Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **0653/23**

Paper 2 (Core) **October/November 2015**

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 a 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 **23** printed pages and **1** blank page.

CAMBRIDGE International Examinations

[Turn over

1 **(a)** Fig. 1.1 shows the human gas exchange system.

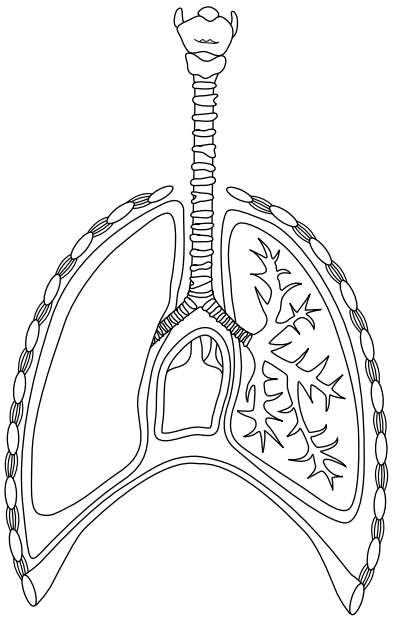


Fig. 1.1

On Fig. 1.1, draw label lines with names to show

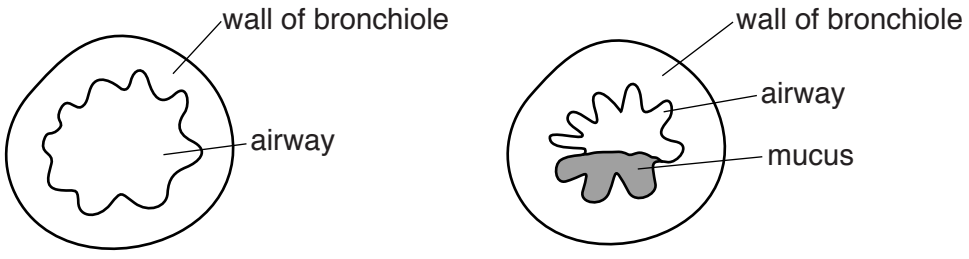
the larynx,

the trachea,

a bronchus. [3]

(b) Some people suffer from asthma which affects the bronchioles of the gas exchange system.

Fig. 1.2 shows cross sections of a normal bronchiole and a bronchiole of a person who has asthma.



normal bronchiole **bronchiole of a person with asthma**

Fig. 1.2

The airflow towards the alveoli is reduced if a person has asthma.

Describe **two** features visible in Fig. 1.2 which could reduce the airflow in the bronchiole of the person suffering from asthma.

1 .....

2 .....[2]

(c) A study is carried out to compare the breathing of people with asthma with the breathing of healthy people.

The volumes of air inhaled in one minute are measured and an average is calculated for both groups.

Both groups of people are tested while resting.

Results

average volume inhaled by a healthy person = 5.8 dm^3 / minute.

average volume inhaled by a person with asthma = 12.5 dm^3 / minute.

(i) Calculate the average percentage of **extra** air the person with asthma inhales per minute compared with a healthy person.

Show your working.

answer = ... % [2]

(ii) Suggest two ways in which the breathing of an asthmatic person is likely to be different from a normal person's breathing in order to inhale a greater volume of air.

1 .....

2 .....[2]

[Turn over

2 Fig. 2.1 shows apparatus used to investigate the temperature changes which occur during some chemical processes.

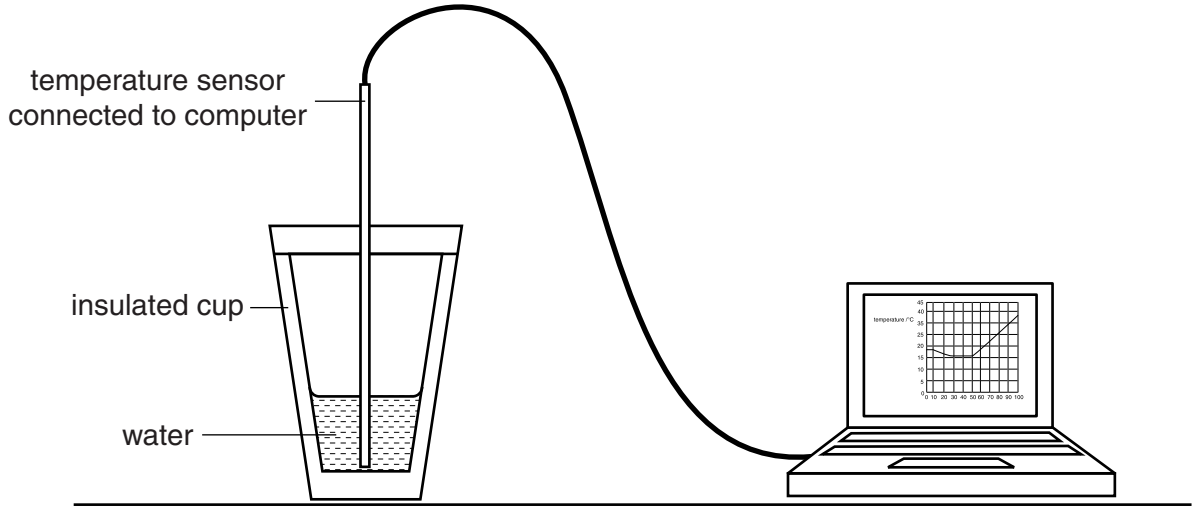


Fig. 2.1

A citric acid solution can be made by dissolving citric acid crystals in water.

