Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

8695586823

COMBINED SCIENCE **0653/33**

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.

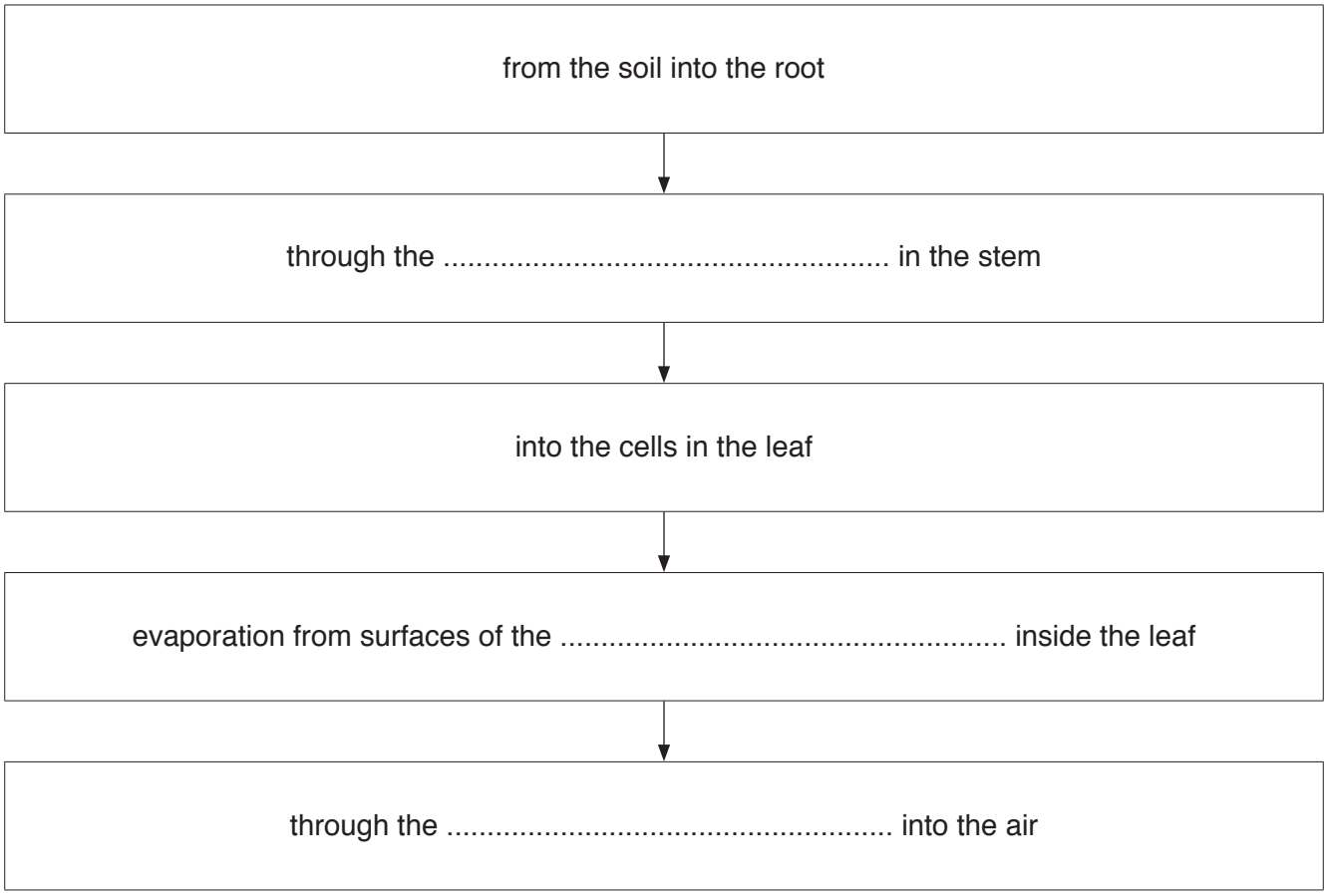
CAMBRIDGE International Examinations

1 **(a)** Use the following words or phrases to complete the flow chart about a possible pathway taken by water through a plant from the soil to the air.

