



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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER



**COMBINED SCIENCE**

**0653/03**

Paper 3 Theory (Core)

**For Examination from 2019**

SPECIMEN PAPER

**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.

1 (a) Fig. 1.1 is a diagram of the internal structure of the heart.

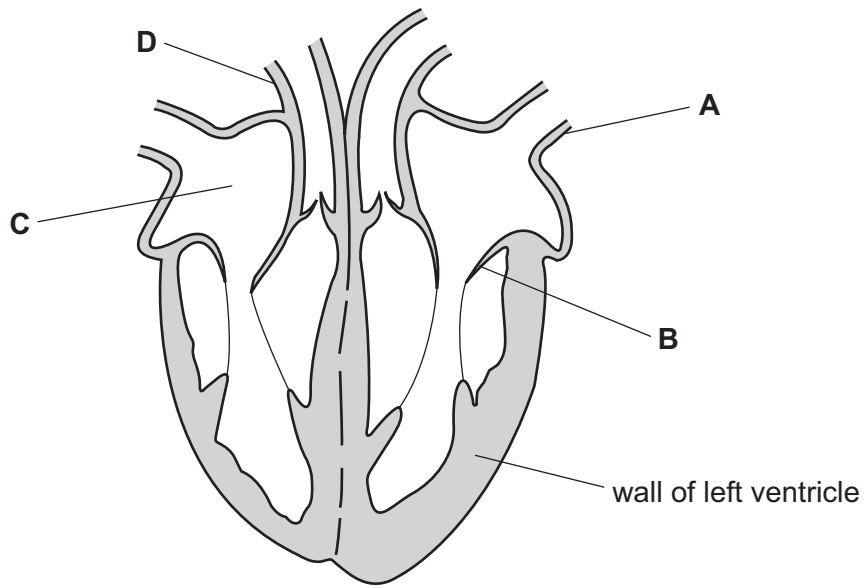


Fig. 1.1

(i) Use the following words or phrases to name structures **B** and **C**.

- |                  |                 |               |
|------------------|-----------------|---------------|
| aorta            | coronary artery | one-way valve |
| pulmonary artery | pulmonary vein  | right atrium  |
| right ventricle  | septum          | vena cava     |

**B** .....

**C** .....

[2]

(ii) On Fig. 1.1, draw two arrows to show



1. the direction of blood flow through **A**,
2. the direction of blood flow through **D**.

[2]

(b) (i) Table 1.1 shows diagrams of some blood cells.

Complete the table.

**Table 1.1**

diagram	name of cells	function of cells
	<p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p>
	<p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p>

[4]

(ii) Describe the function of structure **X** in the cell shown in Table 1.1.

.....

..... [1]

[Total: 9]

- 2 (a) An atom of carbon has a proton (atomic) number of 6 and a nucleon (mass) number of 12.
- (i) Complete Table 2.1 to show the structure of this carbon atom.

Table 2.1

	in nucleus	outside nucleus
number of protons	6	0
number of neutrons	.....	.....
number of electrons	.....	.....

[2]

- (ii) The protons in a carbon atom have a positive charge.

Explain why a carbon atom has no overall charge.

.....

.....

..... [2]

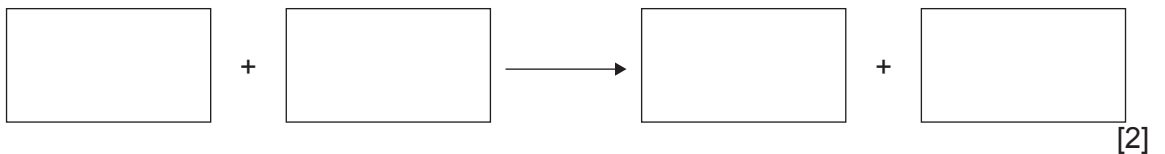
- (b) Methane is a hydrocarbon and the main constituent of natural gas.

- (i) Natural gas is a fossil fuel.

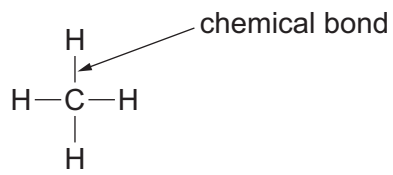
Name two other fossil fuels.