The temperature sensor is placed in the water and the computer starts to log data. After 10 seconds some citric acid crystals are added to the water in a cup. The mixture is stirred until the crystals dissolve.

After another 40 seconds some magnesium ribbon is placed in the solution.

Fig. 2.2 shows the computer display of temperature change for the first 100 seconds.

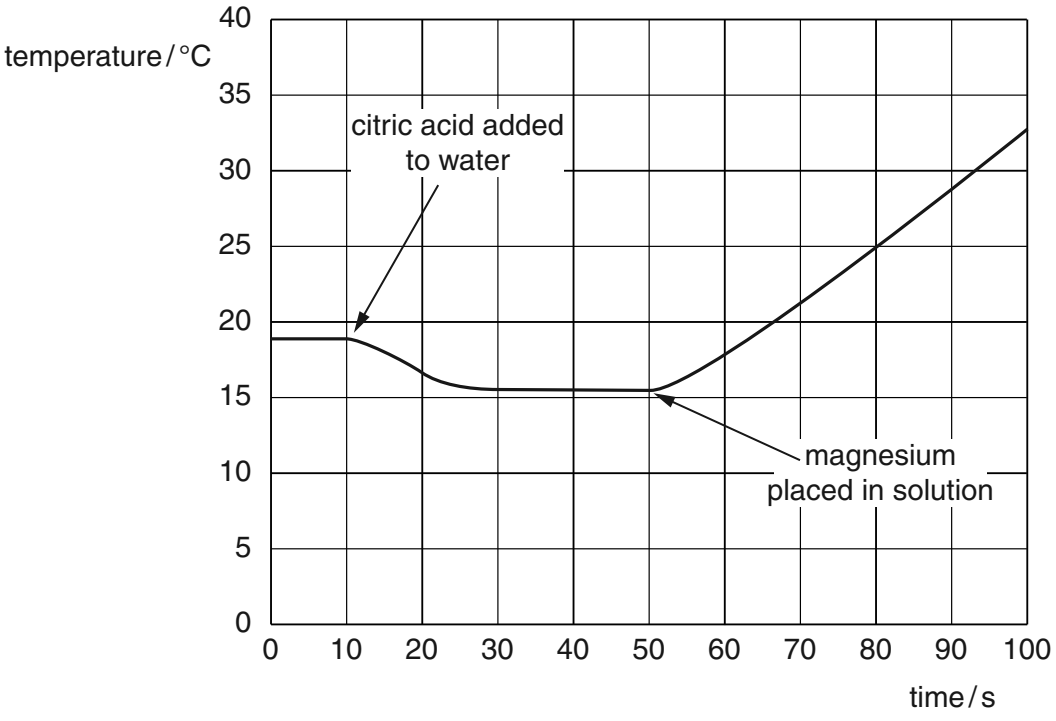


Fig. 2.2

(a) Complete the following sentences, choosing from the words below.

decreases **exothermic** **oxidation**

endothermic **increases** **stays the same**

As the citric acid dissolves in the water the temperature ..... .

This is an ..... process. [1]

(b) Fig. 2.3 shows the appearance of the contents of the cup during the experiment.

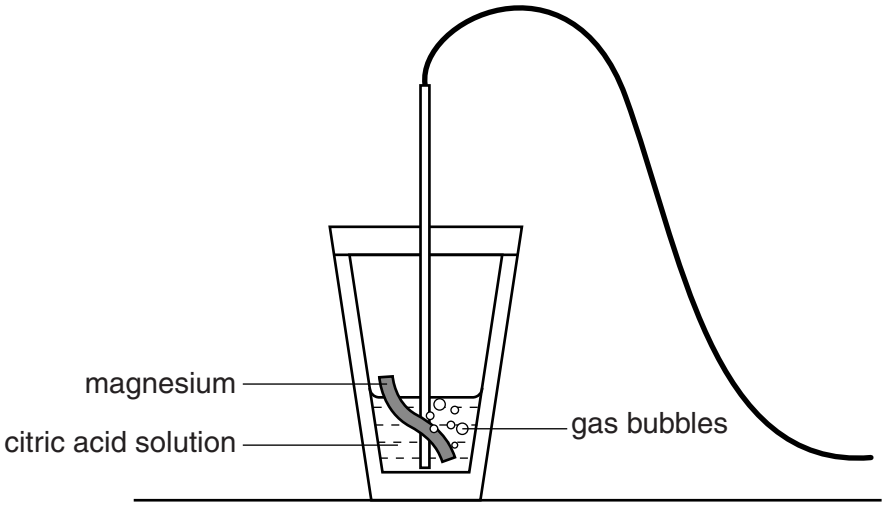


Fig. 2.3

Gas bubbles rise from the surface of the magnesium.

Name the gas produced.

.....[1]

(c) The experiment is repeated using a greater mass of citric acid dissolved in the same mass of pure water. This increases the concentration of the citric acid.

Describe the effect on the reaction with magnesium caused by increasing the concentration of the citric acid.

.....

.....[1]

(d) By referring to the reactivity series, explain how the results of these experiments would change if copper was used instead of magnesium.

.....

.....