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

cuticle **epidermal cells** **mesophyll cells** **phloem**

root hair cells **stomata** **tubes** **xylem**



[3]

(b) State **two** functions of water in plants.

1. .....

2. .....

[2]

(c) A supply of water is needed by humans too. Most of the plasma in the blood is made up from water. The plasma carries the blood cells around the body.

State **two** other substances that are transported by the plasma.

1. .....

2. .....

[2]

(d) The haemoglobin in red blood cells contains iron.

(i) State the role of haemoglobin in the blood.

.....[1]

(ii) Explain why a menstruating woman needs to make sure she takes enough iron in her diet.

.....

.....[1]

(iii) Describe **one** symptom of iron deficiency in the body.

.....

.....[1]

2 **(a)** Some iron objects are shown in Fig. 2.1.

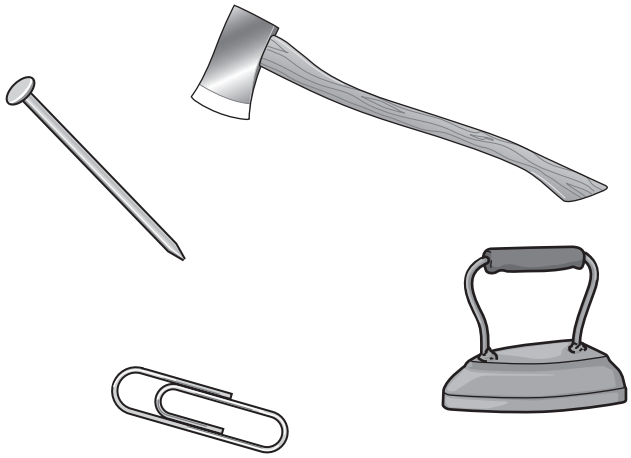


Fig. 2.1

(i) State **two** physical properties of all metals.

1. .....

2. .....

[2]

(ii) Iron is a transition metal.

State **one** physical property of transition metals that is **not** a physical property of Group I metals.

.....[1]

(b) A student adds some iron nails to dilute sulfuric acid.

Iron sulfate and hydrogen gas are produced.

(i) Complete the word equation to show this reaction.

iron	+		→		+	

[1]

(ii) The student tests another dilute acid with aqueous silver nitrate.

A white solid forms.

Deduce the anion present and name the acid.

anion .....

acid .....

[2]

(c) The atomic number of iron is 26.

Explain what is meant by *atomic number*.

.....

.....[1]

3 Fig. 3.1 shows four forces, **P**, **Q**, **R** and **S**, acting on a submarine. The submarine is travelling underwater and moving to the right at constant speed.

