



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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NAME

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COMBINED SCIENCE

0653/31

Paper 3 (Extended)

May/June 2010

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 soft pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

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.

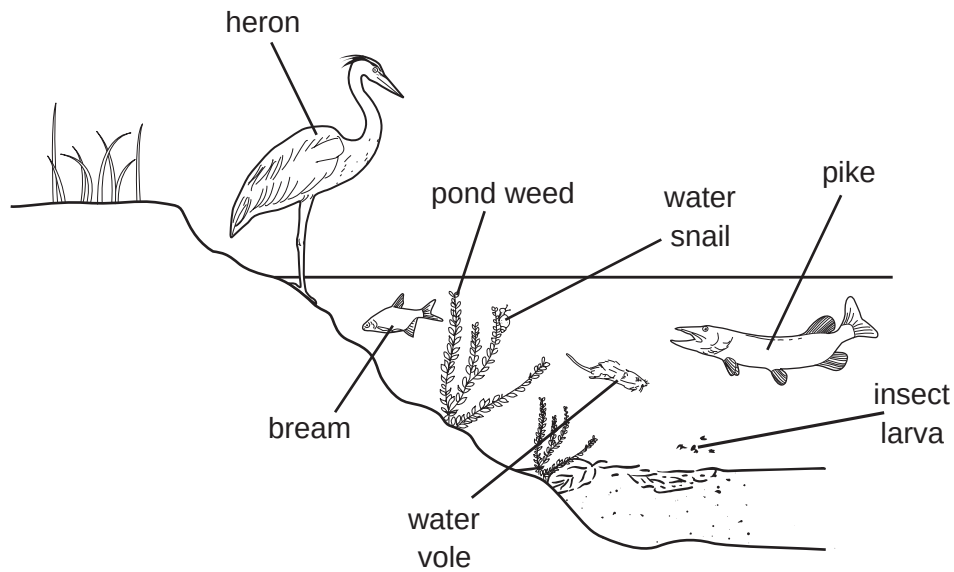
For Examiner's Use

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Total	

This document consists of **24** printed pages.



- 1 Fig. 1.1 shows some of the animals and plants that live in or close to a pond.



not to
scale

Fig. 1.1

- (a) Give the correct term for each of the following.

all the animals and plants that live in and around the pond

all the living things, and their environment, interacting with each other

[2]

- (b) The pond weed is a producer. Water snails and water voles are primary consumers. The heron and pike are secondary consumers.

Draw a food web that includes only these five organisms.

[3]

- (c) The pond is at the bottom of a sloping field which was ploughed.

During very heavy rain, a lot of soil from the field was washed into the pond. It made the water cloudy, and stopped the light from reaching the leaves of the water plants, so that the plants died.

After a while, the fish and other animals also died.

- (i) Give **two** reasons why the fish and other animals died.

1

.....

2

..... [2]

- (ii) Suggest **one** way in which the farmer could stop the soil erosion from the field.

.....

.....

..... [1]

- 2 (a) Fig. 2.1 shows a bicycle with a front lamp and a rear lamp powered by a battery.



Fig. 2.1

Fig. 2.2 shows how the lamps are connected.

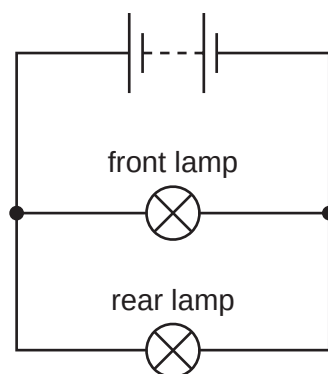


Fig. 2.2

- (i) What name is given to this type of circuit?

..... [1]

- (ii) The resistance of each lamp in the circuit is $4\ \Omega$.

Calculate the combined resistance of the two lamps.

State the formula that you use and show your working.

formula

working

..... [3]

- (b) Fig. 2.3 shows a metal nut on a bicycle wheel which is difficult to unscrew.

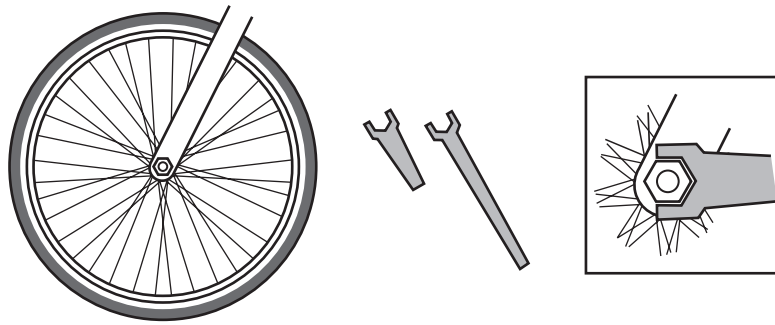


Fig. 2.3

Explain why a long spanner is better than a short spanner to unscrew the nut.

.....

.....

..... [2]

- (c) As the bicycle moves along the road at 4 m/s, the brakes are suddenly applied. The bicycle comes to a stop after 10 m. The average frictional force stopping the bicycle is 250 N. As the bicycle slows down, work is done.

Calculate the work done as the bicycle slows down from 4 m/s to a stop.

State the formula that you use and show your working.

formula

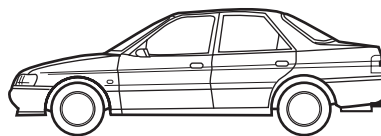
working

..... [2]

- 3 Aluminium, iron and sodium are metallic elements. Aluminium and iron are widely used in the production of many useful objects. No useful objects can be made out of metallic sodium.



aluminium alloys are
used in aircraft



iron is used to make
steel for cars

- (a) Use your knowledge of the alkali metals to state **one** reason why no useful objects can be made out of metallic sodium.

