Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3010357814

COMBINED SCIENCE **0653/31**

Paper 3 (Core) **October/November 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 24.

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 **21** printed pages and **3** blank pages.

CAMBRIDGE International Examinations

1 **(a)** Use the following words or phrases to complete the flow chart about the transport of oxygen to the tissues of the body.

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

aorta **capillaries** **muscles** **plasma** **platelets**

pulmonary artery **pulmonary vein** **red blood cells** **white blood cells**

Oxygen diffuses into the blood from the air in the alveoli.

↓

Oxygen is carried in the blood by the ..... .

↓

Blood travels from the lungs through the .....
towards the heart.

↓

Blood leaves the heart to go around the body through the ..... .

↓

Blood enters the ..... in the tissues.

↓

Oxygen diffuses into tissue cells.

[4]

(b) A person is going to run a race. Her heart starts to beat faster as she is waiting to start. This is due to the hormone adrenaline being released into her bloodstream.

(i) Explain why the heart is described as a *target organ*.

.....

.....[1]

(ii) Describe how the adrenaline is removed from the bloodstream after the race.

.....

.....[1]

(c) Fig. 1.1 shows the human gas exchange system.

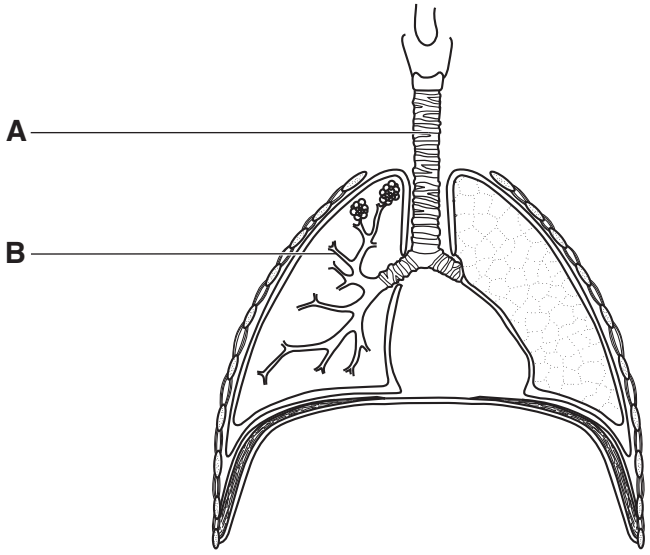


Fig. 1.1

Name the structures **A** and **B** shown in Fig. 1.1.

A .....

B .....

[2]

(d) Describe **two** ways in which a person's pattern of breathing changes during a race.

1. .....

2. .....

[2]

[Turn over

2 **(a)** Electrolysis is used to break up some compounds into simpler substances.

Fig. 2.1 shows the electrolysis of molten lead(II) bromide using inert electrodes.

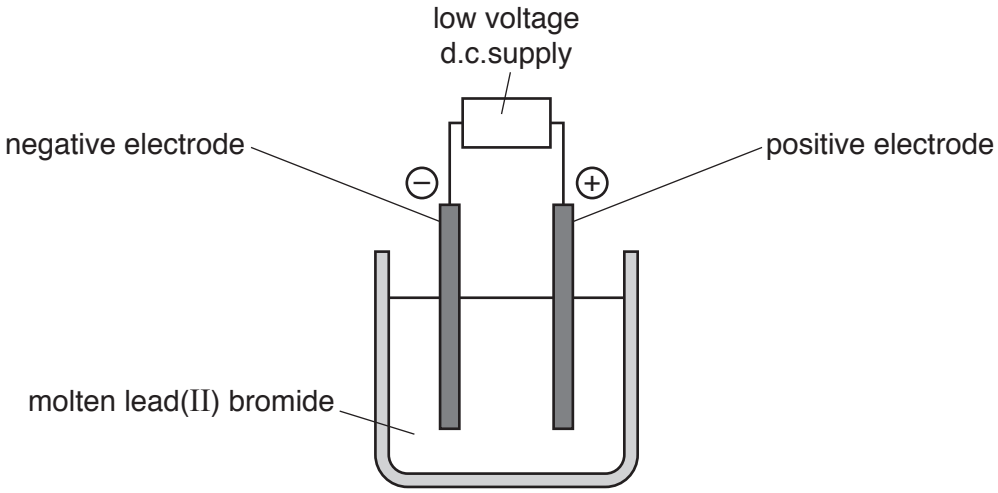


Fig. 2.1

(i) State the names of the negative electrode and of the positive electrode.

negative electrode .....

positive electrode .....
[1]

(ii) Identify the substances formed at the negative electrode and at the positive electrode.

at negative electrode .....

at positive electrode .....
[2]

(iii) State the type of chemical bonding in compounds that are broken up by electrolysis.