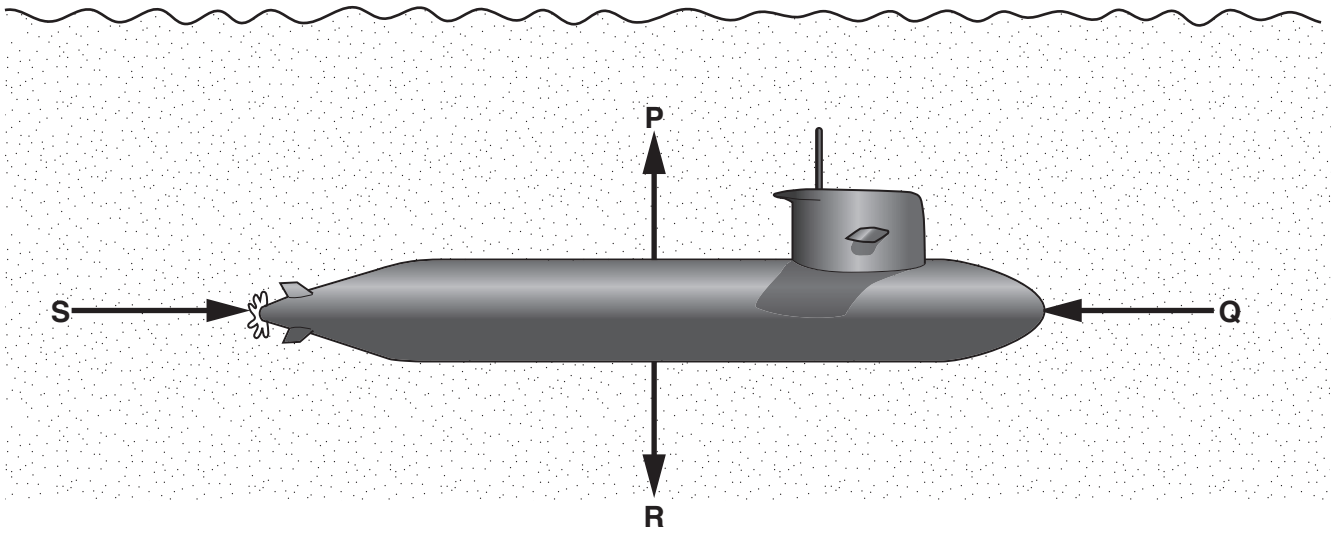


Fig. 3.1

(a) In Table 3.1 complete the names of the forces **P**, **Q**, **R** and **S**.

Table 3.1

P	uplift
Q	
R	
S	driving force

[2]

(b) The submarine is travelling at a constant depth.

State how the magnitude of force **P** compares to force **R.**

.....[1]

(c) The submarine captain cannot use a radio transmitter underwater.

The captain orders the crew to take the submarine to the surface so he can use a radio transmitter.

(i) State which force must be increased to bring the submarine to the surface.

.....[1]

(ii) Fig. 3.2 shows an incomplete electromagnetic spectrum. On Fig. 3.2 add radio waves in their correct place.

gamma			visible light		micro-waves	

Fig. 3.2

[1]

(iii) Electromagnetic waves do not pass easily through sea water. Suggest a different kind of wave that can travel in water and might be used to send a signal.

.....[1]

(d) When submerged, the submarine has to use an energy source that does not depend upon the Sun or on burning a fuel.

Suggest a suitable energy source that can be carried in a submarine in order to power the submarine underwater.

.....[1]

(e) Use steps **1** to **3** below to calculate the average speed of the submarine in metres per second (m/s) if it travels 30 kilometres in 1 hour.

Step **1**: convert 30 kilometres to metres.

..... m

Step **2**: convert 1 hour to seconds.

..... s

Step **3**: calculate the speed in metres per second.

speed = ... m/s
[2]

4 Fig. 4.1 shows a diagram of the alimentary canal. The main areas where digestion takes place are labelled.

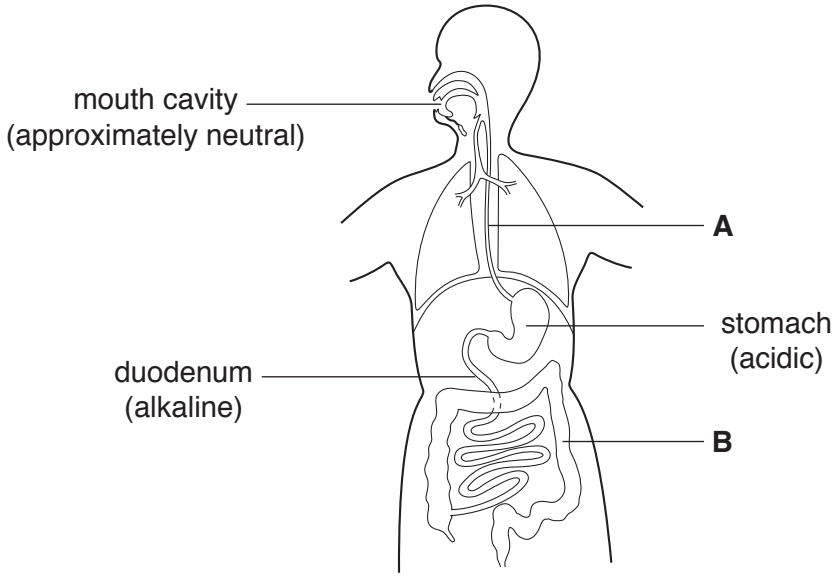


Fig. 4.1

(a) Name structures **A** and **B** shown in Fig. 4.1.