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

- (b) The diagram in Fig. 3.1 shows a cross section through a blast furnace in which iron is extracted from iron oxide.

Symbolic equations for three important chemical reactions which occur in the blast furnace are also shown in Fig. 3.1. **One** of these equations is not balanced.

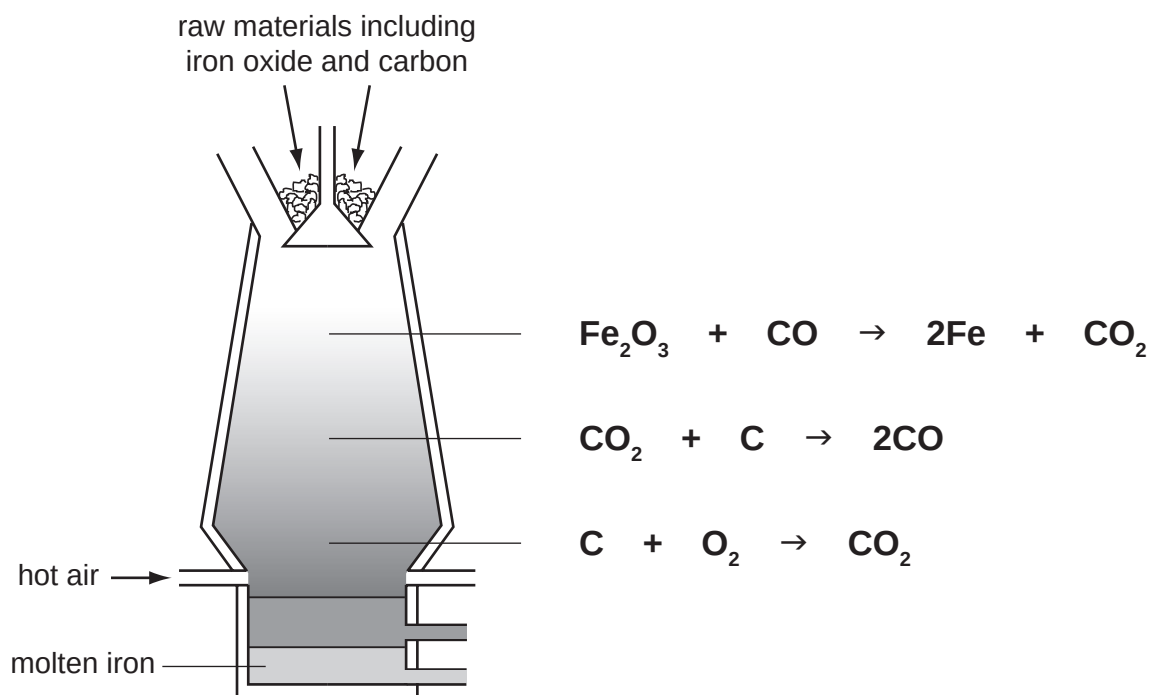


Fig. 3.1

- (i) Balance the incorrect equation in Fig. 3.1 by writing the required numbers in the equation on the diagram. [1]

- (ii) The three equations in Fig. 3.1 all represent redox reactions.

State **two** substances shown in Fig. 3.1 which have been **reduced**.

Explain your answer briefly.

.....

.....

..... [2]

- (c) Aluminium is produced from aluminium oxide using electrolysis as shown in Fig. 3.2.

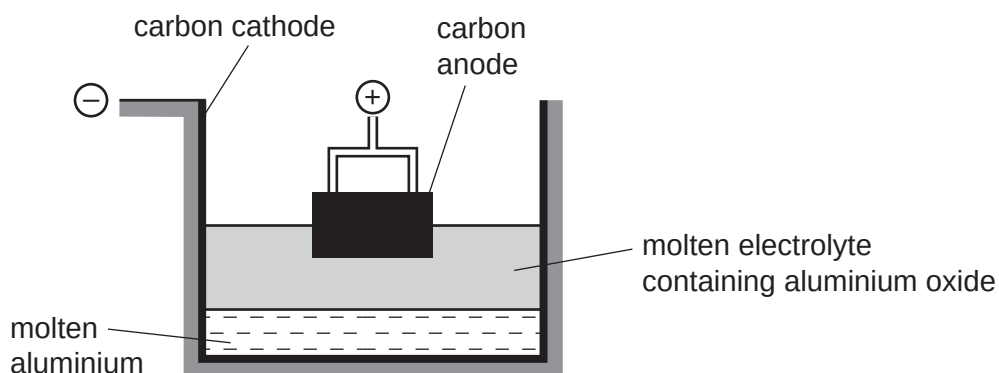


Fig. 3.2

- (i) The lining of the apparatus acts as the cathode in this process.

Describe what happens to aluminium ions when they meet the cathode surface.

.....

.....

..... [2]

- (ii) Explain why aluminium cannot be extracted in a blast furnace in the same way as iron.

.....

.....

..... [2]

- (iii) The chemical formula of aluminium oxide is Al_2O_3 and the electrical charge of an oxide ion is -2.

Deduce the electrical charge of an aluminium ion.

Explain your answer.

.....

.....

..... [2]

- 4 Fig. 4.1 shows samples of three of the elements in Group VII (Group 7) of the Periodic Table.