.....[2]

[Turn over

3 Fig. 3.1 shows a girl on a skateboard track.

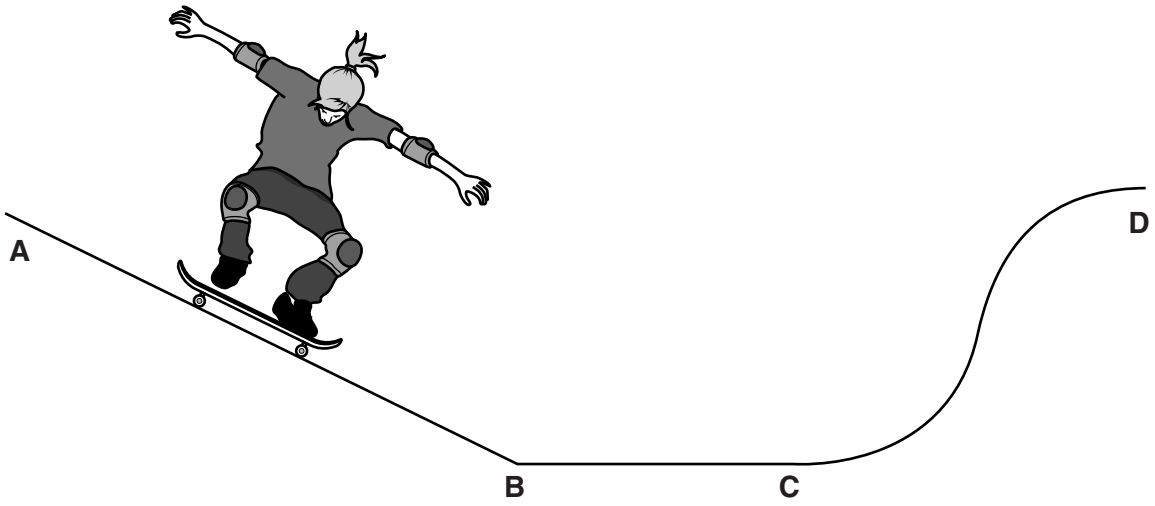


Fig. 3.1

Fig. 3.2 shows a speed/time graph of the girl as she travels.

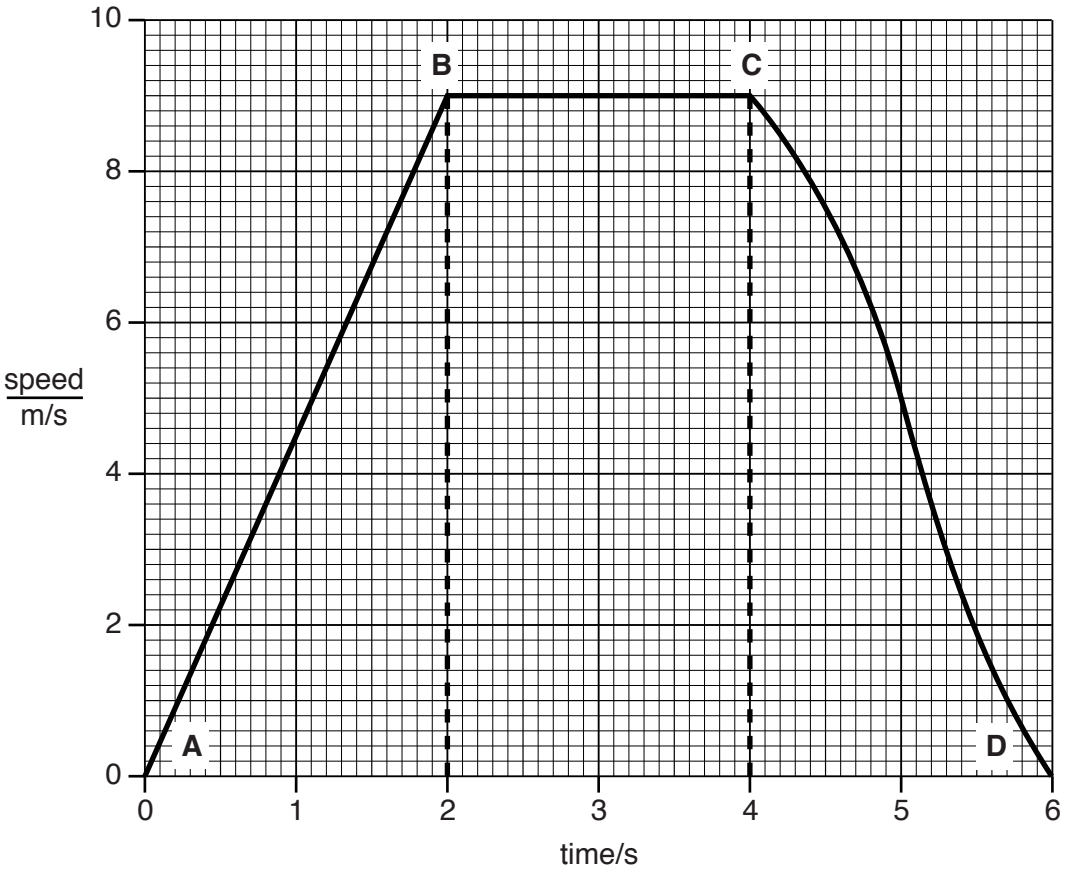


Fig. 3.2

(a) (i) Name the force that causes the girl to move down the skateboard track from **A** to **B**.

.....[1]

(ii) The force acting on the girl has a value of 500 N.

State the name of the unit whose symbol is N. .....[1]

(b) State the main energy transformations as the girl travels from **A** to **D**.

from ..... energy

to ..... energy

to ..... energy.

[2]

(c) Describe the motion of the girl between points

A and **B**, ...

B and **C**. .....[2]

(d) Use Fig. 3.2 to calculate the distance travelled by the girl between points **B** and **C.**

State the formula you use and show your working.

formula

working

distance = ... m [2]

4 **(a)** Vitamins are needed in small quantities as part of a balanced diet. One vitamin is vitamin C.

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

.....

.....[1]

(ii) Explain why we need vitamin C in our diet.

.....