.....[1]

(iv) Electrolysis results in a *chemical change*.

Explain what is meant by the term *chemical change*.

.....

.....

.....[1]

(b) Potassium chloride is made when solid potassium carbonate reacts with an acid.

A gas is made during this reaction.

(i) Name the acid that reacts with potassium carbonate to form potassium chloride.

.....[1]

(ii) Describe the change of the pH of the solution during the reaction.

.....[1]

(iii) Describe a test to show that the colourless solution formed by this reaction contains chloride ions.

test .....

observation .....
[2]

[Turn over

3 Fig. 3.1 shows a guitar.

Fig. 3.1

(a) The guitar produces sounds with frequencies between 80 Hz and 5000 Hz.

(i) State what is meant by a frequency of 80 Hz.

.....[1]

(ii) A guitarist plays a note of frequency 250 Hz twice on his guitar.

The first time he plays the note with a large amplitude.

The second time he plays the note with a small amplitude.

Describe the difference the listener will hear between these two notes.

.....

.....[1]

(iii) State whether a person with normal hearing can hear all the frequencies produced by this guitar. Give a reason for your answer.

.....

.....[1]

(b) At a concert the sound of the guitar is broadcast on a radio programme using radio waves.

Name the type of wave to which radio waves belong.

.....[1]

(c) Fig. 3.2 shows a girl using a periscope to see the guitarist over the heads of people in front of her.

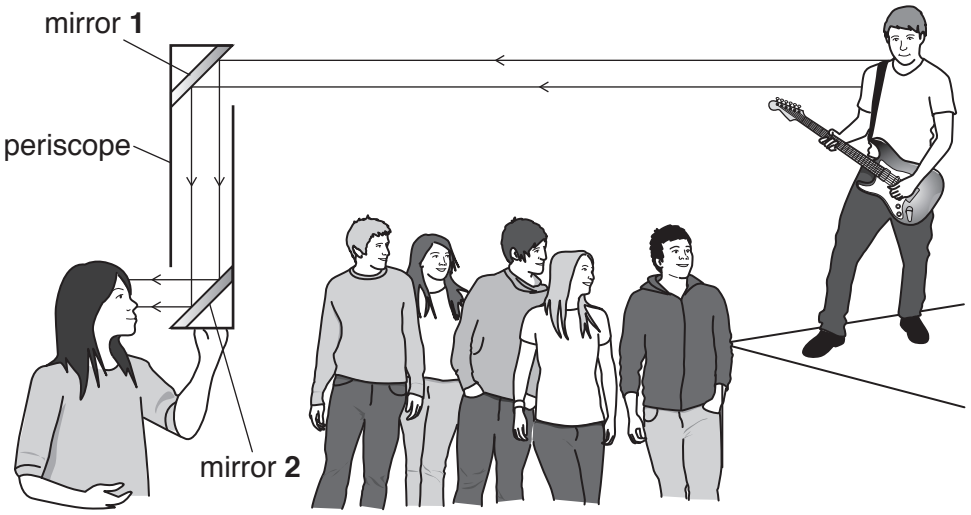


Fig. 3.2

(i) Describe the characteristics of the image of the guitarist that the girl sees in the periscope.

.....

.....[2]

(ii) Fig. 3.3 shows one of the rays of light as it reflects off mirror **2**.

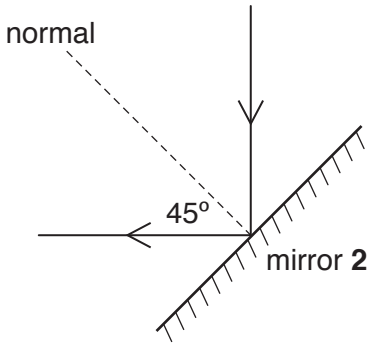


Fig. 3.3 (not to scale)

State the value of the angle of incidence.

.....[1]

[Turn over

(d) The guitarist investigates the extension of a guitar string made of steel when different tension forces are used to stretch it.

