Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

T085856598

COMBINED SCIENCE **0653/23**

Paper 2 (Core) **October/November 2016**

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 Fig. 1.1 shows a man using a longbow to fire arrows at a target.

Fig. 1.1

(a) The man uses a force to pull the arrow back through several centimetres.

(i) State the name of the unit of force.

.....[1]

(ii) Explain why work is done by the man when he pulls the arrow back.

.....

.....[1]

(b) **(i)** Complete the sequence of energy transfers from when the man pulls the arrow back, to when he releases the arrow towards the target.

from ..... energy in the man

to ..... energy in the longbow and bowstring

to ..... energy in the flying arrow. [3]

(ii) Suggest why the efficiency of the energy transfer between the energy in the longbow and bowstring, and the energy of the flying arrow is not 100%.

.....

.....[1]

(c) The arrow flies 100 m to a target at an average speed of 180 km / hour.

(i) Calculate the average speed of the arrow in metres per second.

Show your working

average speed = ... m / s [1]

(ii) Use your answer to **(c)(i)** to calculate the time in seconds taken for the arrow to reach the target after release.

State the formula you use and show your working.

formula

working

time = ... s [2]

2 The chemical symbol of an atom of magnesium is shown below.

$$^{24}_{12}Mg$$

(a) Complete Table 2.1 to show the names and numbers of the two types of particle in the nucleus of this magnesium atom.

Table 2.1

particle	number

[2]

(b) A student uses the apparatus in Fig. 2.1 to burn some magnesium in air.

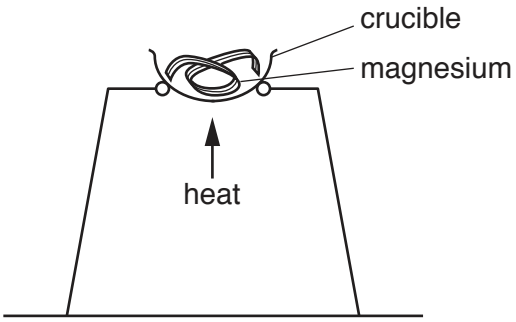


Fig. 2.1

A white solid, magnesium oxide, is formed.

Write the word equation for this reaction.

[ ] + [ ] → [ ]

[2]

(c) Fig. 2.2 shows test-tubes **A** and **B** which both contain dilute sulfuric acid.
The student adds some magnesium to test-tube **A**.
He adds some magnesium oxide to test-tube **B**.

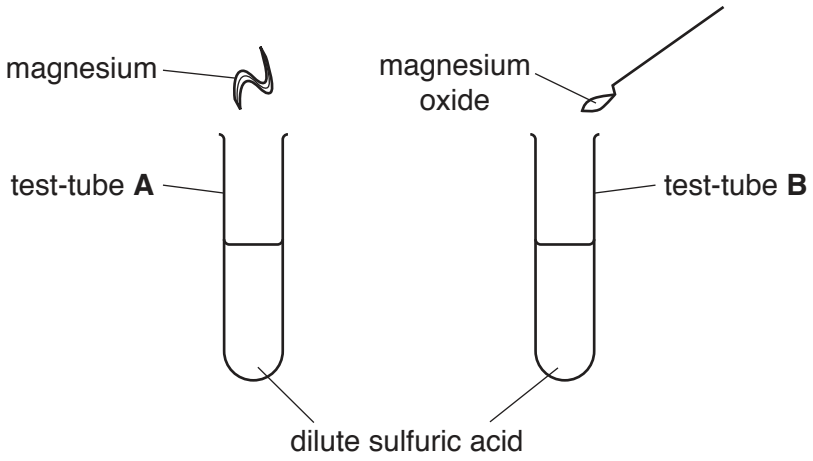


Fig. 2.2

State which of the two test-tubes produces a gas which burns with a squeaky pop.
Identify the gas which is produced.

test-tube .....

gas .....
[1]

(d) **(i)** Sodium, a Group I element, reacts with chlorine, a Group VII element, as shown in the equation below.

sodium + chlorine → sodium chloride

Identify the substance in the word equation which contains ionic bonds.
Explain your answer.

substance .....

explanation .....

.....
[2]

(ii) Sodium also reacts with water, as shown in the word equation below.

sodium + water → sodium hydroxide + hydrogen

Identify a substance in the word equation which contains covalent bonds.
Explain your answer.

substance .....

explanation .....