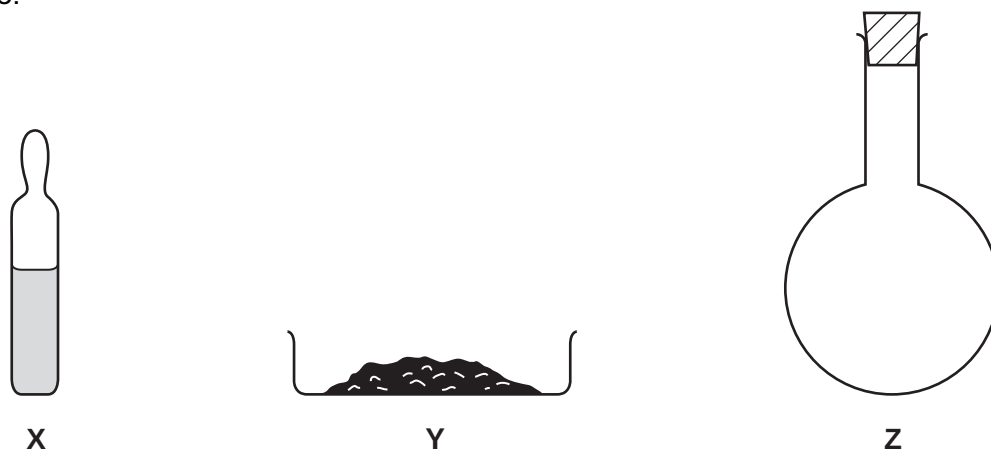


Fig. 4.1

- (a) The elements in Fig. 4.1 are at the same temperature. One element is a solid, one is a liquid and one is a gas.

(i) State which element, **X**, **Y** or **Z**, has the highest melting point. [1]

(ii) Suggest the names of the elements, **X**, **Y** and **Z**.

X

Y

Z [1]

- (b) An atom of fluorine has a proton (atomic) number of 9 and a nucleon (mass) number of 19.

(i) State the number of neutrons in one atom of fluorine.

..... [1]

(ii) Calculate the relative molecular mass of a fluorine molecule.

..... [1]

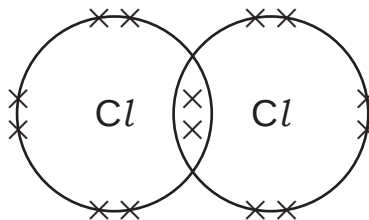
- (c) Hydrogen chloride gas may be produced by combining the gases hydrogen and chlorine.

- (i) Fig. 4.2 shows the chemical bonding in hydrogen and chlorine molecules.

In the space in Fig. 4.2 draw a similar diagram to show the bonding in one molecule of hydrogen chloride.



hydrogen molecule



chlorine molecule

hydrogen chloride molecule

Fig. 4.2

[2]

- (ii) Hydrochloric acid is produced when hydrogen chloride gas reacts with water.

Write the symbol and electrical charge of an ion which forms in the mixture when hydrogen chloride gas reacts with water.

..... [1]

- (d) A student is asked to try and produce some bromine by mixing two solutions from the list below.

potassium bromide

potassium chloride

potassium iodide

chlorine

iodine

When the student mixed her chosen solutions, she successfully produced bromine.

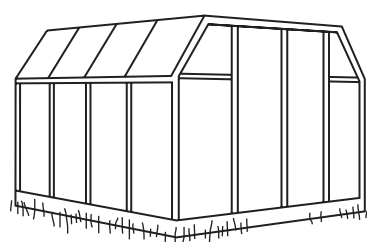
- (i) State which solutions the student chose.

..... [1]

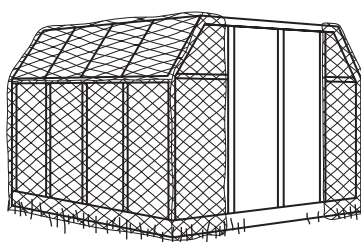
- (ii) Explain your answer to (i).

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

- 5 An investigation was carried out in Tamil Nadu, India, into the best conditions for growing tomatoes. The tomato plants were grown in unheated glasshouses or outside. Netting was used to provide shade in one of the glasshouses.



glasshouse A
no shade



glasshouse B
all four side walls shaded with netting



outside
no shade

In each glasshouse, and outside, the mean temperature in each month between January and October was measured. Fig. 5.1 shows the results.