A .....

B .....
[2]

(b) A student is investigating human digestive enzymes.

He has three test-tubes, **1**, **2** and **3**, containing protein solution at different pH values. He then adds the same enzyme to all three test-tubes and keeps them at 35 °C.

The protein solution is cloudy at the start of the experiment. If the protein in the solution is broken down the solution becomes clear and colourless.

The results are shown in Fig. 4.2.

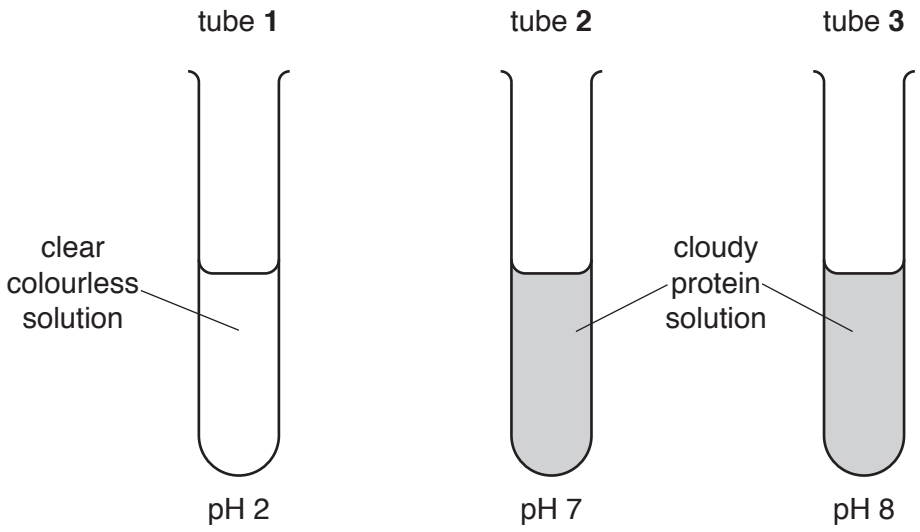


Fig. 4.2

(i) Use the information in Fig. 4.1 to identify the likely source of the digestive enzyme that produces the result in tube **1** in Fig. 4.2.

Explain your answer.

source of enzyme .....

explanation .....

.....

.....

.....
[3]

(ii) Suggest why a temperature of 60 °C is **not** suitable for this experiment.

.....

.....[1]

(iii) Explain why the change that takes place in tube **1** is an example of chemical digestion.

.....

.....

.....[2]

(iv) Describe **one** example of mechanical digestion.

.....

.....[1]

BLANK PAGE

5 **(a)** Pure water can be separated from sea water using the apparatus shown in Fig. 5.1.