.....
[2]

[Turn over

3 **(a)** Fig. 3.1 shows a plan of the human circulatory system.

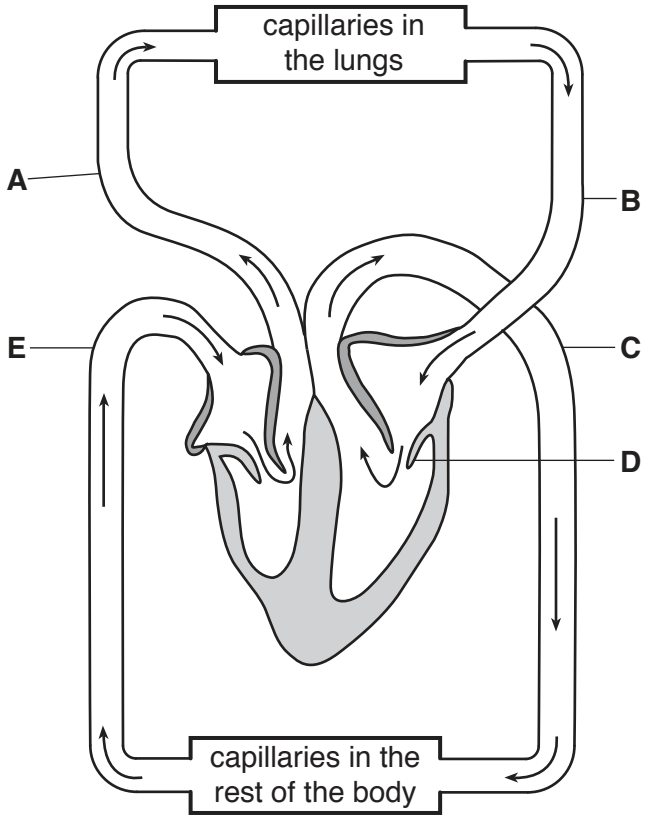


Fig. 3.1

(i) State the letter and name of a vein shown in Fig. 3.1.

letter .....

name .....[1]

(ii) Name the type of structure within the heart labelled **D** and describe its function.

.....

.....

.....[2]

(iii) Describe how the composition of blood changes as it passes through the capillaries of the lungs.

.....

.....

.....[2]

(b) A student is running. His heart beats more quickly. His muscles need more blood for respiration.

(i) State the word equation for respiration.

.....[1]

(ii) The energy released by respiration can be used for contraction of his muscles.

State **two** other uses of the energy released.

1. .....

2. .....
[2]

(c) A student measures his pulse rate during the day. He takes a reading while sitting, and also as he does different activities. Some of his readings are shown in Table 3.1.

Table 3.1

activity	number of beats per minute
sitting	68
running	164
Y	90

Suggest an activity for **Y**. Explain your answer.

activity .....

explanation .....

.....[1]