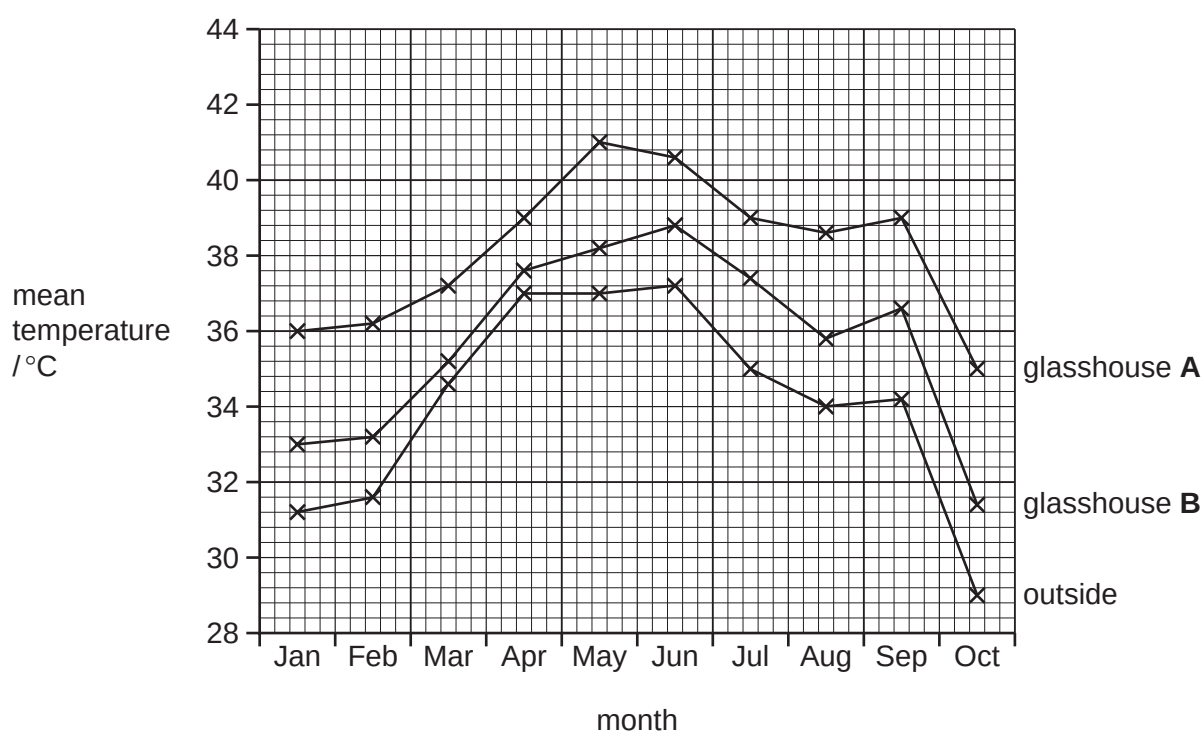


Fig. 5.1

- (a) State the month in which the highest mean temperature was reached in glasshouse A, ...
outside.

[1]

- (b) Light from the Sun passes through the glass of the glasshouse, into the air inside. Soil and other surfaces in the glasshouse re-emit some of this radiation as long wavelength, infra-red, radiation. Some of this radiation cannot pass through glass.

- (i) Use this information to explain why the air inside the glasshouses **became** warmer than the air outside.

.....

 [2]

- (ii) Use your knowledge of convection to explain why the air inside the glasshouses **stayed** warmer than the air outside.

.....

 [2]

- (c) Table 5.2 shows the mass of tomatoes produced by each plant in the two glasshouses and outside.

Table 5.2

	mass of tomatoes produced per plant / g
glasshouse A	1020
glasshouse B	2310
outside	1380

- (i) Tomatoes are a fruit, produced from the fertilised flowers of tomato plants. Tomato flowers are pollinated by bees.

Use the information in Fig. 5.1 to suggest why the plants produced more tomatoes in glasshouse **B** than in glasshouse **A**.

.....
 [2]

- (ii) Suggest **two** factors, other than temperature, that could be different in the glasshouses compared to outside, and that could have affected the results.

1
 2 [2]

- (d) (i) Tomato fruits are red and juicy. Explain how this helps tomato seeds dispersed away from the parent plant.

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

- (ii) Explain why it is useful to plants for their seeds to be dispersed away from the parent plant.

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

- 6 Fig.6.1 shows two dolphins communicating with each other using sound waves.



Fig. 6.1

- (a) Sound travels at 1500 m/s through water. It takes 0.5 seconds for the sound wave to travel from one dolphin to the other dolphin.

Calculate the distance between the two dolphins.

State the formula that you use and show your working.

formula

working

..... [2]

(b) Fig. 6.2 shows the motion of a dolphin travelling through water for 30 seconds.

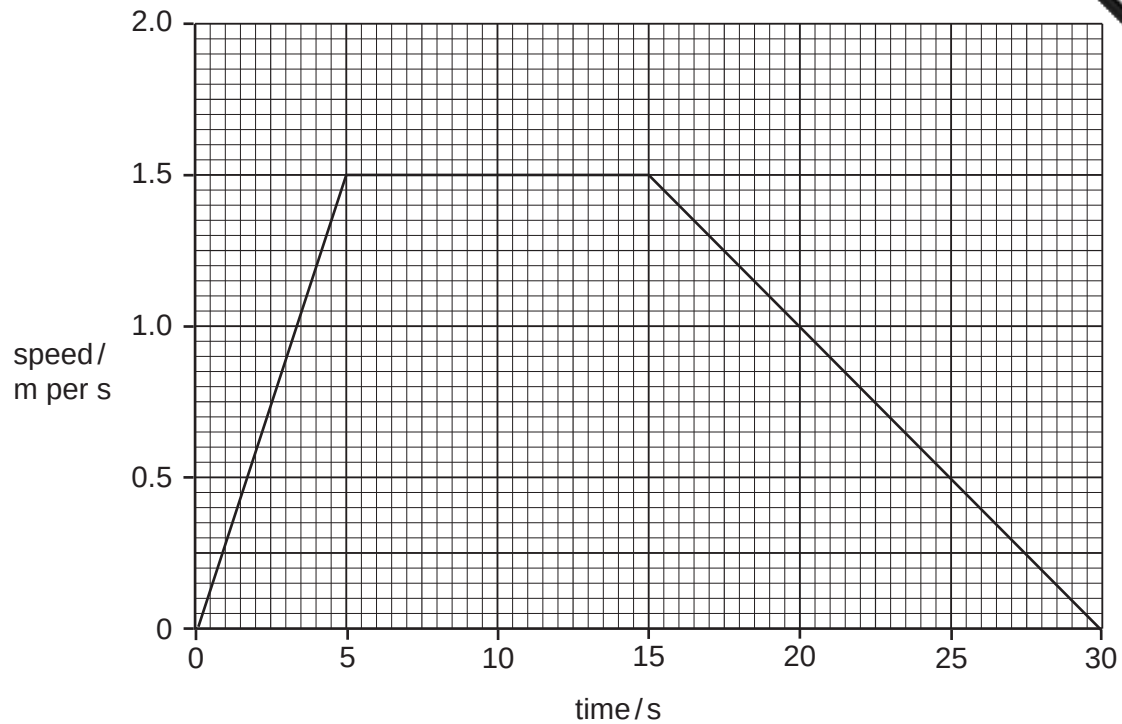


Fig. 6.2

(i) On the graph, use a letter **A** to label a period when the dolphin was accelerating. [1]

(ii) Describe the motion of the dolphin between 5 and 15 seconds.