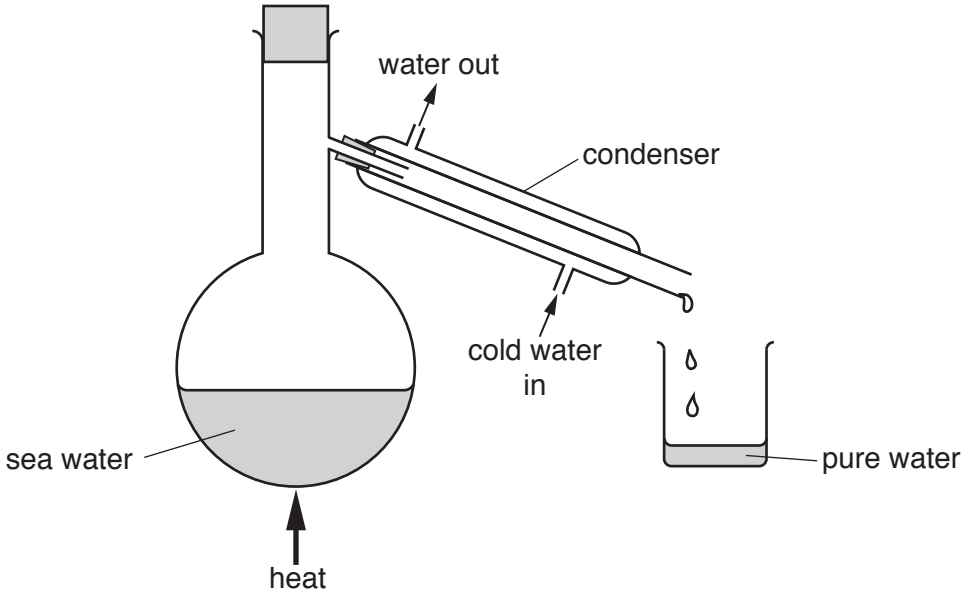


Fig. 5.1

(i) Name this process.

.....[1]

(ii) Describe the change in the temperature of the pure water as it passes through the condenser.

.....[1]

(b) The purification of a water supply involves filtration and chlorination.

Explain how filtration and chlorination purify the water supply.

filtration .....

.....

chlorination .....

.....

[2]

(c) Petroleum is separated into different fractions, as shown in Fig. 5.2.

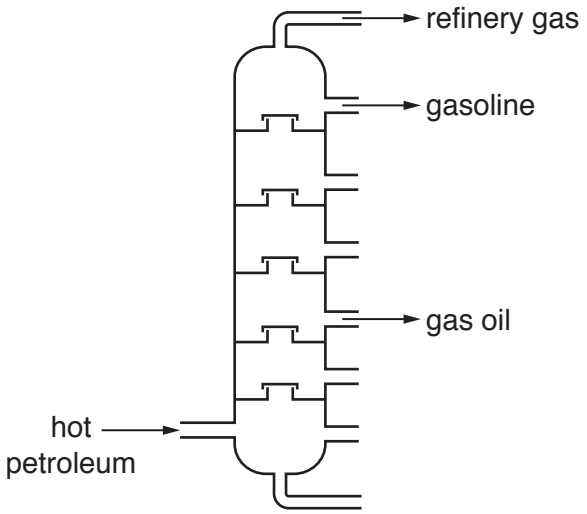


Fig. 5.2

(i) State **one** use for refinery gas and **one** use for gas oil.

refinery gas .....

gas oil .....
[2]

(ii) Gasoline is a mixture of hydrocarbons.

Explain what is meant by a *hydrocarbon*.

.....

.....[2]

(d) The structures of six compounds are shown in Fig. 5.3.

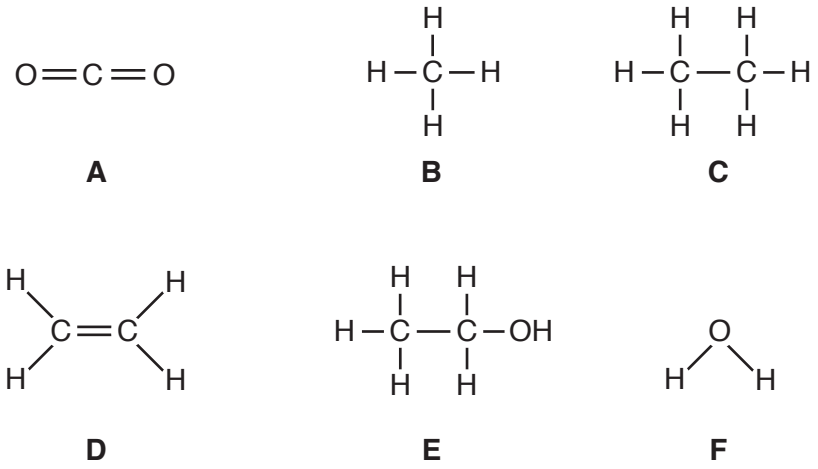


Fig. 5.3

(i) Using letters **A** to **F**, identify the two products of the complete combustion of hydrocarbons.

