .....
[2]

(ii) State **one** conclusion from the results shown by test-tubes **C** and **D**.

.....

..... [1]

(b) Germinating seeds need oxygen for respiration.

State the word equation for respiration.

..... [2]

(c) Energy released from respiration has many different uses.

Put ticks (✓) in the boxes to show **all** the uses of energy needed by germinating seeds.

muscle contraction	
protein synthesis	
cell division	
growth	
maintenance of body temperature	

[2]

(d) Respiration is one of the characteristics of living things.

Name the characteristic of living things that is defined by:

the ability to detect and respond to changes in the environment

.....

an action by an organism causing a change of position or place.

.....

[2]

[Total: 9]

5 **(a)** Meteorites fall to Earth from space.

Some meteorites are mixtures of iron, nickel and other metals.

(i) State the term used for a mixture of metals.

..... [1]

(ii) Metals tend to be shiny and some are sonorous (make a ringing sound when struck).

State two other **physical** properties of metals.

1 .....

2 .....
[2]

(iii) Name the collection of metals in the Periodic Table that contains iron and nickel.

..... [1]

(b) A teacher uses the apparatus shown in Fig. 5.1 to heat four different mixtures containing a powdered metal oxide and powdered carbon.

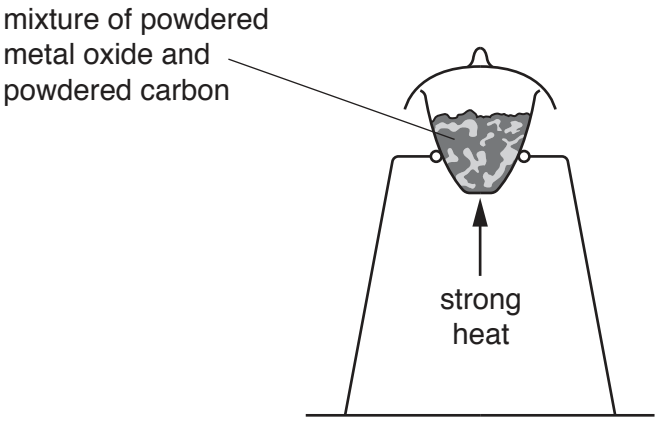

Fig. 5.1

His observations are shown in Table 5.1.

Table 5.1

mixture	observation
calcium oxide + carbon	no reaction
copper oxide + carbon	exothermic reaction
lead oxide + carbon	exothermic reaction
magnesium oxide + carbon	no reaction

Use ideas about reactivity to explain the observations.

.....

.....

..... [2]

(c) The symbol equation for the reaction between zinc oxide and carbon is shown.

$$2ZnO + C \longrightarrow 2Zn + CO_2$$

Use the substances involved in this reaction to describe *reduction* and *oxidation*.

.....

.....

.....

..... [2]

[Total: 8]

[Turn over

6 **(a)** Fig. 6.1 shows a bar magnet. It is not known which end is the north pole or the south pole.

Fig. 6.1

(i) A boy has a second bar magnet. He knows which end is the south pole and which end is the north pole.

Describe how he can use the second magnet to determine which end is the south pole and which end is the north pole of the magnet in Fig. 6.1.

.....

.....

..... [2]

(ii) Draw the pattern and direction of magnetic field lines around the bar magnet in Fig. 6.2.

Fig. 6.2

[3]

(b) The boy hears music from a radio.

The loudness of the music increases. At the same time, the music changes to a lower pitch.

State how the amplitude and the frequency of the sound wave change as the loudness increases and the pitch becomes lower.

amplitude .....

frequency .....

[2]

(c) The boy has healthy hearing so he can clearly hear the sounds from the radio.

State the range of audible frequencies that the boy can hear.

from ..... Hz to ..... Hz

[1]

[Total: 8]

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7 **(a)** A student investigates the conditions needed for photosynthesis.

He keeps similar plants in different conditions for two days and then tests the leaves for starch.

Table 7.1 is a table for the results.