..... [1]

(iii) Calculate the total distance travelled by the dolphin.

Show your working.

..... [2]

- (c) Rays of light from the Sun hit the surface of the water. Some light rays are refracted into the water and some are reflected. The incident and refracted rays are shown on the diagram in Fig. 6.3.

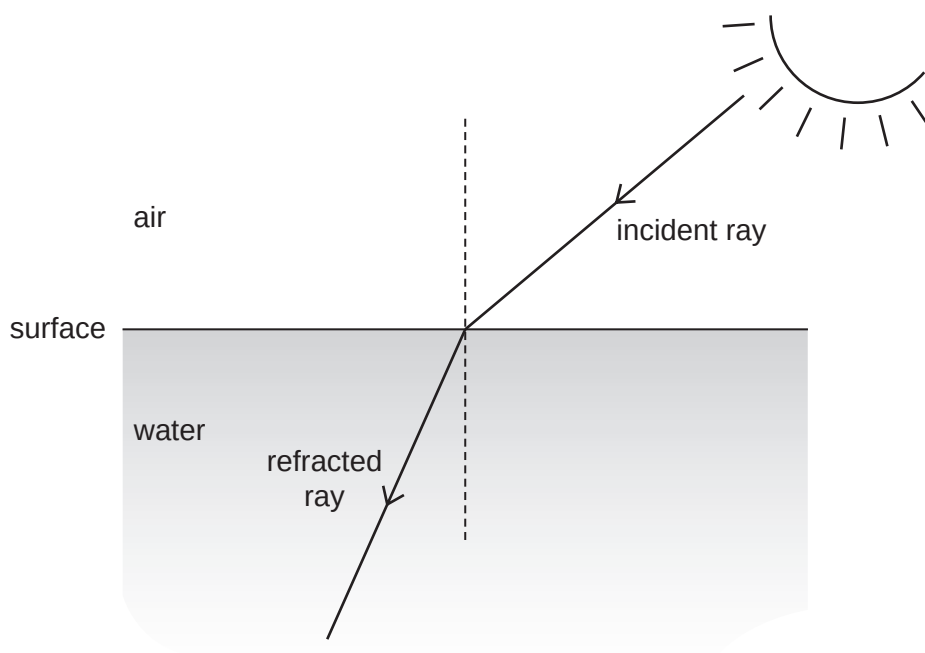


Fig. 6.3

- (i) On Fig. 6.3 use a ruler to draw a ray which is reflected from the surface. [1]
- (ii) Label clearly the angle of incidence, i , and angle of reflection, r . [1]

7 The skin helps to regulate the body temperature. This is an important part of homeostasis.

(a) The skin is an organ.

Explain the meaning of the term *organ*.

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

(b) Fig. 7.1 shows the skin when the body is too cold and when it is too hot.

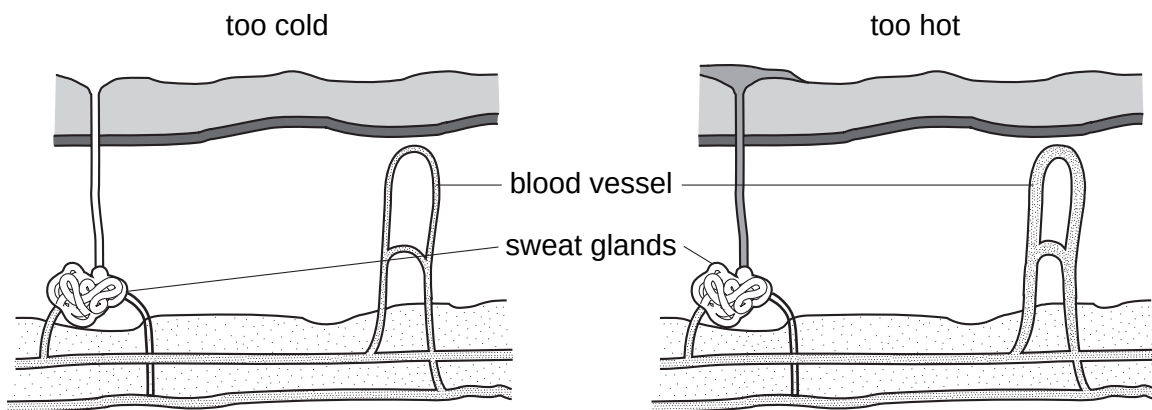


Fig. 7.1

Explain how each of the changes shown in Fig. 7.1 helps the body to cool down when it is too hot.

(i) the change in the activity of the sweat gland

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

(ii) the change in the width of the blood vessels

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

(c) Another example of homeostasis is keeping the blood sugar level constant.

(i) Name the sugar that is transported in the blood.

..... [1]

(ii) Name the hormone that reduces the blood sugar level if it gets too high.

..... [1]

(iii) Suggest why it is harmful to the body if the blood sugar level falls very low.

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

- 8 The bar charts in Fig. 8.1 show the approximate percentages of the main gases in the atmospheres of three planets, **X**, **Y** and **Z**, in our solar system.