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

- (ii) Write a **word** equation for the complete combustion of methane.



(c) Fig. 2.1 shows the structure of a molecule of methane.



**Fig. 2.1**

(i) State the formula of methane.

..... [1]

(ii) Name the type of chemical bond in a methane molecule.

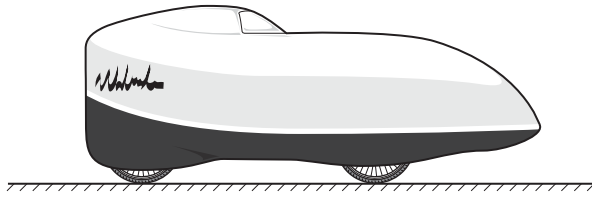
..... [1]

(iii) State the number of electrons in the chemical bond shown in Fig. 2.1.

..... [1]

[Total: 10]

- 3 Fig. 3.1 shows a special bicycle used to break the world speed record for a human-powered bicycle.



**Fig. 3.1**

On one run along a measured distance of 200 m, the bicycle's speed is 40 m/s.

- (a) Calculate the time taken by the bicycle to travel this distance.

State the formula you use and show your working.

formula

working

time = ..... s [2]

- (b) The rider travels at a constant speed and then uses the brakes to gradually stop the bicycle.

On the axes below, sketch the shape of the speed-time graph for this motion.

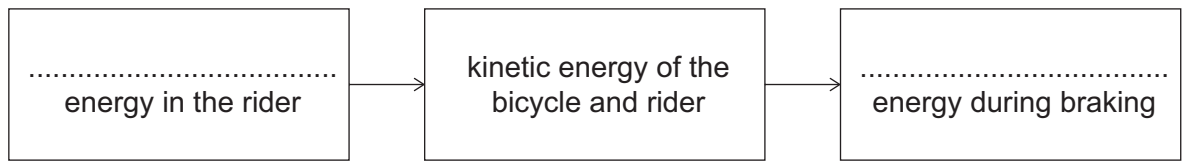


[2]

- (c) Suggest why the bicycle has the streamlined shape as shown in Fig. 3.1.

..... [1]

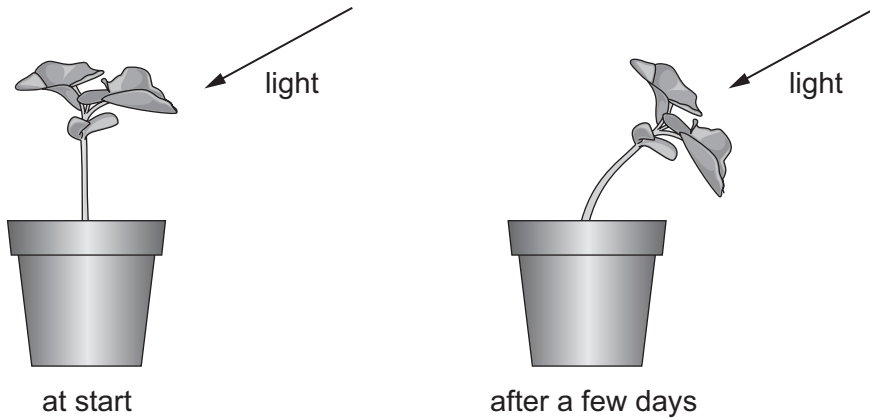
(d) Complete the sequence of energy transfers that occurs during the run.



[2]

[Total: 7]

- 4 (a) Fig. 4.1 shows what happens over a few days when a plant is placed near a window where bright light is coming from one side.



**Fig. 4.1**

- (i) Name the response shown by the plant.

..... [1]

- (ii) Explain how the response shown in Fig. 4.1 is an advantage to the plant.

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

- (iii) Name two characteristics of living things shown by the plant in Fig. 4.1.

Explain your answers.

1. characteristic .....

explanation .....

2. characteristic .....

explanation .....

[4]



- (b) A student does an experiment to find out more about plant responses. He uses simple shoots and light coming from one side.