Table 7.1

test	conditions plant kept in	does the plant photosynthesise? (✓ / ✗)
1	• carbon dioxide • light	
2	• carbon dioxide • no light	
3	• no carbon dioxide • light	
4	• no carbon dioxide • no light	

Complete Table 7.1 to predict the expected results. [1]

(b) Describe the test for starch and the positive result.

test .....

positive result .....
[2]

(c) Oxygen produced during photosynthesis moves out of the plant cells.

Explain in detail how oxygen moves out of plant cells.

Use the word **concentration** in your answer.

.....

.....

.....

.....

..... [3]

(d) Fig. 7.1 is a diagram of a plant cell.

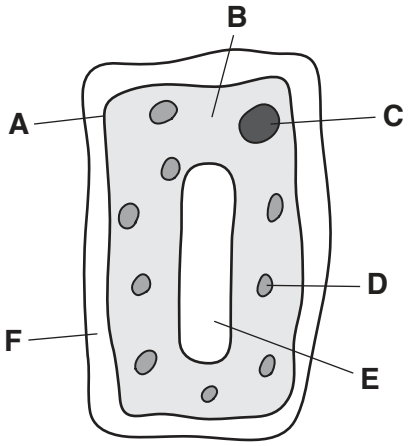

Fig. 7.1

(i) Identify the letter from Fig. 7.1 that shows where photosynthesis occurs.

..... [1]

(ii) Name the part you have identified in **(d)(i)**.

..... [1]

(iii) Name two parts of plant cells that are also present in animal cells.

1 .....

2 .....
[2]

[Total: 10]

8 Fig. 8.1 is a chart showing the composition of clean air.

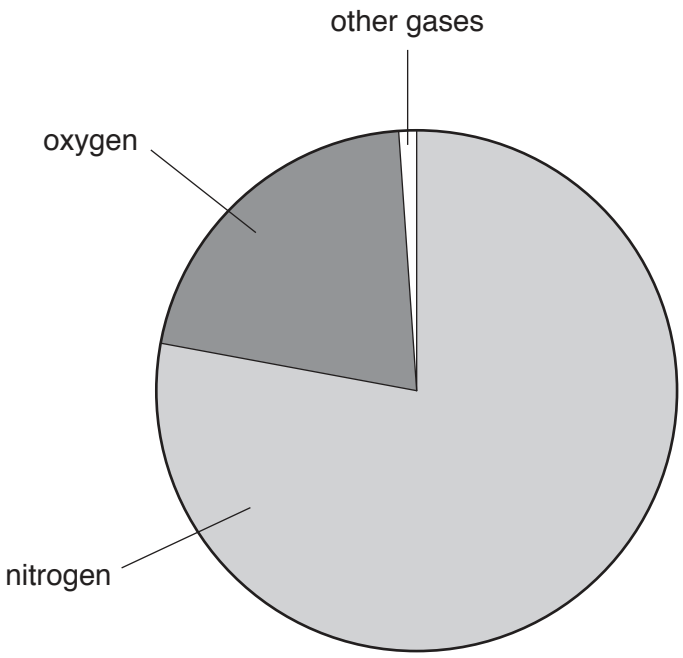

Fig. 8.1

(a) (i) Suggest the percentage of the section labelled other gases.

Use your knowledge of the amounts of nitrogen and oxygen in air.

percentage of other gases = ... % [2]

(ii) The other gases in Fig. 8.1 include very unreactive elements.

State **one** of these unreactive elements.

..... [1]

(iii) State, in terms of electronic structure of its atoms, why the element in **(a)(ii)** is unreactive.

.....

..... [1]

(iv) State two harmful gaseous oxides that are present in polluted air.

1 .....

2 .....
[2]

(b) Fig. 8.2 shows apparatus used in the electrolysis of dilute sulfuric acid.