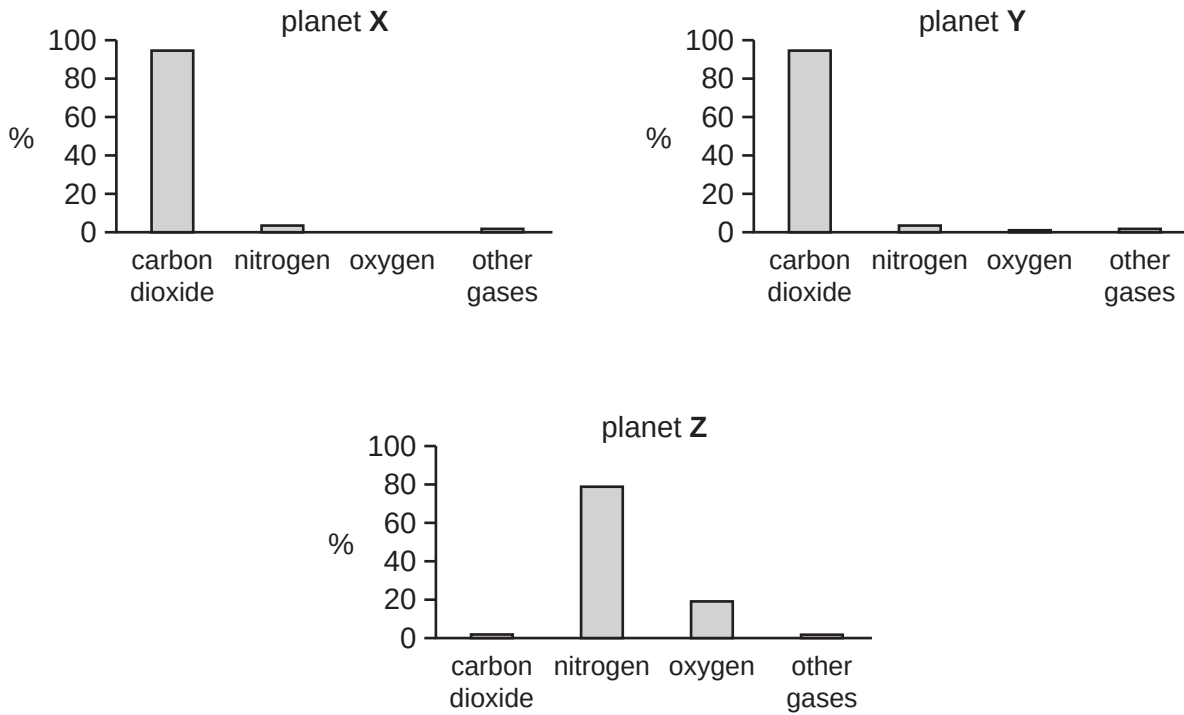


Fig. 8.1

- (a) (i) Explain briefly how the information in Fig. 8.1 shows that planet **Y** is **not** the Earth.

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

- (ii) Name **one** of the 'other gases' in unpolluted air on the Earth.

..... [1]

- (b) Fig. 8.2 shows apparatus which can be used to measure the percentage of oxygen in the atmosphere of planet Z.

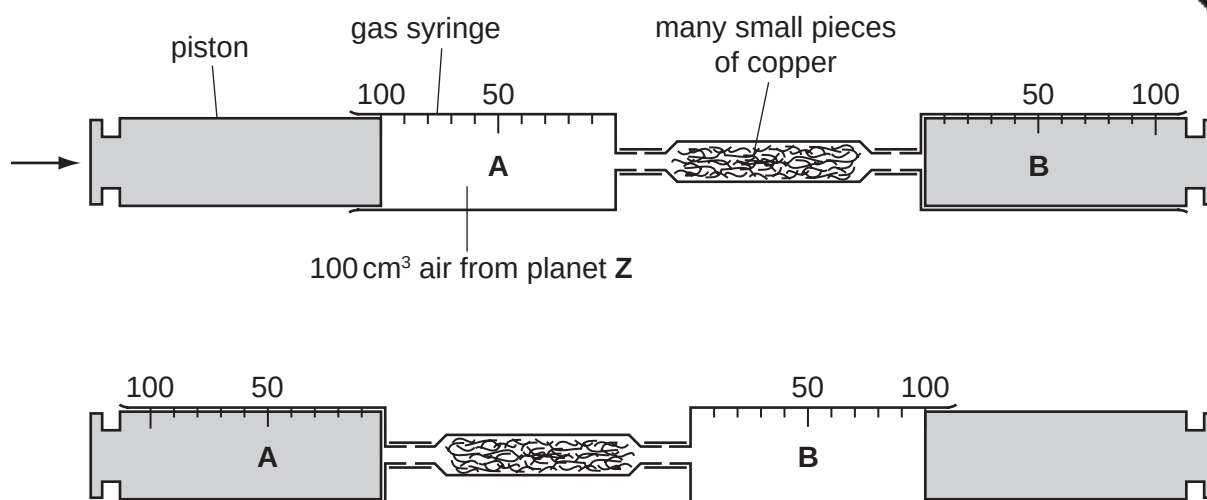


Fig. 8.2

When the piston of gas syringe **A** is pushed in the direction of the arrow, the air flows through the pieces of copper into syringe **B**. The lower diagram in Fig. 8.2 shows how the apparatus appears when this is done.

The pieces of copper are then heated very strongly. The air is pushed many times between **A** and **B** over the hot copper. The copper reacts with all the oxygen in the air.

The apparatus is then allowed to cool to room temperature.

- (i) Predict the volume of gas which remains in the apparatus at the end of the experiment.