The results after a few days are shown in Fig. 4.2.

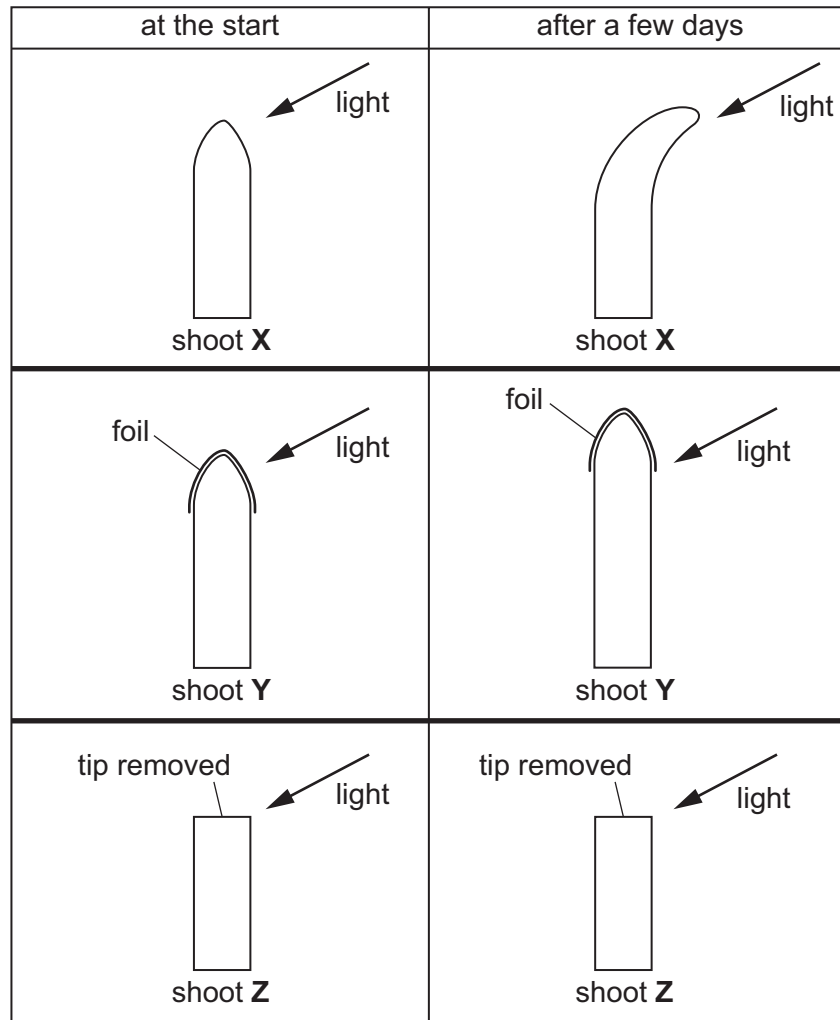


Fig. 4.2

- (i) Describe the results for each shoot after a few days shown in Fig. 4.2.

X .....

Y .....

Z .....

[2]

- (ii) Suggest a possible conclusion about the control of plant responses in the shoots.

.....

..... [1]

[Total 10]

- 5 (a) Lead metal can be extracted from lead oxide by heating it with carbon.

The word equation for this reaction is shown.



Explain how the equation shows that both oxidation and reduction occur in this reaction.