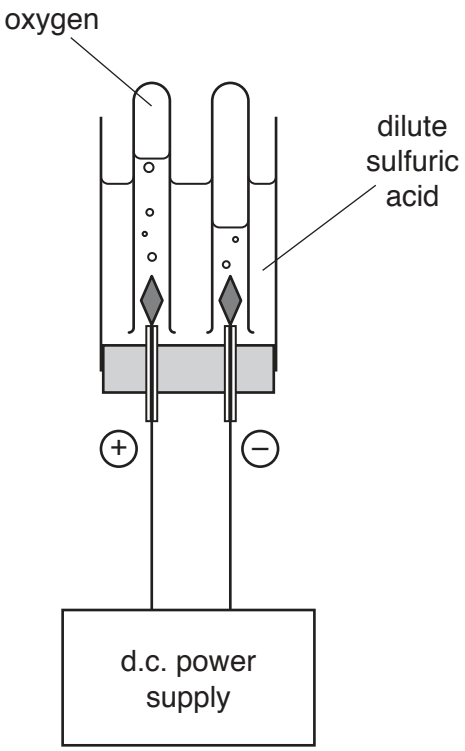

Fig. 8.2

(i) State the term used to describe the dilute sulfuric acid in this electrolysis experiment.

..... [1]

(ii) Identify the gas produced at the cathode.

..... [1]

(c) Fig. 8.3 shows apparatus a student uses to investigate the rate of reaction between calcium carbonate and dilute hydrochloric acid.

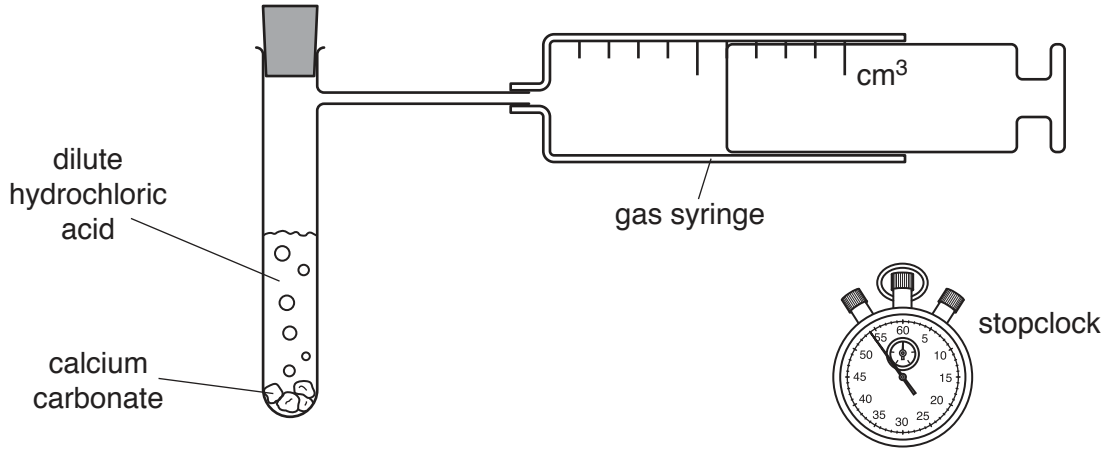

Fig. 8.3

(i) Complete the word equation for this reaction.

hydrochloric acid	+	calcium carbonate	→		+		+	

[2]

(ii) It takes 50 seconds for 80 cm^3 of gas to collect in the gas syringe.

Calculate the rate at which the gas is produced in cm^3/s.

rate = ... cm^3/s [1]

(iii) State **one** change to the reaction conditions that **reduces** the rate of reaction.

.....

..... [1]

[Total: 12]

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9 **(a)** A technician is checking for sources of radioactive emissions around a building.

(i) A radiation detector is placed in front of a source of ionising radiation.

A piece of paper is placed in front of the source and the radiation is no longer detected from the source.

Identify the type of radiation being emitted by the source.

..... [1]

(ii) The radioactive source is removed.

State why the radiation detector continues to detect a small amount of radiation.

..... [1]

(b) The graph in Fig. 9.1 shows the decay curve for a radioactive source.