.....[1]

(iii) Suggest why vitamin C does **not** need to be digested.

.....

.....

.....[2]

(b) Table 4.1 gives details about the vitamin C content of some fruits.

Table 4.1

fruit	mass of vitamin C in 100 g fruit / mg	mass of vitamin C in an average portion / mg
apple	6	8
kiwifruit	98	74
mango	28	57
orange	53	70
watermelon	10	27

The recommended daily allowance (RDA) of vitamin C for humans is 60 mg.

(i) State which of the fruits listed in Table 4.1 provide the RDA of vitamin C in just one portion.

Explain your answer.

.....

.....

.....[2]

(ii) Calculate the mass of mango needed to supply a full RDA of vitamin C.

Show your working.

answer = ... g [2]

(c) Citrus fruits provide a good source of vitamin C. However, many of them are weakly acidic.

(i) Explain why the acid in the citrus fruits could be harmful for teeth if a lot of fruit is eaten.

.....

.....[1]

(ii) Describe what a person can do to reduce the effects on the teeth of eating the acidic fruit.

.....

.....[1]

5 **(a)** On Fig. 5.1 draw one line from each property to show whether it describes metals or non-metals.

One line has been drawn for you.

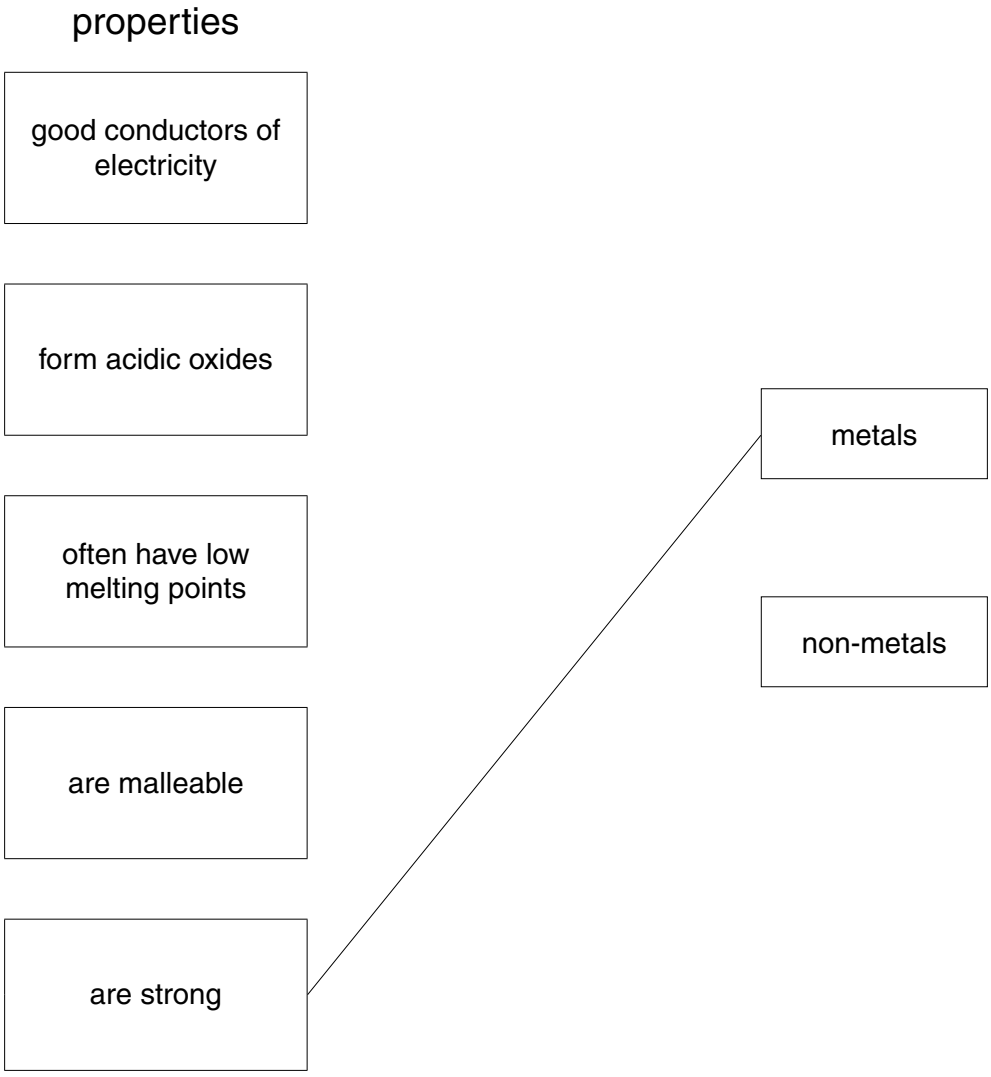


Fig. 5.1

[2]

(b) Fig. 5.2 shows Period 3 of the Periodic Table.

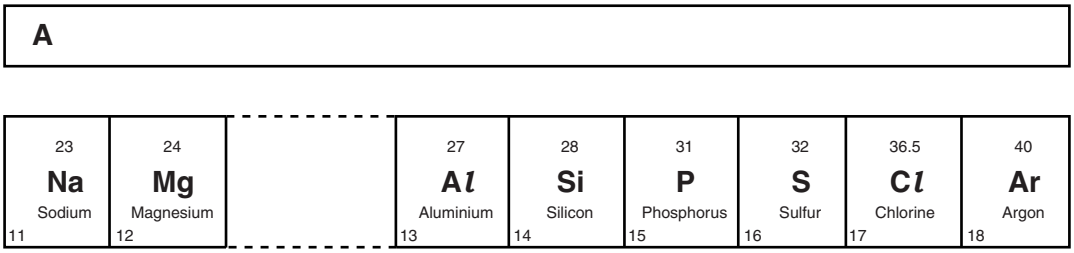


Fig. 5.2

Draw an arrow in box **A** which points towards the metals and away from the non-metals. [1]

(c) Table 5.1 shows some observations made after a piece of sodium is dropped into some water containing full-range indicator (Universal Indicator).