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

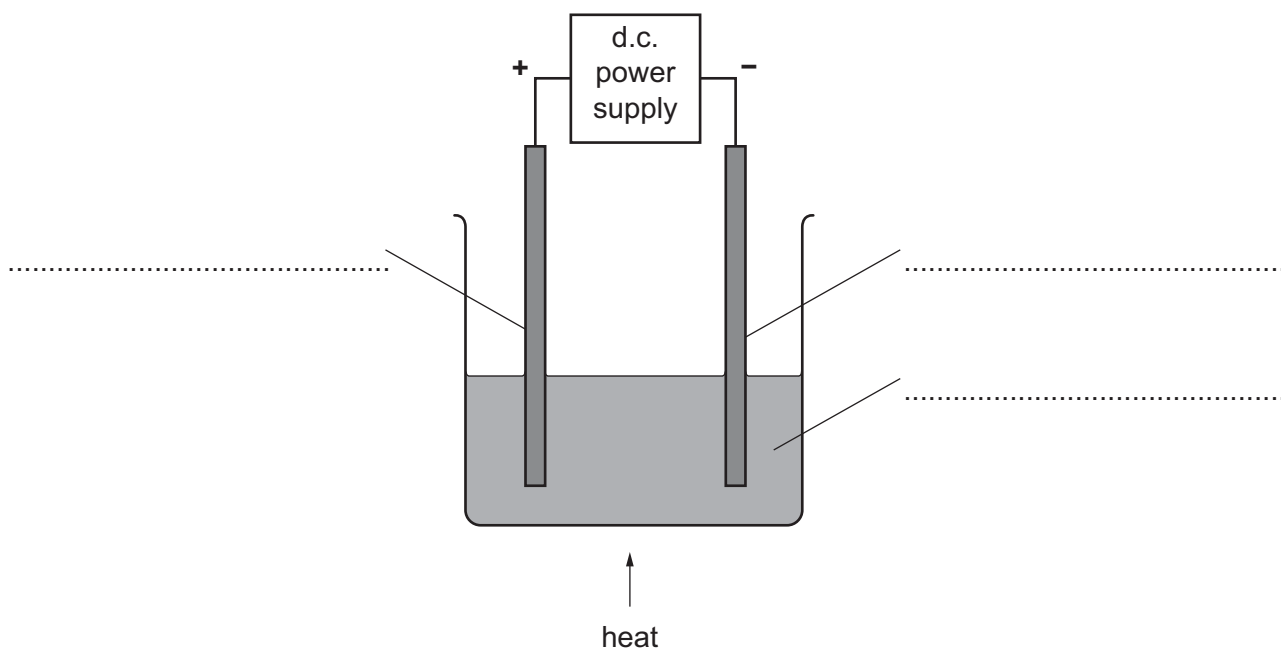
- (b) Another method of extracting lead is by electrolysis.

Before electrolysis, solid lead bromide is heated to form molten lead bromide.

Explain why the lead bromide needs to be molten.

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

- (c) Fig. 5.1 shows the apparatus used for the electrolysis of molten lead(II) bromide.



**Fig. 5.1**

- (i) Use the following terms to complete the labels on the diagram in Fig. 5.1.

**anode      cathode      electrolyte**

[2]

(ii) Name and describe the appearance of the products that form at

the positive electrode, .....

.....

the negative electrode. ....

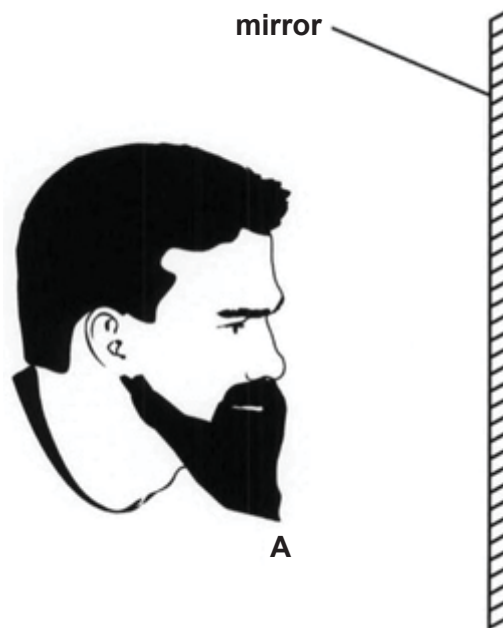
.....