4 Fig. 4.1 shows a simple solar heating system to provide hot water for a house.

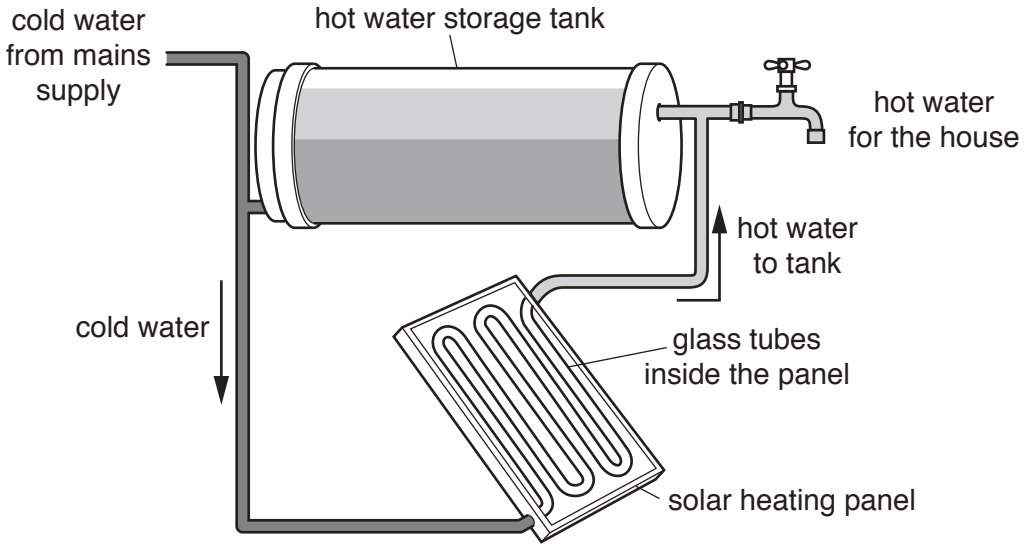


Fig. 4.1

- Cold water in glass tubes inside the panel is heated by energy from the Sun.
- The hot water then flows to the hot water storage tank above.
- Cold water from the tank flows back to the panel.
- A supply of hot water for the house can be taken from the tank.

(a) The Sun emits energy as electromagnetic radiation, some of which is absorbed by the solar panel.

On Table 4.1, in the correct box write the name of the main part of the electromagnetic spectrum which heats the solar panel.

Table 4.1

gamma radiation		ultraviolet				radio waves

[2]

(b) The solar panel is made of glass tubes through which the water flows.

Fig. 4.2 shows how each glass tube is placed inside an outer glass tube. The space between the outer and inner tubes has had all the air pumped out, leaving a vacuum between the tubes.

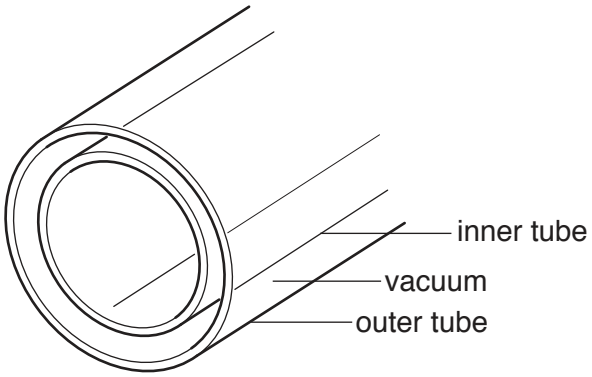


Fig. 4.2

State the method of thermal energy transfer

1. from the outer glass tube across the vacuum to the inner tube which contains the water,

   .....

2. from the hot water in the glass tubes up to the storage tank on top of the panel.

   .....
   [2]

(c) The water in the storage tank reaches a temperature of 60 °C on a sunny day.

Suggest how the storage tank is designed to prevent the stored hot water cooling down again at night.

.....

.....[1]

(d) The storage tank is made of metal.

Describe the change to the storage tank caused by the increase in temperature.

.....

.....

.....[1]

(e) On a cold night in winter, the temperature falls below the melting point of water.

Suggest one problem this might cause for this solar heating system on the roof of a house.

.....

.....[1]

(f) Light from the Sun has to pass through the walls of the glass tubes.

On Fig. 4.3 complete the ray diagram to show the path of light from the Sun through the outer glass tube into the vacuum between the tubes.

Show the angles of incidence and refraction at the air-to-glass surface.

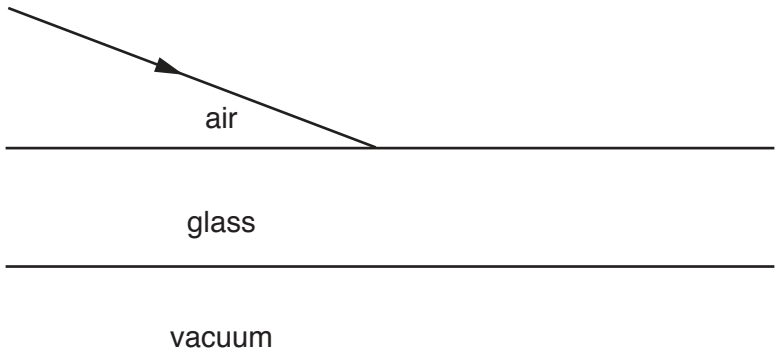


Fig. 4.3

[3]

5 Fig. 5.1 shows a bottle labelled copper(II) chloride solution.

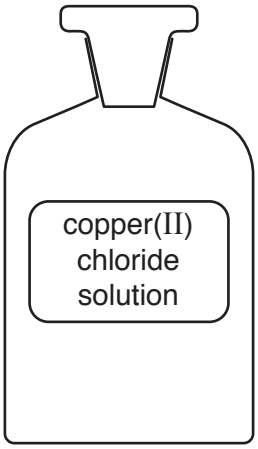


Fig. 5.1

(a) A student tests the solution in the bottle to make sure that it contains copper chloride.