Fig. 3.4 shows the graph of some results obtained from this experiment.

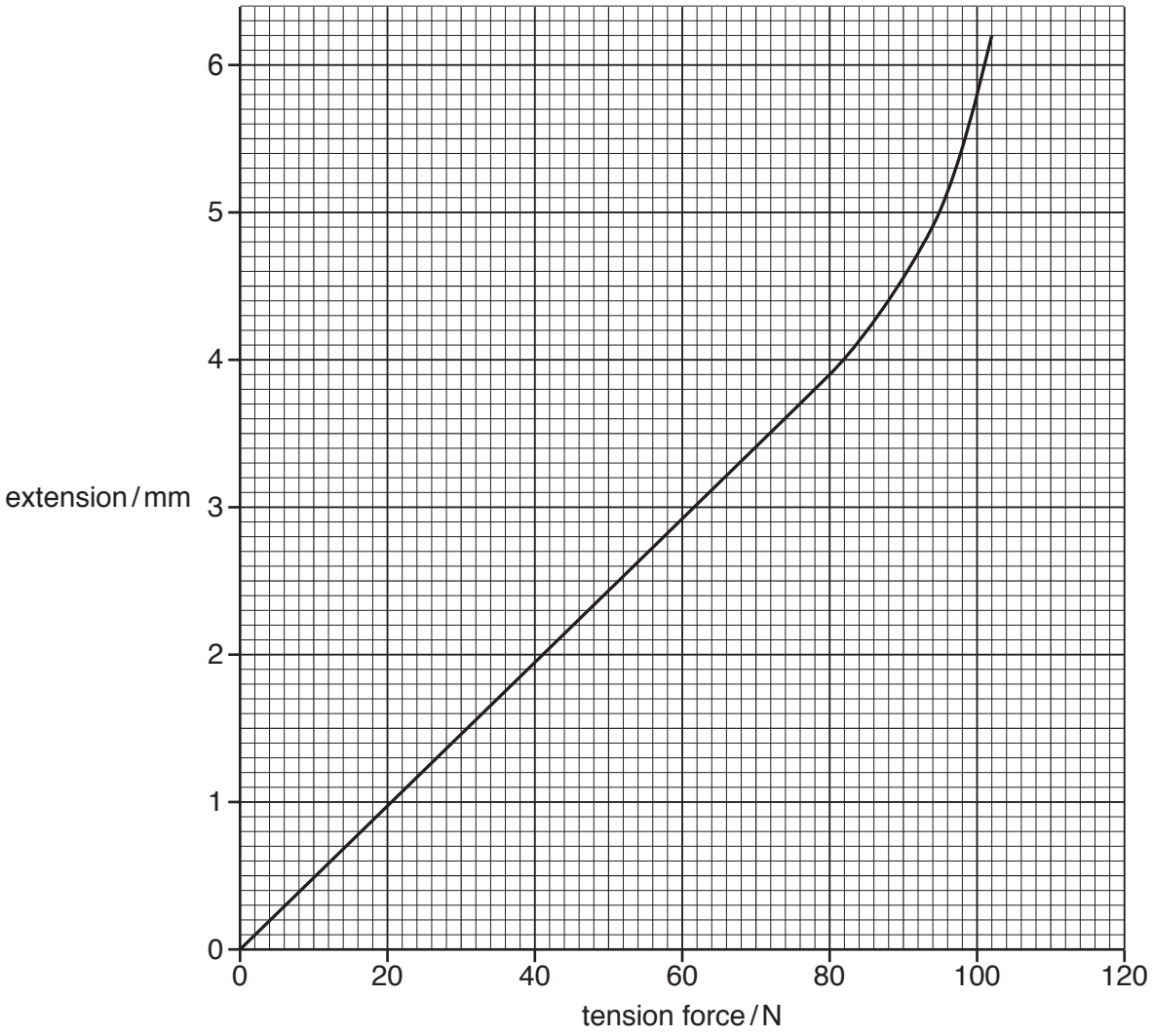


Fig. 3.4

The guitarist adjusts the note played by a guitar string by adjusting the tension in the guitar string. The more the tension force, the higher the note.

(i) The guitarist must only increase the tension force while the extension remains proportional to the tension force.

Use the graph to suggest the maximum tension force that the guitarist can use.

.....[1]

(ii) Suggest what would happen to the guitar string if the tension force is increased to 110 N.