Explain your answer.

volume

explanation

.....

.....

.....

[3]

- (ii) In the experiment, many small pieces of copper, rather than a single large piece, are used.

Explain, in terms of particles, the effect this has on the rate of the oxidation reaction.

.....

.....

.....

..... [3]

9 (a) Alpha, beta and gamma are three types of radiation emitted during radioactive decay.

(i) State the meaning of the term *radioactive decay*.

..... [1]

(ii) Alpha radiation is described as ionising radiation.

Explain the meaning of the term *ionising radiation*.

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

(b) (i) Explain why alpha radiation is deflected by an electric field but gamma radiation is not.

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

(ii) Explain why beta radiation is deflected the opposite way to alpha radiation by an electric field.

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

(iii) Explain why it is more dangerous to swallow a substance that emits alpha radiation than one that emits gamma radiation.

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

(c) We are exposed to radiation all the time and we receive it in various ways.

What name is given to the radiation that is around us all the time?

..... [1]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
												1 H Hydrogen 1					
7 Li Lithium 3	9 Be Beryllium 4																
23 Na Sodium 11	24 Mg Magnesium 12																
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	101 Ru Ruthenium 44	101 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	127 Te Tellurium 52	128 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	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															
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14713-1																	

Key

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

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).



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COMBINED SCIENCE

0653/32

Paper 3 (Extended)

May/June 2010

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 soft pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **20** printed pages.



1 (a) Fig. 1.1 shows four fruits.

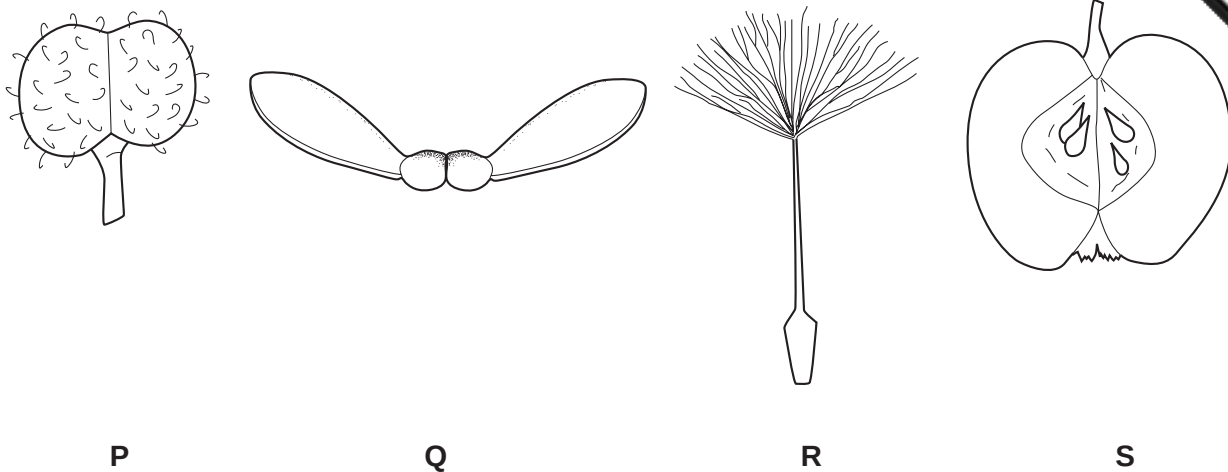


Fig. 1.1

(i) Give the letters of **two** fruits which are adapted for wind dispersal.

..... and [1]

(ii) Name the part of a flower from which the fruit develops. [1]

(iii) Explain the importance of fruits in the life cycle of a plant.

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

(b) Cacao trees produce many pink and white flowers from which the fruits develop. The seeds inside the pods (fruits) are used to make chocolate.

Wild cacao trees grow in rainforests in warm, humid climates. Most kinds of trees cultivated by humans, such as rubber trees or oil palms, grow best on cleared land, but cacao trees grow best underneath other rainforest trees. Most cacao trees are grown without the use of fertilisers or pesticides.

(i) Suggest how the flowers of the cacao tree are pollinated, giving a reason for your answer.

..... [1]

- (ii) Explain why cultivating cacao trees may cause less damage to rainforests than cultivating other trees.

.....

.....

.....

.....

.....

..... [3]

- 2 (a) A teacher placed a small piece of potassium into a container filled with chlorine gas.

Fig. 2.1 shows what the class observed.

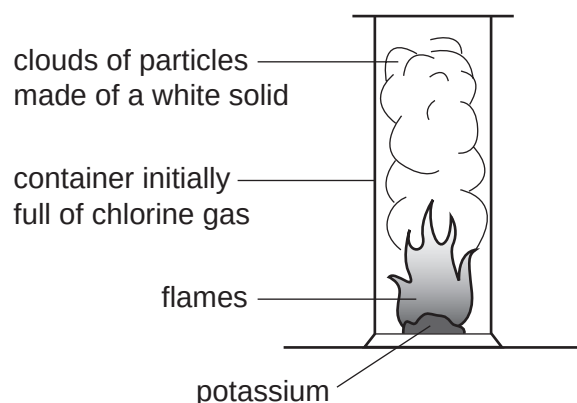


Fig. 2.1

- (i) Suggest the name of the white solid formed when potassium and chlorine react.

[1]

- (ii) Fig. 2.2 shows a potassium atom and a chlorine atom.