Complete Table 5.1. State the reagents and give the positive result for the test for each ion.

Table 5.1

ion	reagent	result
copper(II)		
chloride		

[4]

(b) Fig. 5.2 shows the electrolysis of the copper chloride solution using inert electrodes.

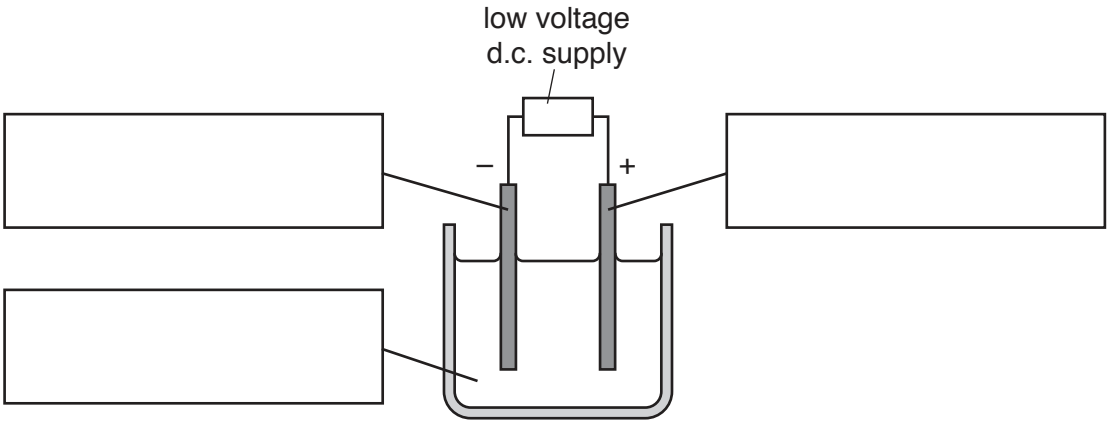


Fig. 5.2

(i) Use the words *anode*, *cathode* and *electrolyte* in the correct boxes to complete Fig. 5.2. [2]

(ii) After a few minutes a coloured solid forms on the negative electrode.

Name the solid and state its colour.

name .....

colour .....

[2]

(iii) Chlorine gas forms at the positive electrode and is tested with damp blue litmus paper.

State the colour of chlorine gas and the final colour of the litmus paper.

colour of chlorine gas .....

colour of litmus paper .....

[2]

6 **(a)** A student takes a flower apart and displays all the flower parts as shown in Fig. 6.1.

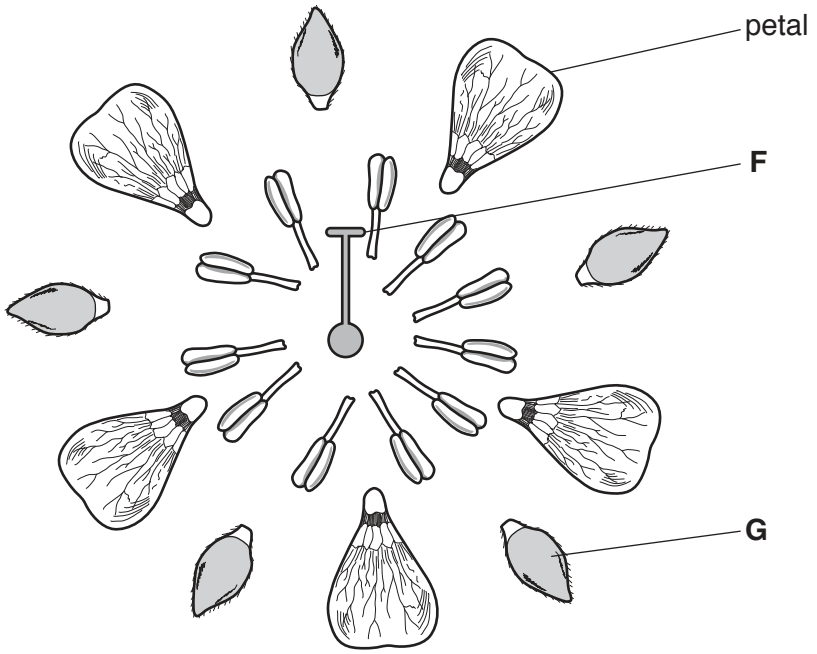


Fig. 6.1

(i) Name flower parts **F** and **G**.