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

(ii) Using letters **A** to **F**, identify the main constituent of natural gas.

..... [1]

6 Fig. 6.1a shows an insulated bag used to carry frozen food. The bag keeps the food below the melting point of ice.

Fig. 6.1b shows the structure of the walls of the bag.

Fig 6.1a

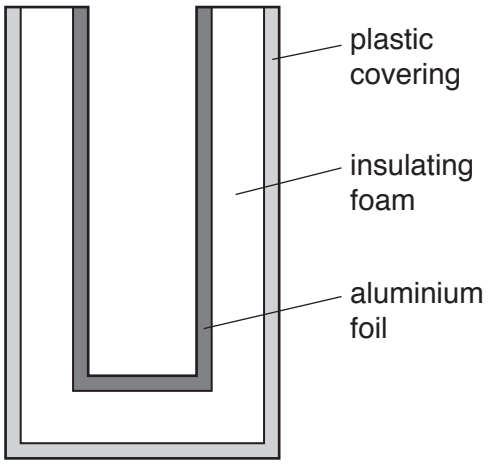


Fig. 6.1b (not to scale)

(a) State the meaning of *melting point*.

.....

.....[1]

(b) The insulating foam is designed to reduce thermal energy transfer through the bag.

(i) Name two methods of thermal energy transfer that the insulating foam is designed to reduce.

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

(ii) Describe how the insulating foam reduces thermal energy transfer by these two methods.

.....

.....

.....[2]

(c) The aluminium foil is designed to reduce thermal energy transfer by radiation.

Name the part of the electromagnetic spectrum mainly involved in thermal energy transfer by radiation.

.....[1]

(d) A box of ice cream is carried in the bag.

The ice cream weighs 1900 g, and has a volume of 2000 cm^3.

Calculate the density of the ice cream.

State the formula you use and show your working.

formula

working

density = ... g/cm^3 [2]

7 Fig. 7.1 shows some processes occurring in a forest growing on a hill.

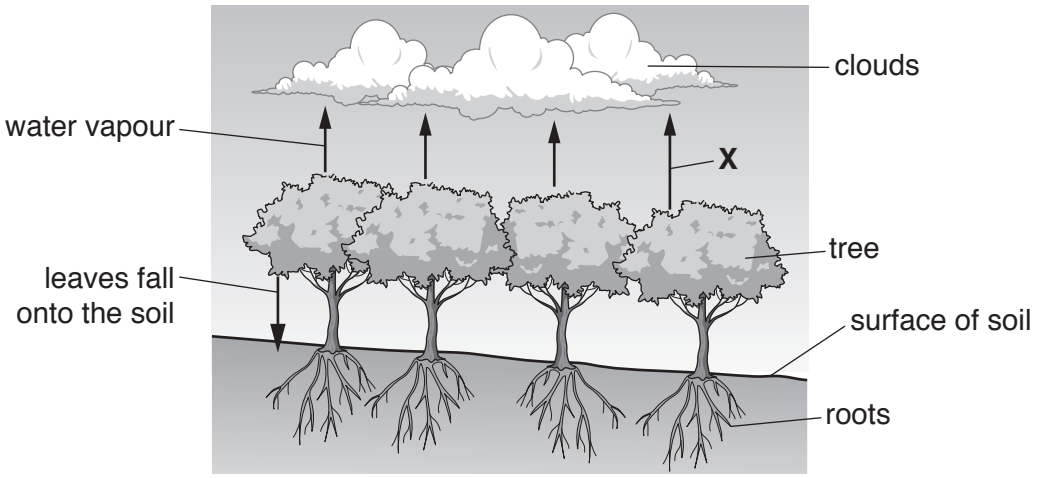


Fig. 7.1

(a) Name the process labelled **X**.