Complete Table 5.1 to explain each observation.

Table 5.1

observation	explanation
bubbles of gas	
indicator changes from green to purple	

[2]

(d) Sodium reacts with chlorine to form sodium chloride.

(i) Fig. 5.3 shows diagrams that represent the particles in each substance.

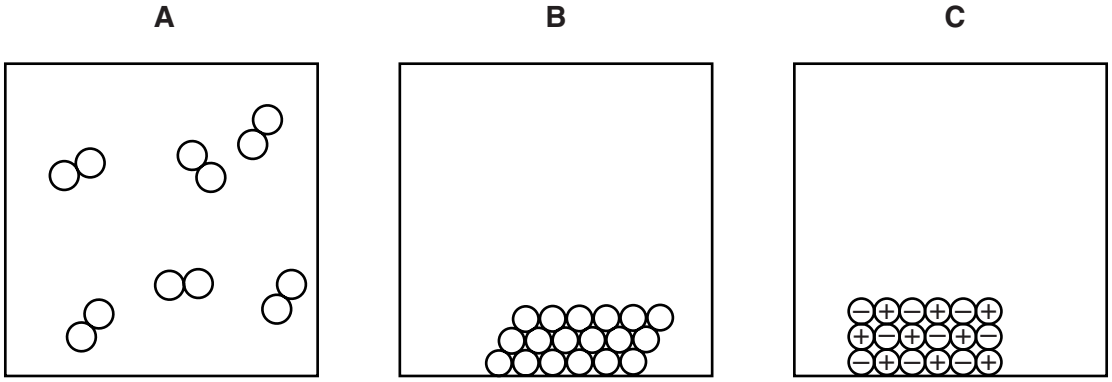


Fig. 5.3

Complete Table 5.2 to show which diagram, **A**, **B** or **C**, represents each substance.

Table 5.2

substance	diagram
chlorine	
sodium	
sodium chloride	

[2]

(ii) Describe, in terms of the loss or gain of electrons, how sodium and chloride ions are formed from sodium and chlorine atoms.

.....

.....

.....[2]

(iii) Describe how the sodium ions and chloride ions are held together.

.....

.....[1]

(iv) Zinc chloride can be made by reacting zinc with chlorine.
Zinc chloride contains half as many zinc ions as chloride ions.

State the chemical formula of zinc chloride.

..... [2]

Please turn over for Question 6.

6 Electric power can be generated using the energy of waves on the sea. Fig. 6.1 shows a group of small wave energy converters which are anchored to the sea floor below.

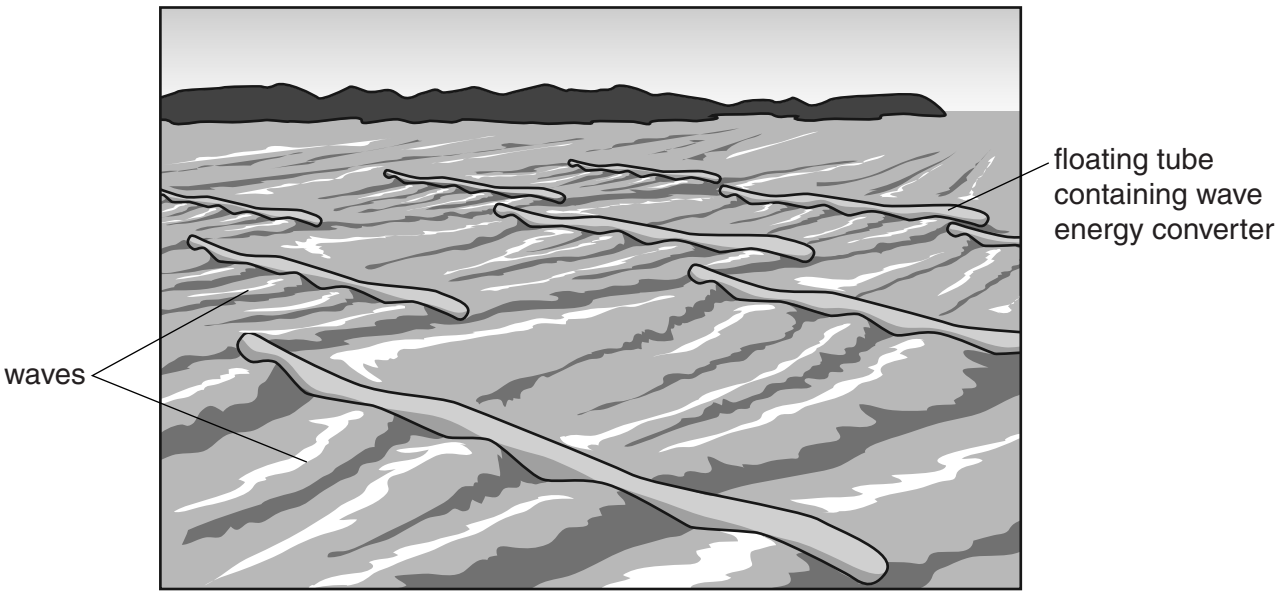


Fig. 6.1

Inside each floating tube there are several generators that convert the wave movement energy into electrical energy.