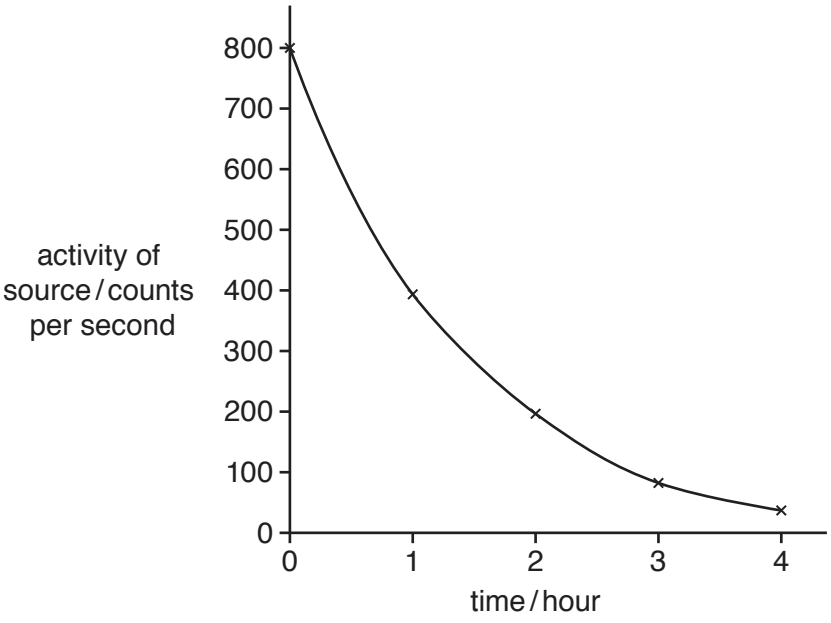

Fig. 9.1

Determine the half-life of the source.

Show on the graph how you determined your answer.

..... [2]

(c) The radiation detector is powered by a battery. Fig. 9.2 shows the part of the electrical circuit which lights a lamp when the detector is switched on.

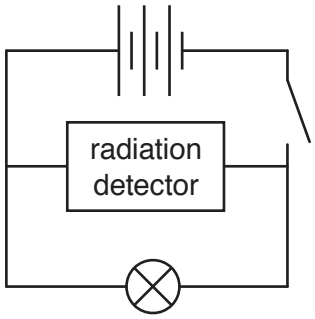

Fig. 9.2

(i) The technician checks the potential difference across the lamp.

On Fig. 9.2 add the circuit symbol for a meter to measure the potential difference across the lamp. [2]

(ii) The current supplied by the battery is 0.1 A.

The technician adds another cell to the battery.

Describe how the current changes.

..... [1]

(iii) Complete the sentence to describe current in metals.

Current in metals is due to the flow of ..... [1]

[Total: 8]

10 (a) The graph in Fig. 10.1 shows the area of land cleared by deforestation in one country between 2000 and 2010.