.....[1]

(b) **(i)** The leaves of the trees contain carbohydrates, for example sugar.

Describe how leaves use a carbon compound in the air to make sugar.

.....

.....

.....[2]

(ii) When leaves die they fall onto the soil. Decomposers (bacteria and fungi) feed on the dead leaves and use the sugar present in the leaves.

Suggest and explain how the carbon in the sugar is returned to the atmosphere by the decomposers.

.....

.....

.....[2]

(c) The trees in the forest shown in Fig. 7.1 are cut down.

Predict **and** explain the effect of clearing the trees on the amount of rain falling on the area.

.....

.....

.....[1]

(d) A storm occurs higher up the hill and water comes flowing down the hill.

Suggest how the soil in the cleared area will be affected by water from heavy rainfall flowing down the hill.

Explain your answer.

.....

.....

.....[2]

[Turn over

8 **(a)** Molten lead(II) bromide is broken down into simpler substances using the apparatus shown in Fig. 8.1.

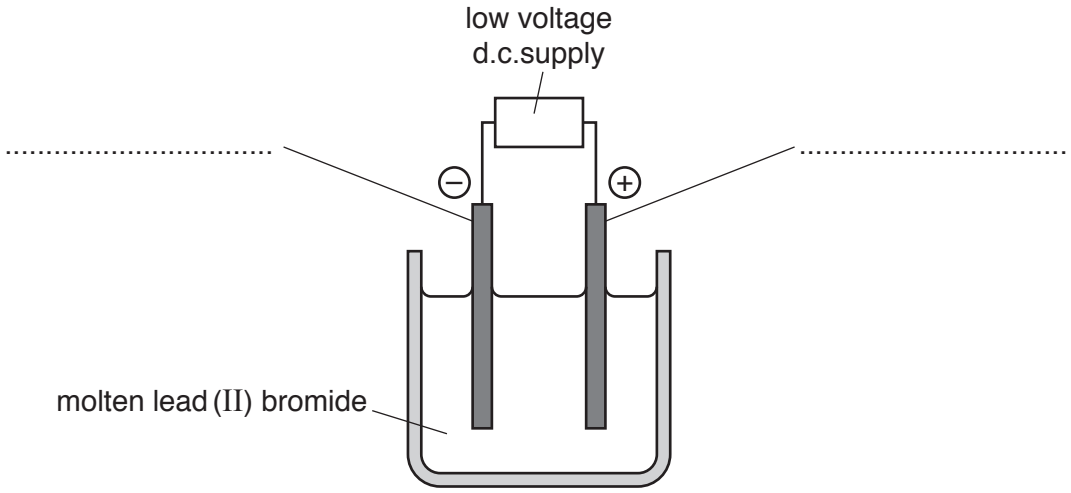


Fig. 8.1

(i) Use the names of the electrodes to complete Fig. 8.1. [2]

(ii) Describe the appearance of the substance that forms at the positive electrode.

.....[1]

(b) Copper is extracted from copper oxide by heating with carbon.

The equation for this reaction is

copper oxide + carbon → copper + carbon dioxide.

State whether the copper oxide is oxidised or reduced during this reaction.

Explain your answer.

.....

.....[1]

(c) Copper, Cu, does not react with water.

Calcium, Ca, reacts rapidly with water.

Magnesium, Mg, reacts slowly with water.

Potassium, K, reacts very rapidly with water.

Place these four metals in order of reactivity, from most to least reactive.

..... most reactive

.....

.....

..... least reactive

[2]

(d) A student adds excess magnesium to dilute hydrochloric acid.

(i) State **two** changes that the student can make to increase the rate of this reaction.

1. .....

2. .....

[2]

(ii) Identify the salt produced during this reaction.

.....[1]

(iii) After the reaction finishes, the student removes the unreacted magnesium from the solution that has formed.

Name the separation technique that the student uses.