[3]

[Total: 9]

6 A man looks at his reflection in a mirror. The tip of his beard is labelled **A**.

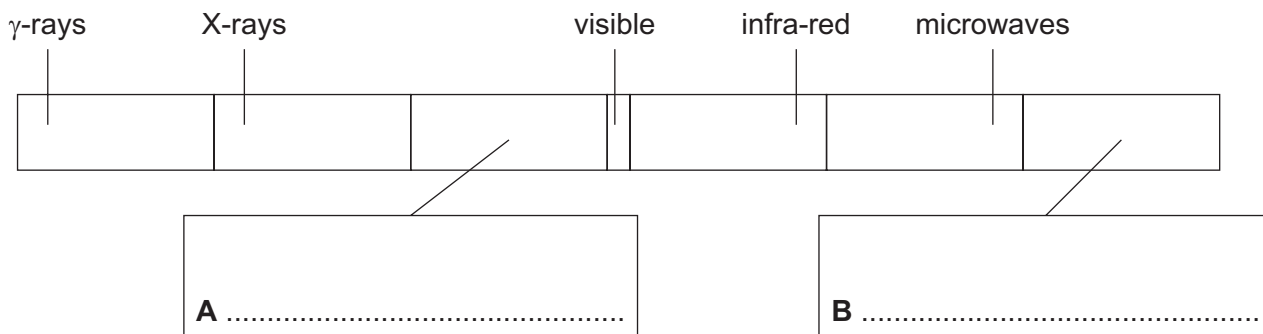
This is shown from the side in Fig. 6.1.



**Fig. 6.1**

- (a) (i) On Fig. 6.1, accurately mark with the letter **X** the position of the image of point **A** in the mirror. [2]
- (ii) On Fig. 6.1, draw a ray from point **A** that reflects from the mirror and goes into the man's eye. Use a ruler to draw this ray. Use arrows to show the direction of the ray. [2]
- (iii) On Fig. 6.1, mark the angle of incidence at the mirror using the letter *i*. [1]

(b) Fig. 6.2 represents the regions of the electromagnetic spectrum.



**Fig. 6.2**

(i) Two of the regions have not been named on Fig. 6.2.

In the two boxes, **A** and **B**, below the spectrum, write the names of these regions. [2]

(ii) On Fig. 6.2, write the letter **S** at the short wavelength end of the electromagnetic spectrum. [1]

(iii) State one use of

infra-red .....

X-rays .....

[2]

[Total: 10]

7 Fig. 7.1 represents the carbon cycle.

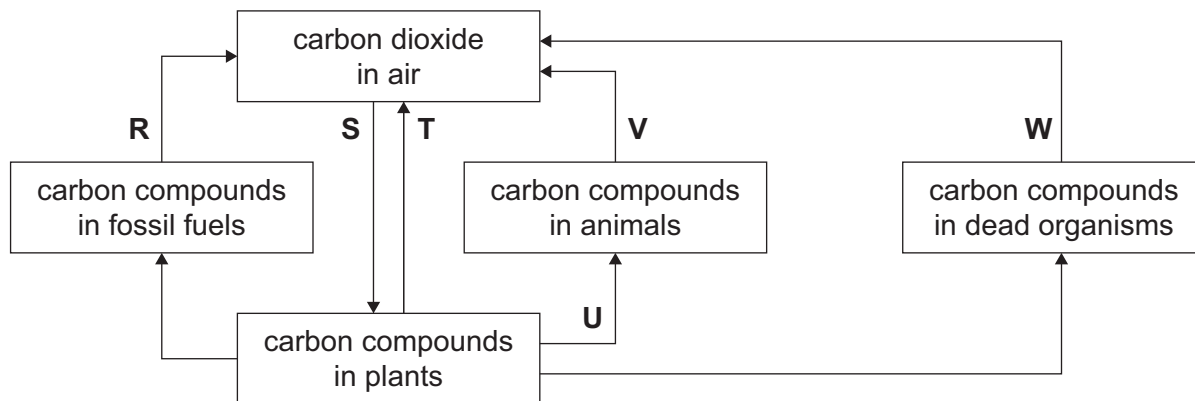


Fig.7.1

(a) Use Fig. 7.1 to answer the following questions.

(i) Name the process labelled **U**.