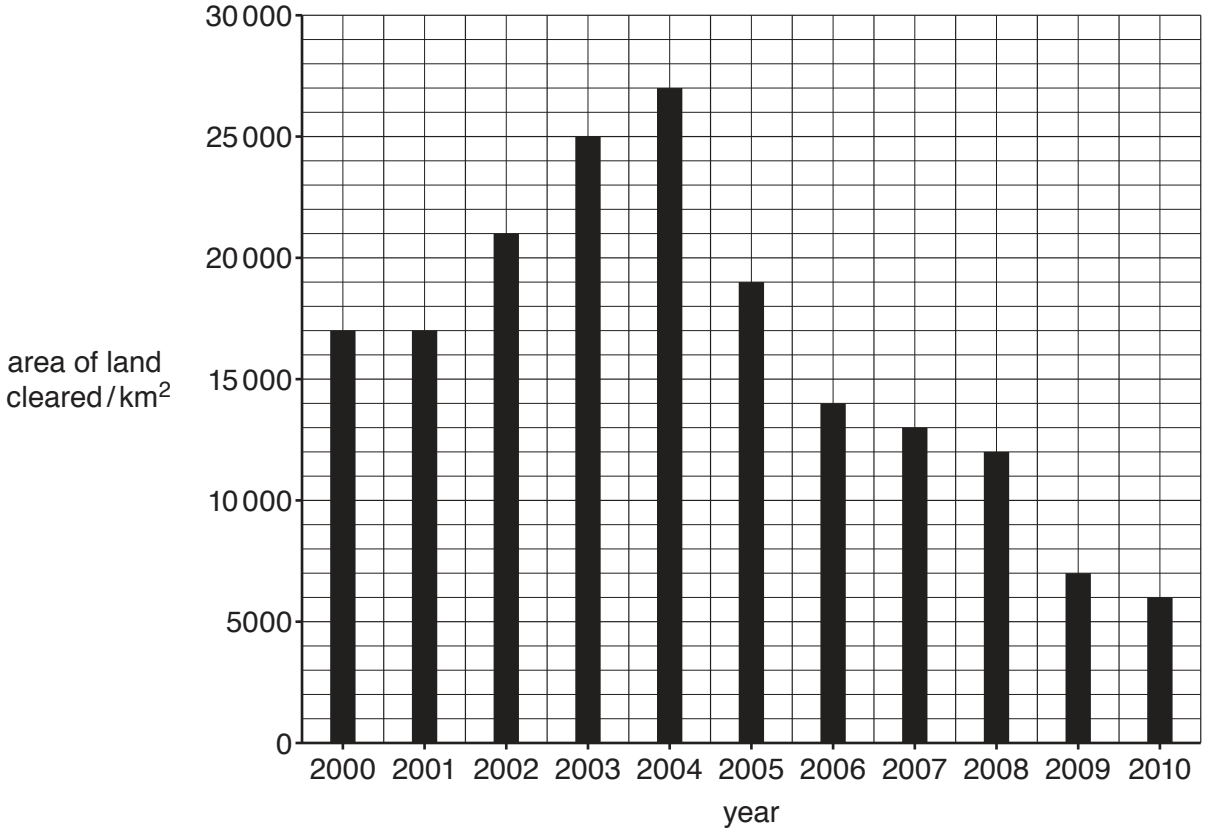

Fig. 10.1

(i) Describe the pattern in the results shown in Fig. 10.1.

Include data in your answer.

.....

.....

.....

..... [2]

(ii) Calculate the percentage decrease in the area of land cleared between **2008** and **2009**.

..... % [2]

(b) Deforestation can cause a build-up of carbon dioxide in the atmosphere.

Describe **one** way that humans directly increase the concentration of carbon dioxide in the atmosphere.

.....

..... [1]

(c) Many human activities create pollution which is harmful to the environment.

(i) The boxes on the left show some water pollutants.

The boxes on the right show the sources of these pollutants.

Draw one line from each pollutant to its source.

pollutant	source
chemical waste	crop plant agriculture / farming
fertiliser	domestic / household waste
rubbish (solid waste)	human and animal faeces
untreated sewage	industries

[3]

(ii) State **one** harmful effect of untreated sewage.

..... [1]

[Total: 9]

[Turn over

11 Fig. 11.1 shows the structure of three molecules, ethene, ethanol and methane.

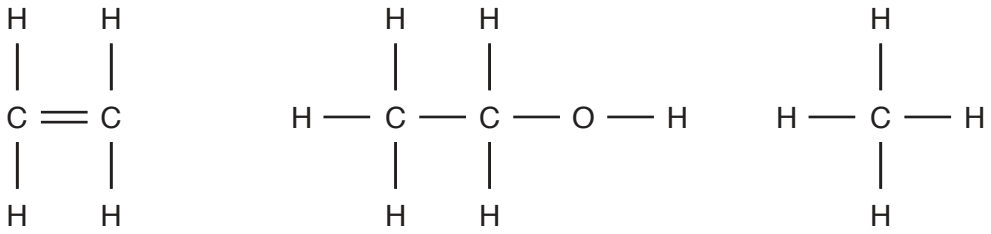

Fig. 11.1

(a) State which of these molecules is **not** a hydrocarbon.

Explain your answer.

molecule .....

explanation .....

.....

[1]

(b) **(i)** Alkanes and alkenes are two different families of hydrocarbons.

Six hydrocarbons, **L** to **Q**, are listed below.

L butene
M dodecane
N hexane
O octane
P pentene
Q propane

Select from the letters **L** to **Q** the hydrocarbons that are alkenes.