Give a reason for your answer.

.....

.....

.....[1]

4 Fig. 4.1 shows diagrams of primrose flowers. The flowers have two slightly different forms, **C** and **D**.

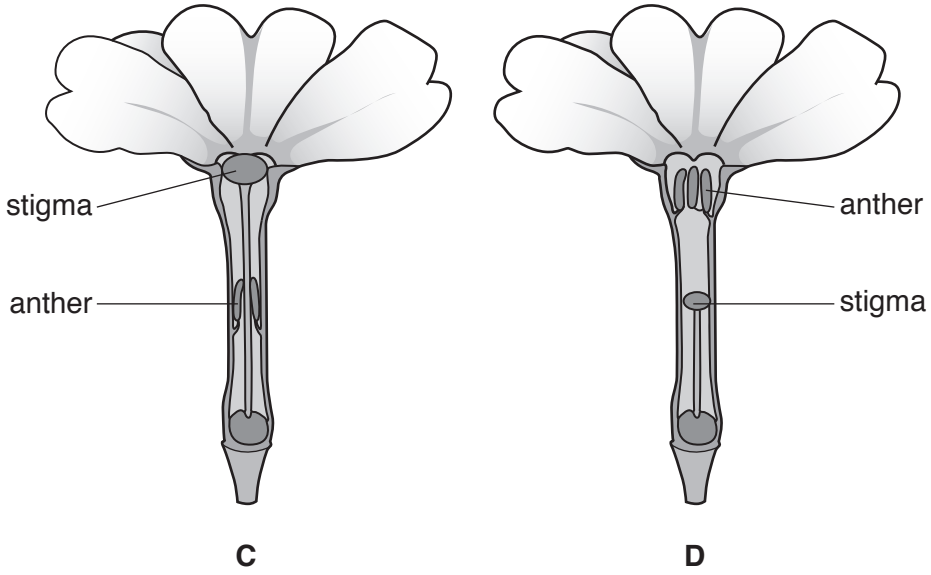


Fig. 4.1

(a) Describe **two** pieces of evidence from Fig. 4.1 that suggest these primroses are insect-pollinated.

1. .....

.....

2. .....

.....

[2]

(b) Compare the diagrams in Fig. 4.1 and predict which flower, **C** or **D**, is more likely to be pollinated by its own pollen.

Explain your answer.

flower .....

explanation .....

.....

.....

.....

[2]

[Turn over

(c) Cross-pollination is the transfer of pollen from one flower to another flower on a different plant. This leads to the production of seeds.

State **and** explain why the genetic material in the seeds is different from the genetic material in the parent plants.

.....

.....

.....

.....[2]

(d) The following feeding relationships occur in the field where the primroses grow.

- thrushes feed on snails
- snails feed on primroses
- buzzards feed on thrushes

(i) Draw a food chain to show the flow of energy through these organisms.

[2]

(ii) State **all** of the organisms in the food chain which are consumers.

Explain your answer.

consumers .....

explanation .....

.....

.....
[2]

5 **(a)** Ethene is a hydrocarbon.

(i) State what is meant by the term *hydrocarbon*.

.....

.....[2]

(ii) Complete Fig. 5.1 to show the structure of **ethene**.

Fig. 5.1

[2]

(iii) State the **two** products of complete combustion of hydrocarbons.

1. .....

2. .....
[2]

(b) Natural gas is a fossil fuel.

(i) Name **two** other fossil fuels.

1. .....

2. .....
[2]

(ii) Name the main constituent of natural gas.

.....[1]

[Turn over

6 Fig. 6.1 shows a fan heater used to heat a room in cold weather.

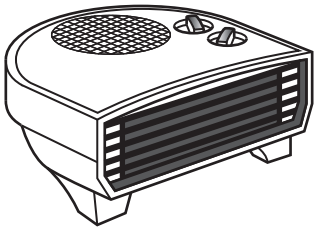


Fig. 6.1

The fan heater is connected to the mains electricity supply.

Fig. 6.2 shows the circuit diagram for the fan heater.