.....[1]

9 Fig. 9.1 shows a toy car powered by batteries.

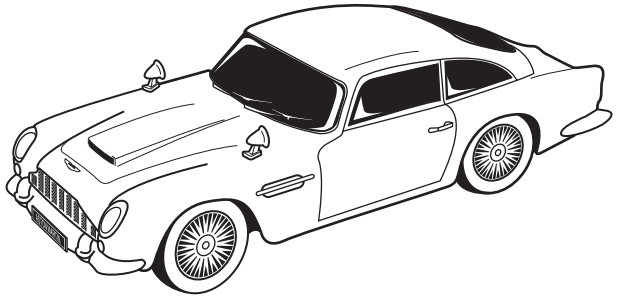


Fig. 9.1

Fig. 9.2 shows part of the circuit diagram for a circuit in the toy car, including the two headlamps which can be switched on when needed.

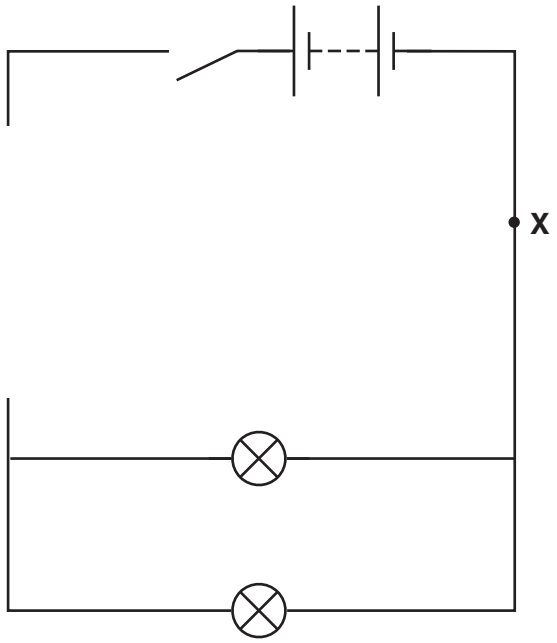


Fig. 9.2

(a) The car is driven by an electric motor which must be able to operate whenever the switch shown in Fig. 9.2 is on.

On Fig. 9.2 complete the circuit diagram by adding

- the electric motor in parallel with the headlamps, with a wire connecting it to point **X** on the circuit.

  The symbol for an electric motor is —(M)—.

- a variable resistor connected to the electric motor to control the speed of the motor.
- a separate switch to control both headlamps only.
- any wires needed to complete the circuit connections.

[4]

(b) The resistance of the variable resistor is decreased in order to speed up the motor.

Suggest why decreasing the resistance will speed up the motor.

.....

.....[1]

(c) Complete the sentences below by writing the correct phrase in each space.

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

by an ammeter **by an insulator** **in parallel** **in series**

less than **more than** **the same as**

The headlamps are connected ..... with each other.

When the headlamps are switched off, the current through the motor is

..... the current through the battery.

When the headlamps are switched on, the combined resistance of the motor and

headlamps is ..... the resistance of the motor before the

headlamps are switched on. [3]

(d) Some modern cars on the road are powered by batteries.

Fig. 9.3 shows an electric car being charged by connecting it to the mains supply at an outdoor charging point.

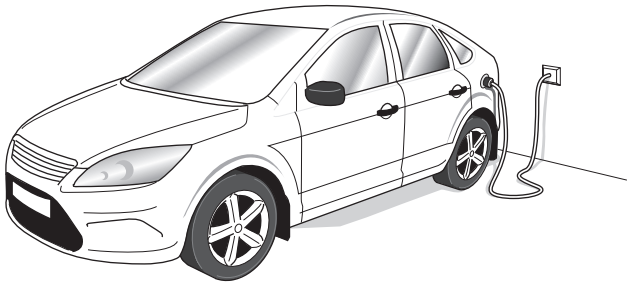


Fig. 9.3

Suggest one important electrical hazard for this charging process.

Suggest a way to make this safer.

hazard .....

safety improvement .....

.....

[2]

BLANK PAGE

BLANK PAGE

The Periodic Table of Elements

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 –		

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.).