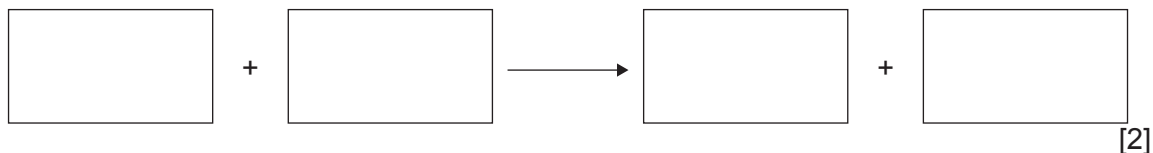
..... [1]

(ii) Name a group of organisms that are responsible for the process labelled **W**.

..... [1]

(b) (i) Letters **T** and **V** in Fig. 7.1 both show the process of aerobic respiration.

State the word equation for aerobic respiration.



(ii) In Fig. 7.1 process **R** is combustion.

Describe two ways in which the process of combustion is different from aerobic respiration.

1. ....

2. .... [2]

- (c) One of the undesirable effects of deforestation is an increase in the carbon dioxide concentration in the air.

List two other undesirable effects of deforestation.

1. ....

2. ....

[2]

[Total: 8]

8 When metal carbonates are heated, carbon dioxide gas is formed.

A student compares the rates of reaction when three different metal carbonates are heated.

She uses the apparatus shown in Fig. 8.1 to measure the volume of carbon dioxide formed.

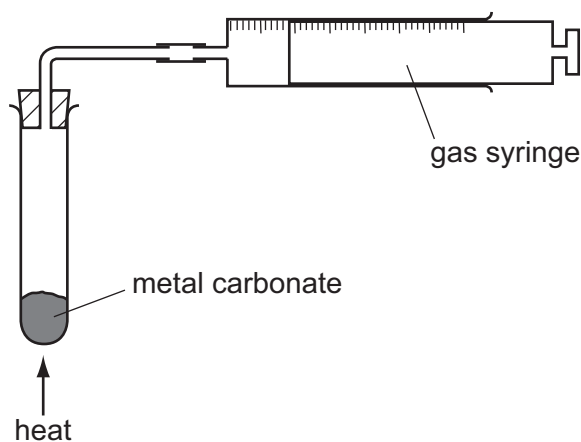


Fig. 8.1

(a) State **one** variable that must be kept constant if the rates of the three reactions are to be compared in a fair way.

..... [1]

(b) The graph in Fig. 8.2 shows how the volume of carbon dioxide changes with time when the three metal carbonates are heated.