F .....

G .....
[2]

(ii) On Fig. 6.1 label and name a part of the flower that contains many haploid cells.

Explain your answer.

.....

.....[2]

(iii) The flower is insect-pollinated.

Suggest **one** feature that helps with insect pollination.

.....

.....[1]

[Turn over

(b) A student investigates the rate of transpiration from a leafy twig under different conditions. Fig. 6.2 shows the apparatus he uses.

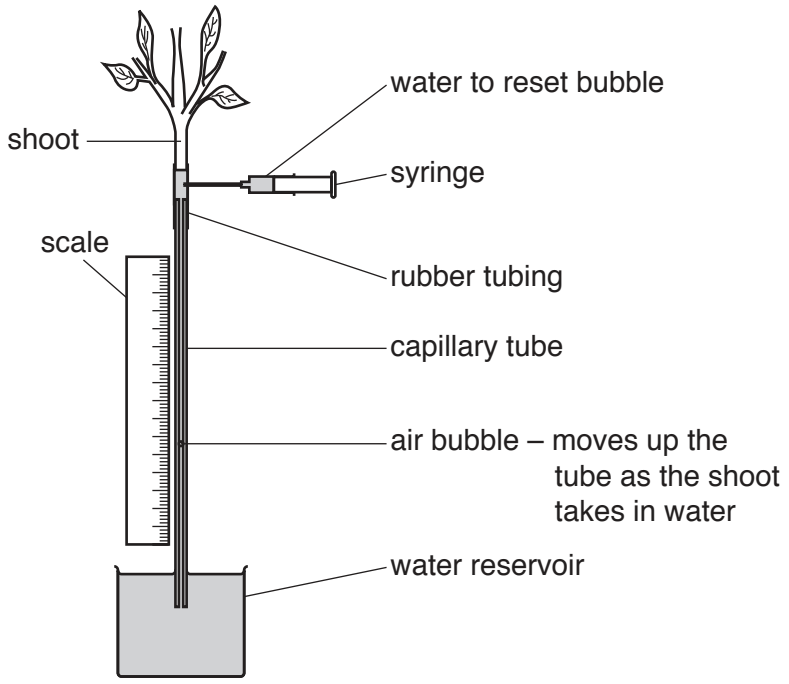


Fig. 6.2

- He measures how far the air bubble moves upwards in one minute.
- He uses the syringe of water to reset the apparatus.
- The student repeats the experiment under different environmental conditions.
- His readings are shown in Table 6.1.

Table 6.1

conditions	distance moved by bubble in one minute / cm
dry air at 22 °C	1.1
dry air at 27 °C	6.8
humid air at 22 °C	

(i) Explain why the distance the bubble moves increases when the temperature rises to 27 °C.

.....

.....

.....

.....[2]

(ii) Suggest a possible reading for humid air at 22 °C. Explain your answer.

reading .....

explanation .....

.....

.....[1]

(c) In the ground the plant takes in water at the roots.

Fig. 6.3 shows the distribution of the tissues in the cross-sections of two similar roots of the same size.

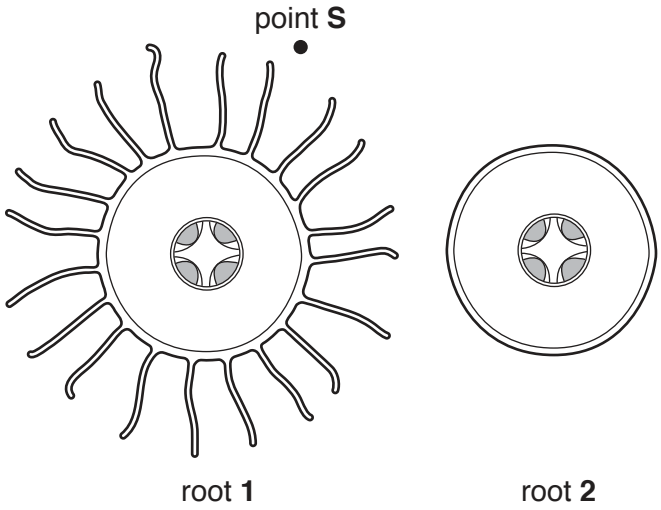


Fig. 6.3

(i) Suggest which root takes in water more quickly. Explain your answer.

root .....

explanation .....

.....