..... [1]

(ii) Describe a chemical test that shows whether a hydrocarbon is an alkane or an alkene.

test .....

.....

result with an alkane .....

.....

result with an alkene .....

.....

.....

[2]

(c) Ethanol is made when ethene reacts at high temperatures with substance **U** in the presence of a catalyst.

(i) Identify substance **U**.

..... [1]

(ii) State the purpose of a catalyst in chemical reactions.

..... [1]

(d) Fig. 11.2 shows a process that produces an aqueous solution containing ethanol.

The gas given off causes limewater to turn milky.

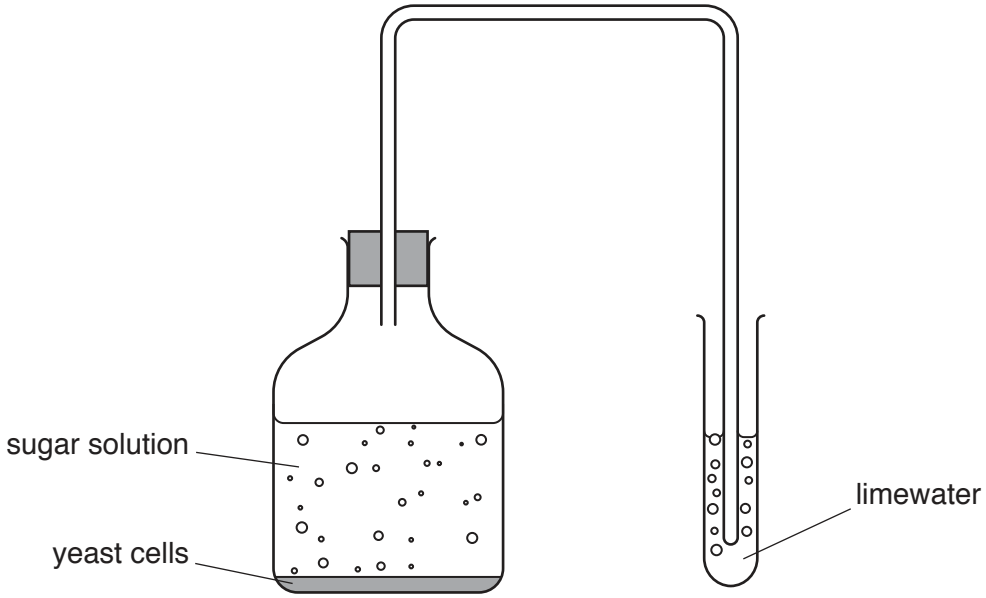

Fig. 11.2

(i) Name the process shown in Fig. 11.2.

..... [1]

(ii) Name the gas given off.

..... [1]

(iii) State a method that is used to separate ethanol from the aqueous solution.

..... [1]

[Total: 9]

12 (a) Fig. 12.1 shows an electric heater containing three heating elements.

Fig. 12.2 shows how a heating element is made of metal wire wound around a ceramic rod.