(a) (i) Each floating container is 30 m long. In Fig. 6.1 each sea wave takes 10 seconds to pass along each floating container from end to end.

Calculate the speed of the waves across the sea.

speed = ... m/s [1]

(ii) A total of 10 waves passed one end of a container in 20 seconds.

Calculate the frequency of the waves. Show your working and state the unit of your answer.

frequency = ... unit ..... [2]

(b) The amplitude of the waves on one day was 0.5 m.

State the vertical distance that each container will move through as a wave passes.

distance = ... m [1]

(c) The generators are controlled by radio signals. A radio signal is sent from a control centre 100 km away.

Fig. 6.2 shows an incomplete diagram of the electromagnetic spectrum.

gamma radiation			visible light			

Fig. 6.2

Write an **R** in the box for the part of the spectrum where radio waves are found. [1]

(d) Engineers believe wave generators will be important for supplying electrical energy in the future. These generators have advantages over older methods such as coal-fired power stations.

Give **one** advantage of wave generators for the supply of electrical energy.

.....

.....[1]

[Turn over

7 **(a)** In some areas of the world large areas of forest are cleared to use the land for agriculture.

However, sometimes not all of the trees are cleared from an area. Some of the largest trees are left standing and the areas in between them are cleared. This is called partial deforestation.

(i) Describe and explain why partial deforestation is better than complete deforestation for the soil in the forest.

.....

.....

.....[2]

(ii) Describe **two** advantages of partial deforestation compared with complete deforestation for the animal life in the forest.

1 .....

.....

2 .....

.....[2]

(b) In some areas of the world raw sewage is discharged into rivers or lakes. This can cause problems for plants and animals that live in the water.

(i) Explain why the sewage reduces the amount of dissolved oxygen in the water.

.....

.....

.....[2]

(ii) When sewage is added to water it can affect the transparency of the water by making it cloudy.

Explain why this reduces the growth of aquatic plants.

.....

.....

.....[2]

8 A student extracts some copper from a sample of copper carbonate.

(a) He adds dilute hydrochloric acid to the copper carbonate until it is all dissolved.

Bubbles of carbon dioxide gas appear and a solution of copper chloride is formed.

Fig. 8.1 shows the experiment during and after the reaction.

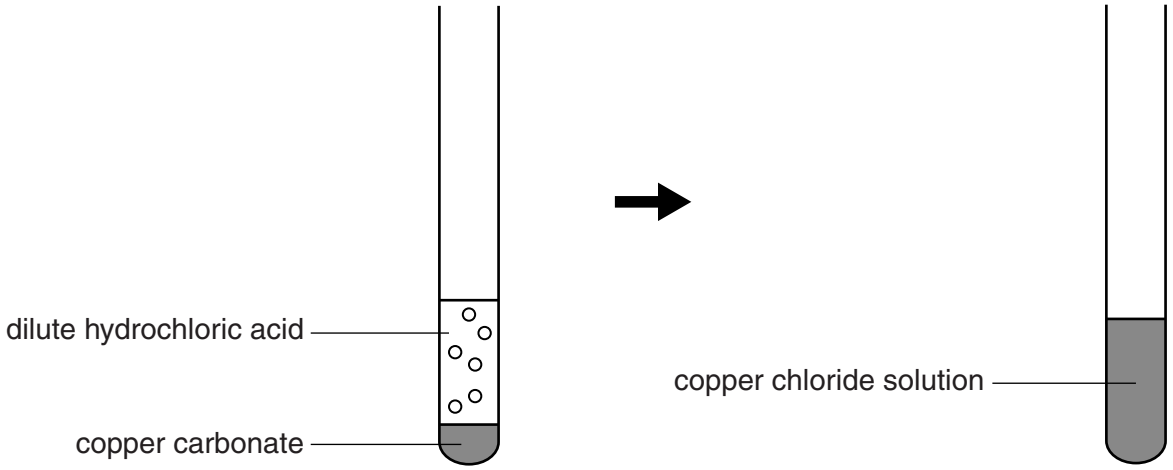
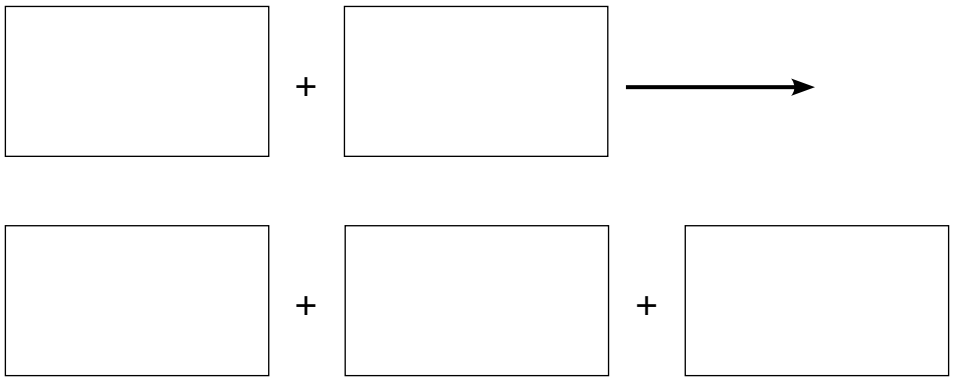


Fig. 8.1

(i) Write a word equation for the reaction.



[2]

(ii) The student checks that the gas is carbon dioxide.

When the reaction is complete, he collects some of the gas in a pipette.

Fig. 8.2 shows how he collects the gas and then passes it through a solution **X**.