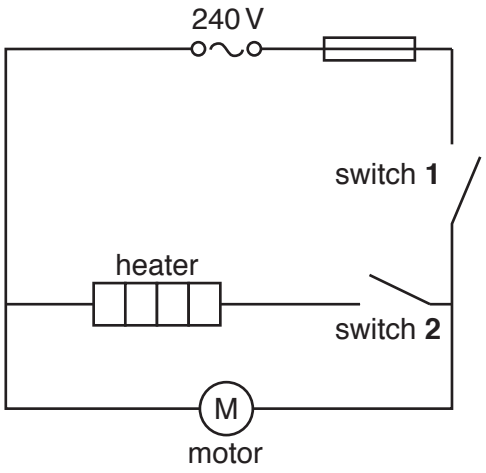


Fig. 6.2

(a) (i) State the name of the circuit component represented by this symbol.

.....[1]

(ii) Explain why it is important for this component to be included in the circuit.

.....

.....[1]

(iii) Deduce which switch or switches must be closed (on) for the heater to work.

.....[1]

(b) (i) An electrician wants to measure the current through the fan motor.

Complete the circuit diagram in Fig. 6.3 to show how the electrician should connect a meter to do this.

You should use the correct symbol for the meter to be used, and complete all missing circuit connections.

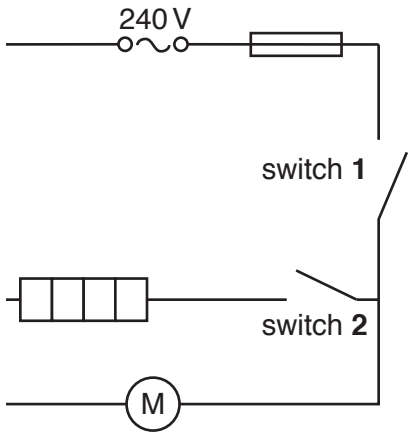


Fig. 6.3

[2]

(ii) The current through the fan motor is found to be 0.2 A when connected to a mains electricity supply of 240 V.

Calculate the resistance of the fan motor.

State the formula you use, show your working and state the unit of your answer.

formula

working

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

7 Fig. 7.1 shows a sealed glass jar containing soil and plants. An oxygen sensor is used to find out how the concentration of oxygen in the glass jar changes during the day.

The plants can live in the glass jar for several weeks without opening the jar.

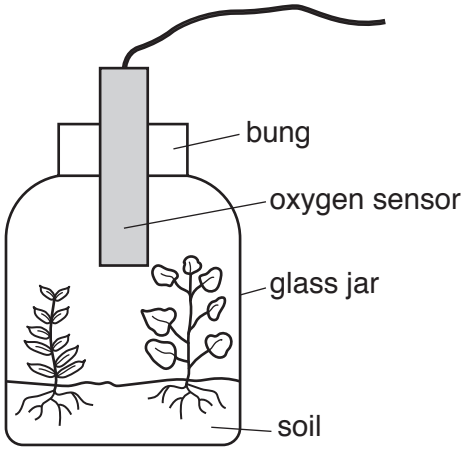
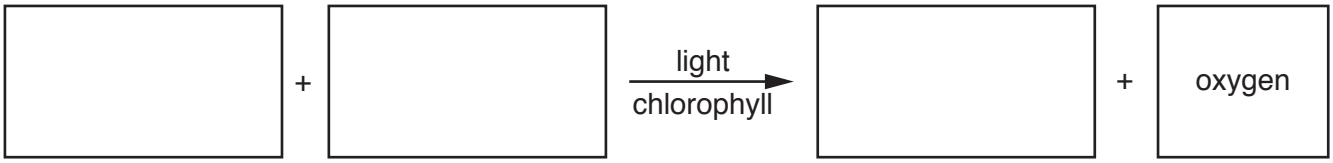


Fig. 7.1

(a) The plants in Fig. 7.1 produce oxygen during photosynthesis.

Complete the word equation for photosynthesis.



[2]

(b) Fig. 7.2 shows a graph of the oxygen concentration in the glass jar shown in Fig. 7.1 over a 12-hour period on a sunny day.