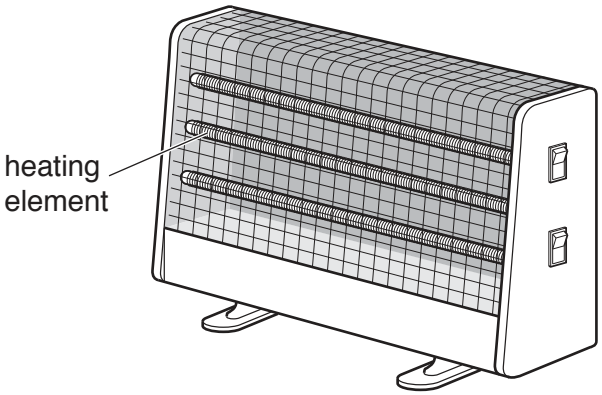

Fig. 12.1

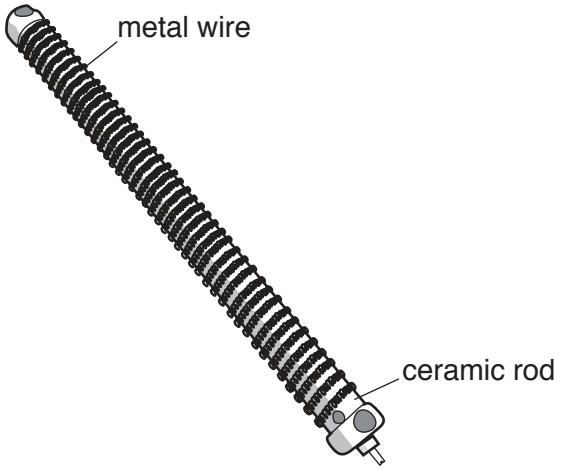

Fig. 12.2

(i) Describe what happens to the motion of the atoms in the solid metal wire as it increases in temperature.

..... [1]

(ii) Explain why the metal wire is wound around a ceramic rod and not around a metal rod.

.....

..... [1]

(iii) State two methods of thermal energy transfer from the heater to a person in the room.

1 .....

2 .....
[2]

(b) The heater is plugged into an extension socket along with other appliances.

Fig. 12.3 shows the extension socket plugged into a single socket which is connected to the mains supply.

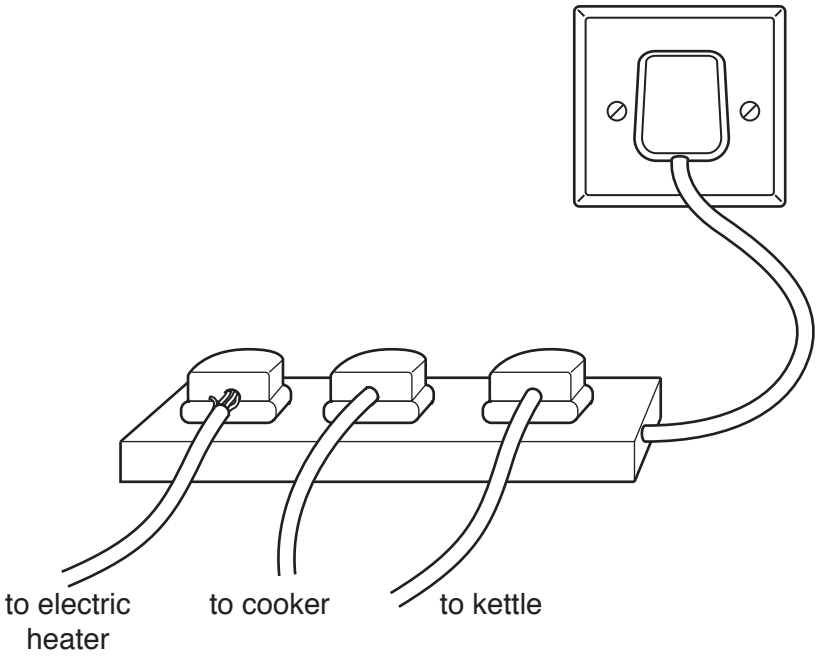

Fig. 12.3

(i) Identify two electrical hazards in Fig. 12.3.

1 .....

2 .....
[2]

(ii) The plug for the heater requires a new fuse.

The current through the heater is 10 A in normal use.

Four different fuse ratings are available.

3 A **10 A** **13 A** **30 A**

State the most appropriate fuse rating.

..... A [1]

(iii) State the purpose of a fuse in an electrical appliance.

..... [1]

(c) The heater emits visible light and infrared radiation.

(i) Place **visible light** and **infrared** in their correct positions in the incomplete electromagnetic spectrum in Fig. 12.4.

gamma rays						radio waves

Fig. 12.4

[2]

(ii) Each part of the electromagnetic spectrum has a different frequency.

In terms of waves, state the meaning of the term *frequency*.

..... [1]

(d) Two heating elements are connected in series.

Each heating element has an electrical resistance of 6 Ω.

Calculate the combined resistance of the two heating elements.

resistance = ... Ω [1]

[Total: 12]

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 –	113	114 Fl flerovium –	115	116 Lv livermorium –	117	118

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.).