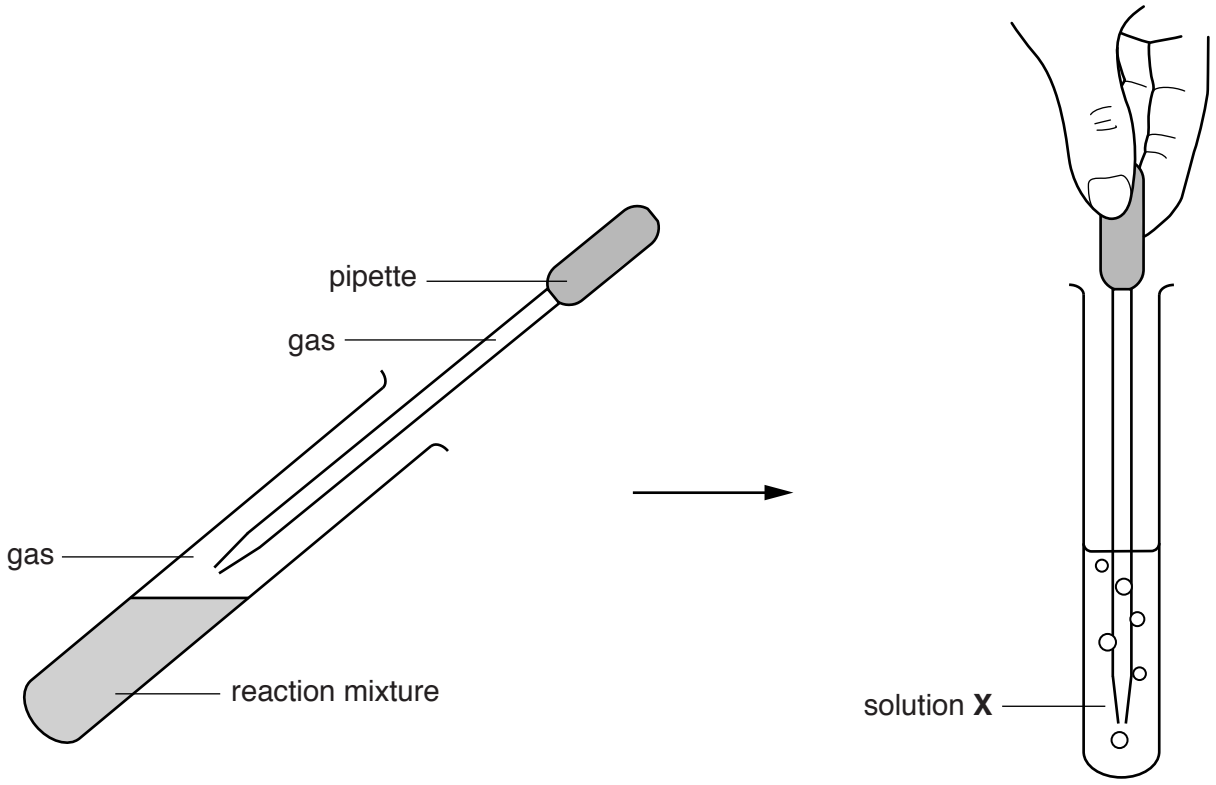


Fig. 8.2

State the name of solution **X** and describe the effect of carbon dioxide on its appearance.

name .....

effect .....

.....[2]

(b) The student places the copper chloride solution that he has made into the electrolysis cell shown in Fig. 8.3.

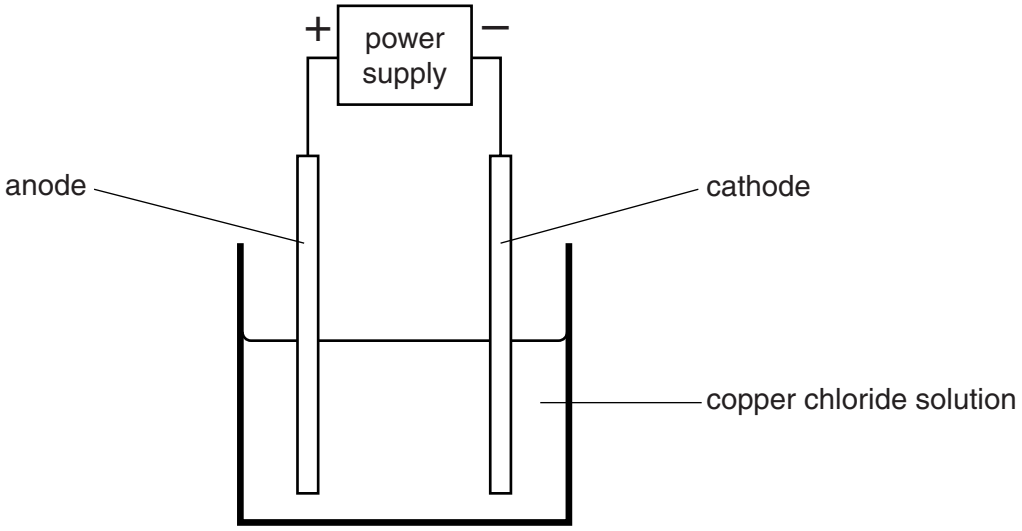


Fig. 8.3

(i) Complete Fig. 8.3 by labelling each electrode to show the product formed. [2]

(ii) Choose from the following phrases to complete the sentences about electrolysis.

a covalent compound **an element** **a hydrocarbon**

an ionic compound **a mixture**

Copper chloride solution is the electrolyte because copper chloride is

.....

During electrolysis copper chloride breaks up into simpler substances each of which is

.....