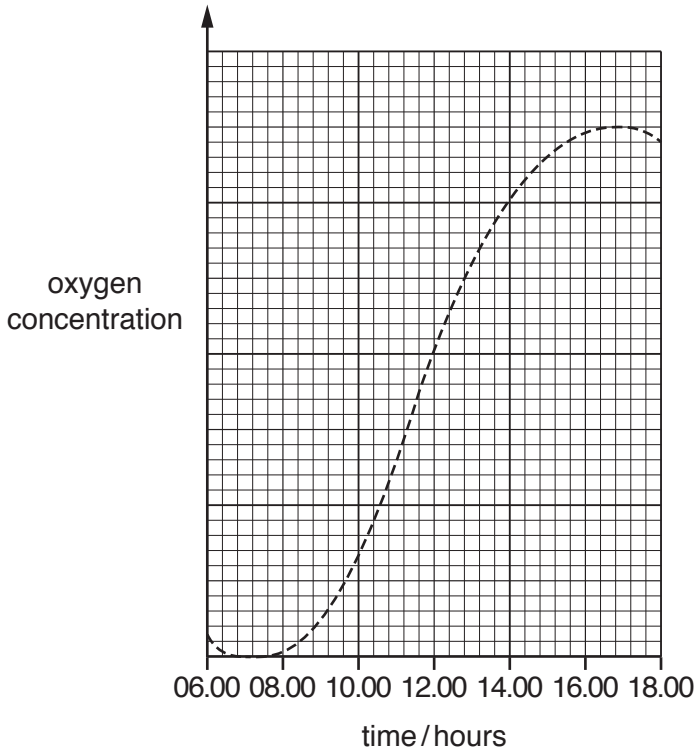


Fig. 7.2

(i) State a time when the rate of photosynthesis is highest.

Explain your answer.

time .....

explanation .....

.....

.....

[2]

(ii) On a different day the graph follows a similar pattern until 10.00 hours.

After 10.00 hours the weather changes and it becomes darker. This affects the concentration of oxygen in the glass jar.

On Fig. 7.2, add the letter **X** to show a possible value for oxygen concentration at 14.00 hours.

Explain your answer.

.....

.....

.....[2]

(c) Water is lost as water vapour from leaves by transpiration.

On a very warm day the concentration of water vapour in the air in the glass jar increases.

Describe the effect of this increase in water vapour on the rate of transpiration from the plants in the glass jar.

.....

.....

.....[1]

[Turn over

8 **(a)** An iron nail is left in a beaker of water, as shown in Fig. 8.1a.

Another iron nail is left in dry air in a closed container, as shown in Fig. 8.1b.

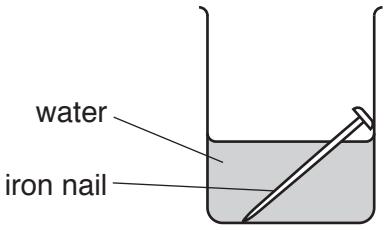


Fig. 8.1a

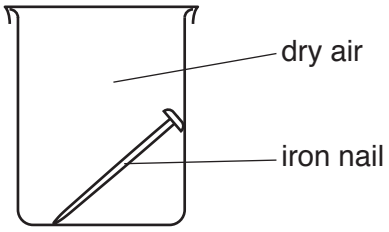


Fig. 8.1b

The iron nail in the water rusts but the iron nail in the dry air does not rust.

(i) Describe **one** other method of rust prevention.

.....

.....[1]

(ii) Rust is a form of iron oxide.

Name the element that combines with iron to form iron oxide.

.....[1]

(iii) Suggest **one** change that can be made to the experiment shown in Fig. 8.1a which increases the rate of rusting.

.....

.....[1]

(b) A piece of calcium is placed into a beaker of water, as shown in Fig. 8.2.

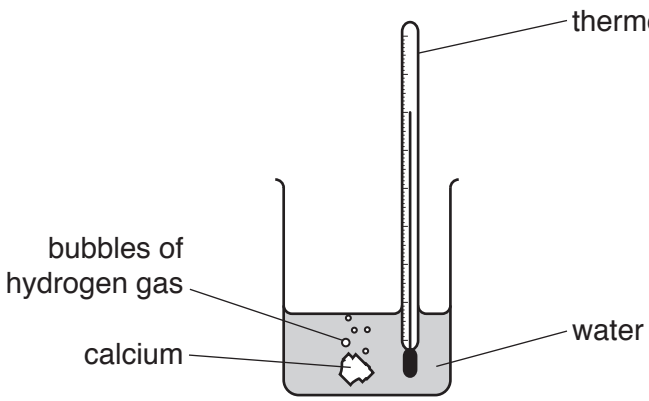
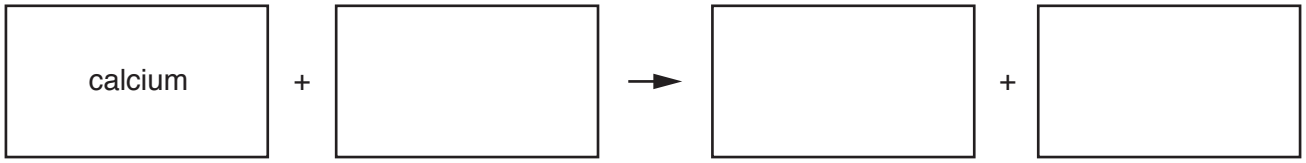


Fig. 8.2

(i) Hydrogen and calcium hydroxide are produced during this reaction.