.....[1]

(ii) On Fig. 6.3 draw a line to show a path taken by water from point **S** to the xylem. [2]

7 **(a)** Fig. 7.1 shows a wave generated in a string. One end of the string is fixed to a stand and clamp, while the other end is attached to a vibrator driven by an electric motor.

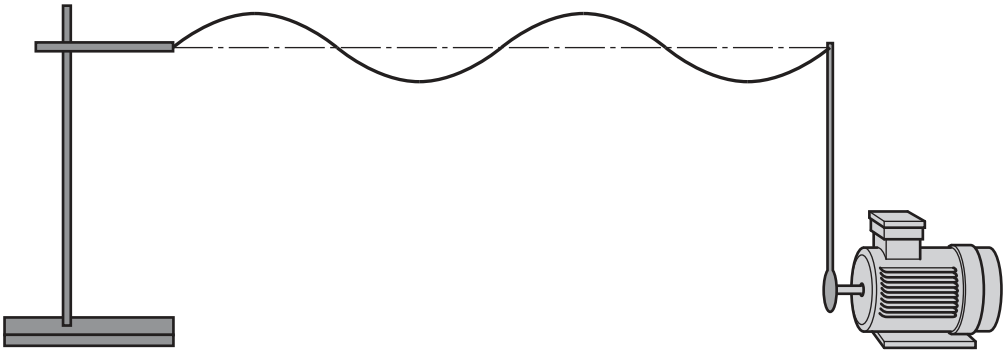


Fig. 7.1

(i) The length of the string is 100 cm.

State the wavelength of the wave motion shown in Fig. 7.1.

..... cm [1]

(ii) On Fig. 7.1 draw a double-headed arrow (↔ or ↕) to show the *amplitude* of the wave. [1]

(b) Fig. 7.2 shows part of the circuit diagram for the circuit used to drive the vibrator.

The vibrator is driven by the electric motor. The speed of the motor is controlled by a variable resistor.

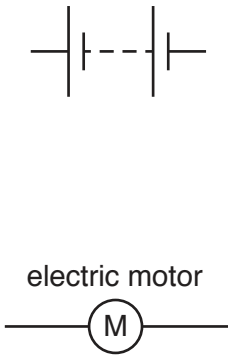


Fig. 7.2

Complete the circuit diagram by including the correct symbols in the correct places in the circuit for

1. a variable resistor to control the current through the motor,

2. a way of measuring the current through the motor.

[3]

(c) The variable resistor is adjusted so that the current through the motor is 2A. The potential difference (p.d.) across the motor is 3.0 V.

(i) State the name of the property of the motor given by the expression

$$\frac{\text{p.d.}}{\text{current}}.$$

.....[1]

(ii) Calculate the value of this property and give the unit of your answer.

Show your working.

value of property = ... unit .....[2]

8 Fig. 8.1 shows the processes a student uses to make the salt, zinc sulfate.

She reacts zinc carbonate powder with dilute sulfuric acid.

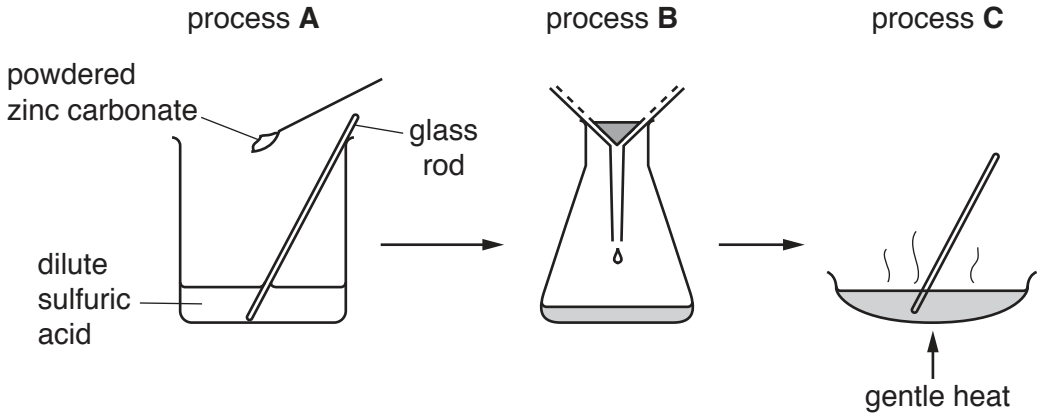


Fig. 8.1

(a) Name processes **B** and **C**.

process **B** .....

process **C** .....