Pure water does not undergo electrolysis because it is

..... [3]

[Turn over

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9 Fig. 9.1 shows a small electrical immersion heater for heating a drink in a cup.

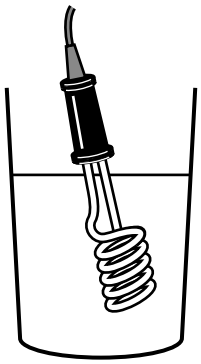


Fig. 9.1

(a) As the drink is heated, the liquid level in the cup rises slightly.

Describe what is happening that causes the liquid level to rise.

.....

.....[1]

(b) State the main method of thermal energy transfer involved in

(i) transferring thermal energy from the hot wire inside the electrical heater to the liquid,

.....[1]

(ii) distributing the thermal energy throughout the liquid.

.....[1]

(c) As the drink gets hot, water vapour escapes from the surface of the liquid before the drink boils.

(i) State the name of this process.

.....[1]

(ii) Explain why this happens in terms of the molecules in the liquid.

.....

.....

.....[2]

[Turn over

10 **(a)** Fig. 10.1 shows a negatively charged plastic plate mounted on a plastic handle and held by a student.

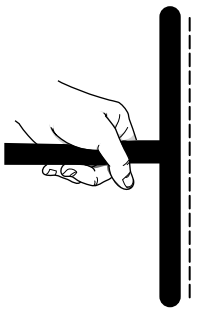


Fig. 10.1

Describe a method of producing a charge on a plastic object.

.....

.....[1]

(b) Fig. 10.2 shows a charged metal plate mounted on a plastic handle.

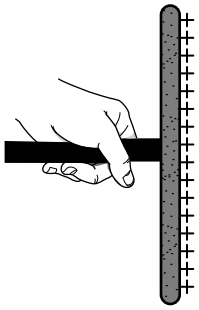


Fig. 10.2

Explain why the handle should be made of plastic rather than metal.

.....

.....

.....[2]

(c) Fig. 10.3 shows a circuit diagram for an electric heater, supplied with 12V from a car battery.

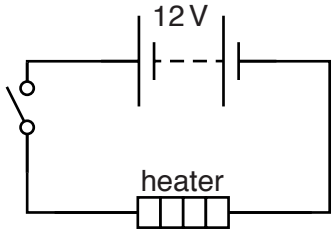


Fig. 10.3

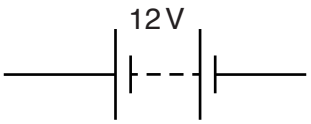
(i) When the switch is closed, there is an electric current in the heater.

State the meaning of *electric current*.

.....[1]

(ii) The heater circuit is changed to include a second identical heater and two switches to switch each heater on independently. The heaters must be connected in parallel to work.

Complete the circuit diagram below to include both heaters and the switches, connected so that both the heaters work and can be switched on independently.



[3]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 **H** Hydrogen 1										4 **He** Helium 2
7 **Li** Lithium 3	9 **Be** Beryllium 4											11 **B** Boron 5	12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
23 **Na** Sodium 11	24 **Mg** Magnesium 12											27 **Al** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulfur 16	35.5 **Cl** Chlorine 17	40 **Ar** Argon 18
39 **K** Potassium 19	40 **Ca** Calcium 20	45 **Sc** Scandium 21	48 **Ti** Titanium 22	51 **V** Vanadium 23	52 **Cr** Chromium 24	55 **Mn** Manganese 25	56 **Fe** Iron 26	59 **Co** Cobalt 27	59 **Ni** Nickel 28	64 **Cu** Copper 29	65 **Zn** Zinc 30	70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	**Tc** Technetium 43	101 **Ru** Ruthenium 44	103 **Rh** Rhodium 45	106 **Pd** Palladium 46	108 **Ag** Silver 47	112 **Cd** Cadmium 48	115 **In** Indium 49	119 **Sn** Tin 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 **I** Iodine 53	131 **Xe** Xenon 54
133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57 *	178 **Hf** Hafnium 72	181 **Ta** Tantalum 73	184 **W** Tungsten 74	186 **Re** Rhenium 75	190 **Os** Osmium 76	192 **Ir** Iridium 77	195 **Pt** Platinum 78	197 **Au** Gold 79	201 **Hg** Mercury 80	204 **Tl** Thallium 81	207 **Pb** Lead 82	209 **Bi** Bismuth 83	209 **Po** Polonium 84	210 **At** Astatine 85	222 **Rn** Radon 86
223 **Fr** Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

* 58–71 Lanthanoid series
† 90–103 Actinoid series

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	147 **Pm** Promethium 61	150 **Sm** Samarium 62	152 **Eu** Europium 63	157 **Gd** Gadolinium 64	159 **Tb** Terbium 65	162 **Dy** Dysprosium 66	165 **Ho** Holmium 67	167 **Er** Erbium 68	169 **Tm** Thulium 69	173 **Yb** Ytterbium 70	175 **Lu** Lutetium 71
232 **Th** Thorium 90	231 **Pa** Protactinium 91	238 **U** Uranium 92	237 **Np** Neptunium 93	244 **Pu** Plutonium 94	243 **Am** Americium 95	247 **Cm** Curium 96	247 **Bk** Berkelium 97	251 **Cf** Californium 98	252 **Es** Einsteinium 99	257 **Fm** Fermium 100	258 **Md** Mendelevium 101	259 **No** Nobelium 102	260 **Lr** Lawrencium 103

Key: a over **X** over b

a = relative atomic mass
X = atomic symbol
b = atomic (proton) number

The volume of one mole of any gas is $24\,dm^3$ at room temperature and pressure (r.t.p.).