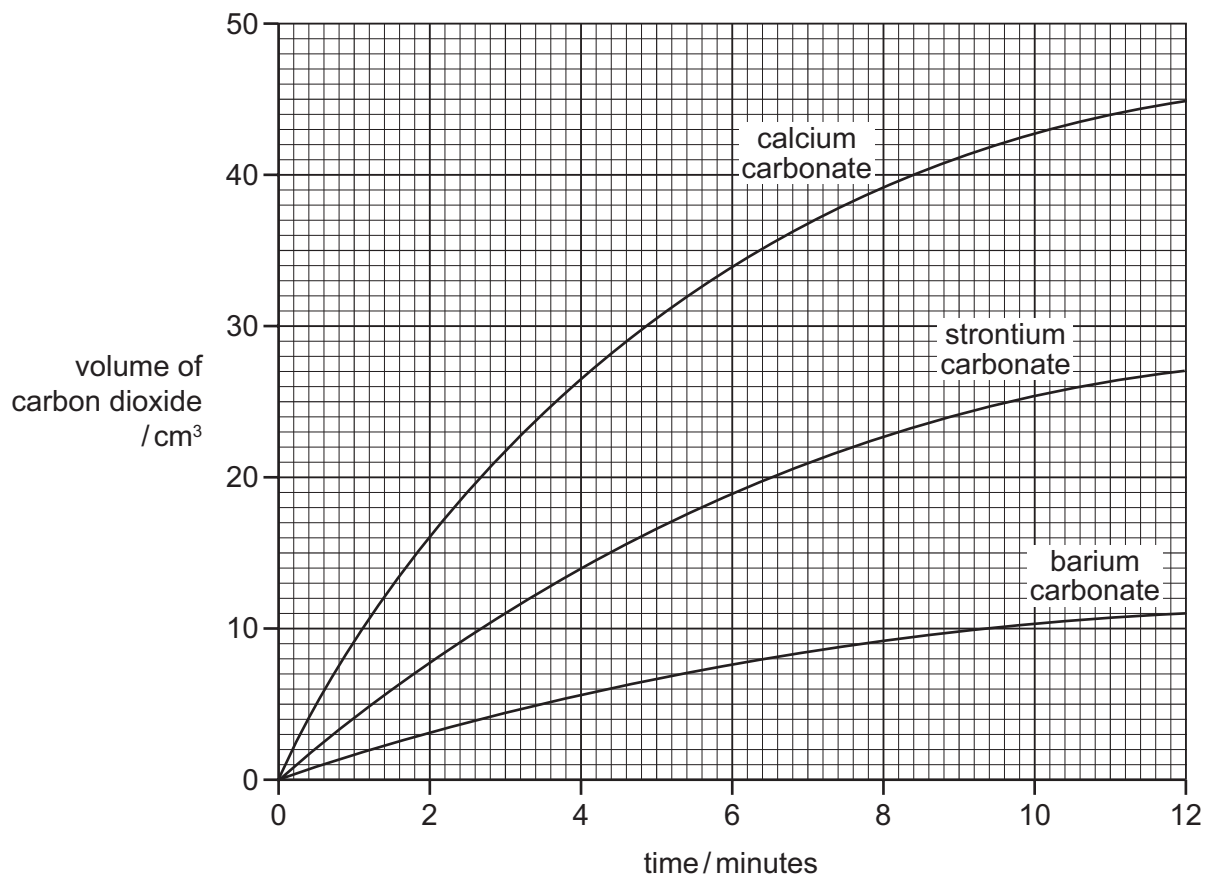


Fig. 8.2

- (i) Name the carbonate which forms carbon dioxide at the highest rate.

..... [1]

- (ii) Use the graph in Fig. 8.2 to find the volume of carbon dioxide formed by heating strontium carbonate for four minutes.

..... cm<sup>3</sup> [1]

- (iii) Calcium, strontium and barium are all in Group II of the Periodic Table.

Use the graph in Fig. 8.2 to describe how the rates of reaction of the metal carbonates change down Group II.

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

- (c) Describe how hydrochloric acid and limewater are used to show that carbonate ions are present in calcium carbonate.

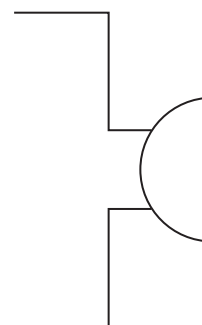
.....  
 .....  
 ..... [3]

9 Fig. 9.1 shows the circuit symbols for an electric bell and a push-switch.



**Fig. 9.1**

(a) (i) On Fig. 9.2 complete the diagram to show a circuit for a door-bell. The door-bell is powered by a battery with four cells and is operated using a push-switch.



**Fig. 9.2**

[2]

(ii) On Fig. 9.2, draw a voltmeter to measure the potential difference across the battery. [1]

(b) The ringing bell emits a sound of frequency 400 Hz.

(i) State the meaning of the term *frequency*.

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

(ii) The house owner makes the sound of the bell louder by adding another cell to the battery. The pitch of the sound from the bell remains unchanged.

State the effect this change has on the amplitude and frequency of the sound emitted.

effect on the amplitude .....  
 .....

effect on the frequency .....  
 .....

[2]

- (c) (i) The potential difference across the battery is 6.0V. When the switch is closed, there is a current of 2.0A in the bell.

Calculate the resistance of the bell.

Show your working and give the unit of your answer.

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

- (ii) The house owner adds an identical bell in parallel with the first bell. When the switch is pushed, both bells ring.

State how this affects the total current in the circuit.

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

[Total: 10]

## The Periodic Table of Elements

Group																							
I	II											III	IV	V	VI	VII	VIII						
												1 <b>H</b> hydrogen 1											2 <b>He</b> helium 4
												<b>Key</b> atomic number atomic symbol name relative atomic mass						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
3 <b>Li</b> lithium 7	4 <b>Be</b> beryllium 9											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.).

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.  
 Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.