Complete the word equation for this reaction.



[1]

(ii) During this reaction the temperature in the beaker increases.

State the type of chemical reaction that causes an increase in temperature.

.....[1]

(iii) Explain, in terms of reactivity, why calcium reacts with water more slowly than sodium reacts with water.

.....

.....[1]

(c) (i) Copper is a metal that has a high melting point and a high density. It forms coloured compounds.

Name the collection of metals in the Periodic Table which includes copper.

.....[1]

(ii) Copper alloys, rather than pure copper, are used to make coins.

Suggest **one** reason, other than cost, for this.

.....

.....[1]

[Turn over

9 Fig. 9.1 shows two horizontal forces acting on a car driving along a road.

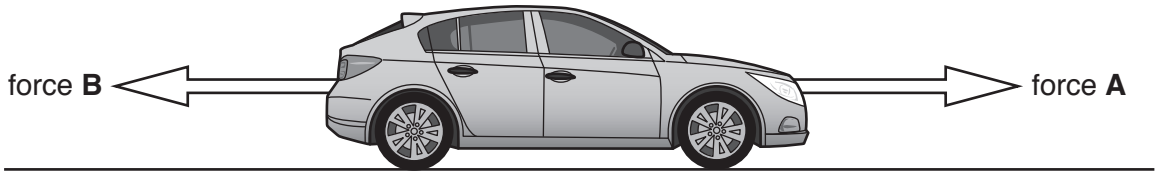


Fig. 9.1

(a) **(i)** Force **A** is the driving force produced by the engine.

Name force **B**.

.....[1]

(ii) The car is travelling at constant speed.

Describe how force **A** compares with force **B**.

.....

.....[2]

(b) The car is powered by batteries that can be recharged from solar cells when the batteries run down.

Complete the sequence of energy transfers as the batteries are recharged. Write the types of energy produced in the blank spaces.

Nuclear energy in the Sun

→ ..... energy transferred from the Sun to the solar cells

→ ..... energy transferred from the solar cells

→ chemical energy in the batteries. [2]

(c) Fig. 9.2 shows a car crossing a bridge.

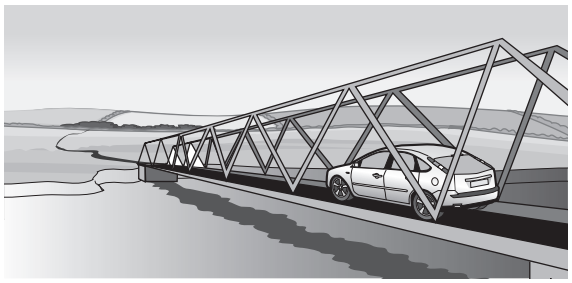


Fig. 9.2

Fig. 9.3 shows a gap in the road surface on the bridge.

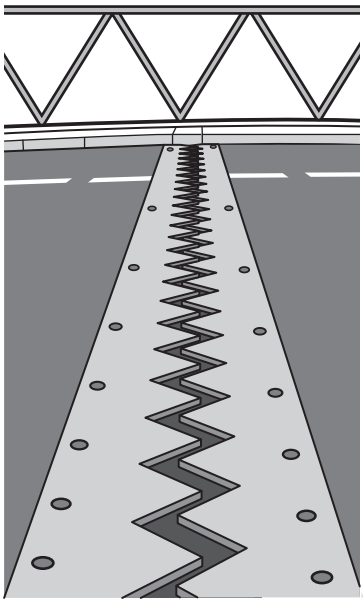


Fig. 9.3

(i) On a hot sunny day the temperature of the bridge rises. Describe what will happen to the gap as the temperature rises.

Give a reason for your answer.

.....

.....

.....[2]

(ii) Use words from the list below to complete the blanks in the sentence that follows.