[2]

(b) The student stirs the mixture to increase the speed of the reaction in process **A**.

Suggest **two** other ways of increasing the speed of this reaction.

1. .....

2. .....

[2]

(c) **(i)** Deduce the identity of the salt and name the gas which forms when the student adds sodium carbonate to dilute sulfuric acid.

salt .....

gas .....

[2]

(ii) Describe what happens to the pH of the acid as it reacts with sodium carbonate.

.....[1]

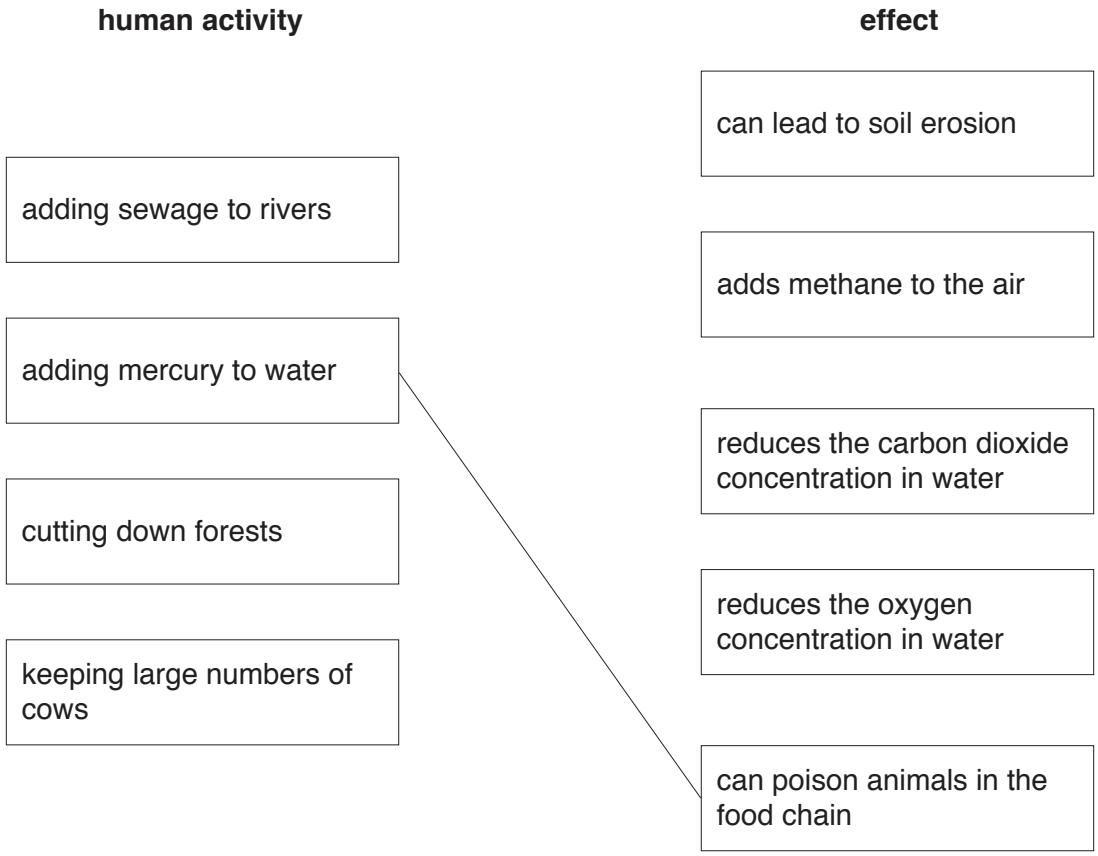
(iii) The formula of sodium carbonate is Na_2CO_3.

State the number of different elements in sodium carbonate.

..... [1]

9 **(a)** Many human activities can affect the environment.

Draw **one** line from each human activity to its effect. One line is drawn for you.



[3]

(b) Human activities can cause an increase in the concentration of carbon dioxide in the atmosphere.

(i) State one large-scale activity of humans which increases the concentration of carbon dioxide in the atmosphere.

.....

.....[1]

(ii) Explain why an increase in the concentration of carbon dioxide in the atmosphere is undesirable.

.....

.....

.....

.....[2]

The Periodic Table of Elements

Key

atomic number atomic symbol name relative atomic mass

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										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 –		

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.)