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

boils **evaporates** **faster** **larger** **melts** **slower** **smaller**

After rain, the road surface is wet with water which slowly .....

as the ..... molecules escape from the water surface. [2]

(iii) On a cold winter's day, the temperature is –5 °C.

Water vapour in the air freezes onto the road surface as ice.

On Fig. 9.4 draw a line to link the correct arrangement of molecules in water vapour to the correct arrangement of molecules in ice.

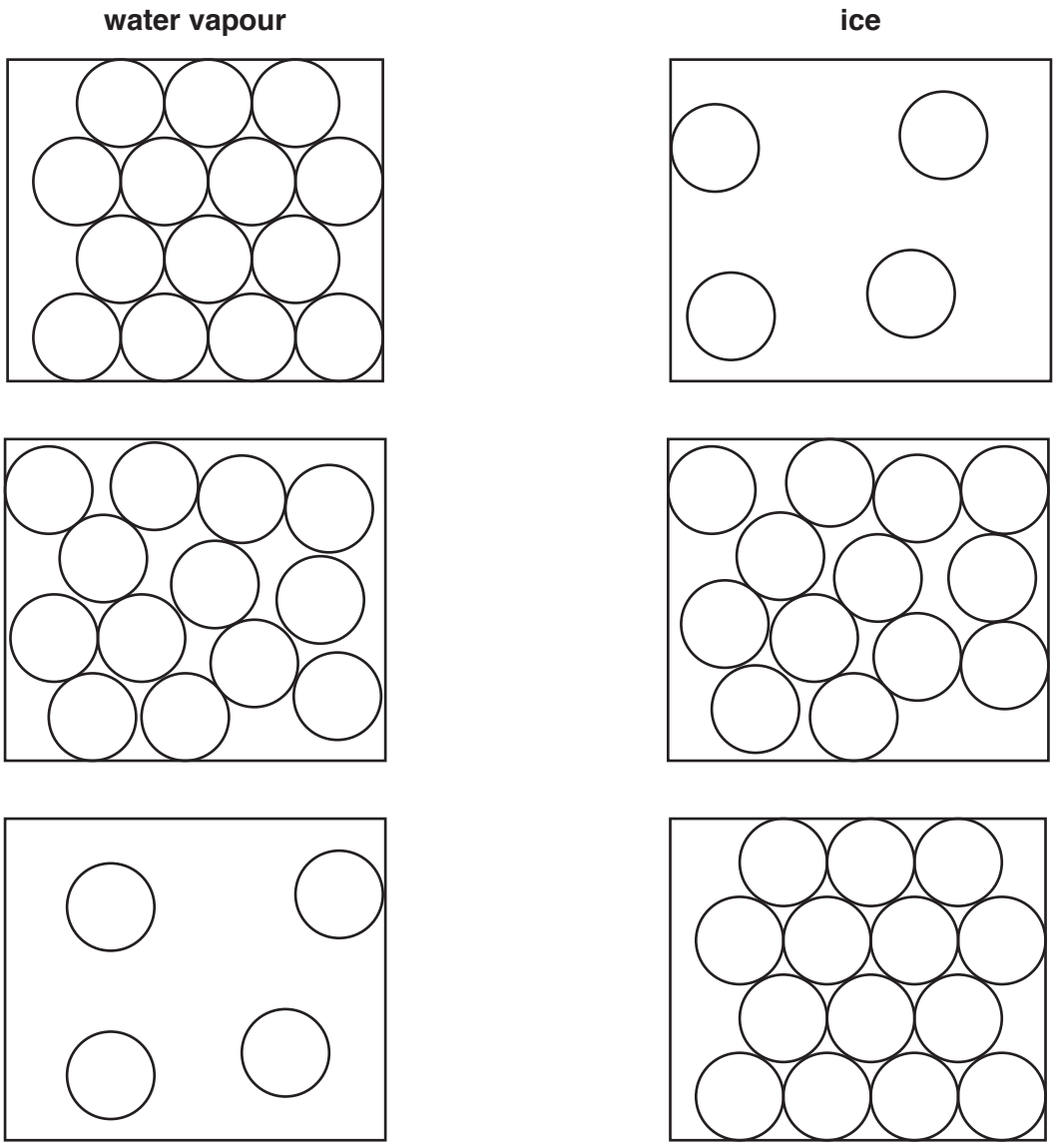


Fig. 9.4

[1]

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The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 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 –		

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.).