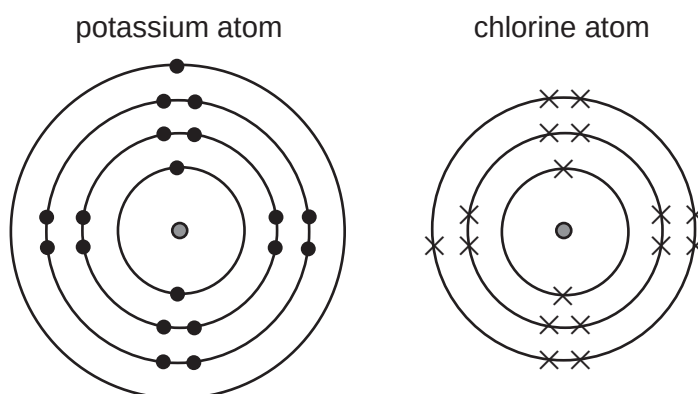


Fig. 2.2

Describe and explain, in terms of electronic structures, what happens when potassium and chlorine atoms react with each other. You may draw diagrams in the space below if it helps you to answer the question.

.....
.....
.....
..... [4]

(b) Metallic potassium can be produced by electrolysis of molten potassium chloride. In this process, potassium forms at the cathode.

(i) Explain why potassium ions travel to the cathode and **not** the anode during electrolysis.

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

(ii) Describe, in terms of electrons, what happens when potassium ions collide with the surface of the cathode.

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

- 3 (a) Fig. 3.1 shows an astronaut on a space walk. His space suit is designed to protect him from dangerous electromagnetic radiation from the Sun reaching the astronaut's body.

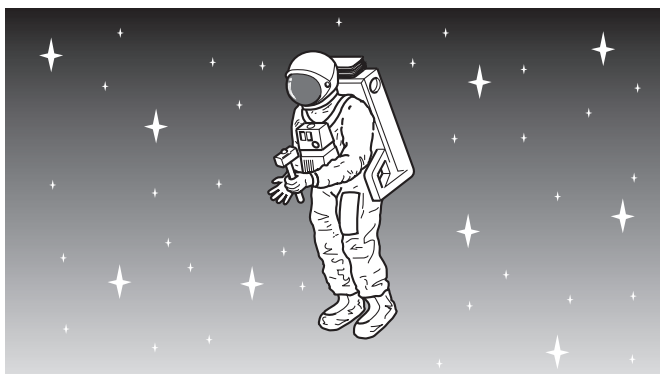


Fig. 3.1

- (i) Name **two** types of electromagnetic radiation that can harm the body.

1 2 [1]

- (ii) State **one** way in which electromagnetic radiation can harm the body.

..... [1]

- (iii) All electromagnetic waves travel at the same speed. What is the value of this speed?

..... [1]

- (b) The astronaut has a mass of 96 kg. The gravitational field strength on the Moon is about one sixth of that on the Earth.

State the difference, if any, between

- (i) the mass of the astronaut on the Earth and on the Moon,

..... [1]

- (ii) the weight of the astronaut on the Earth and on the Moon.

..... [1]

- (c) The astronaut stands on the surface of the Moon and drops a ball. The graph in Fig. 3.2 shows the speed of the ball over a period of 1.6 seconds.

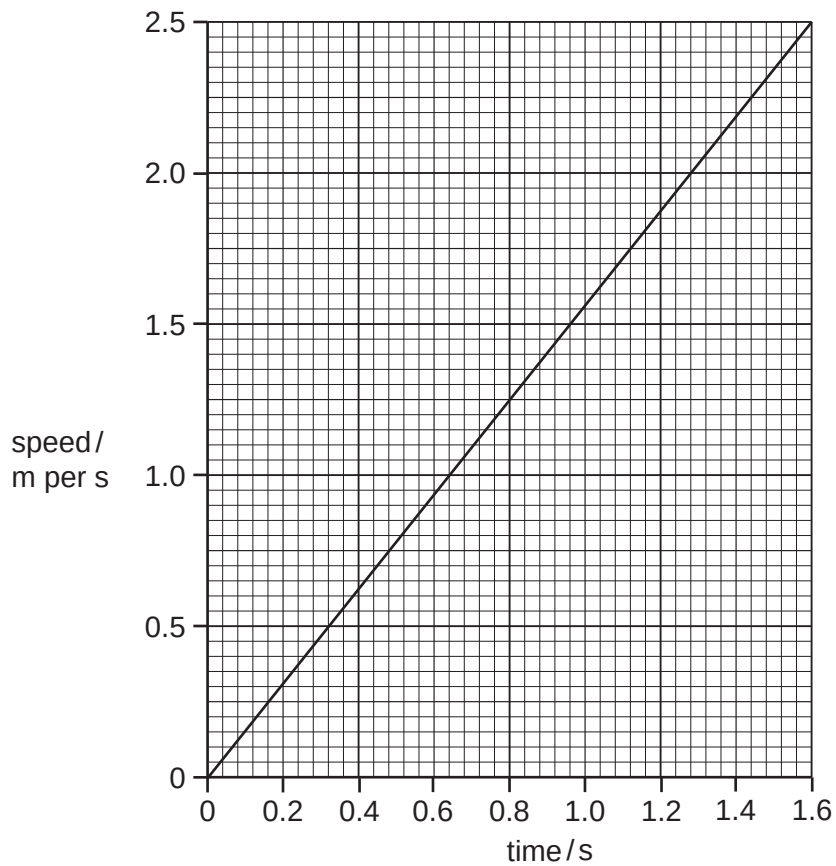


Fig. 3.2

- (i) On the same graph, sketch a line to show the speed of the same ball if it was dropped on Earth. [1]
- (ii) Explain your answer to (c)(i).

.....

..... [1]

(d) A rock on the Moon weighs 6 N. The astronaut lifts it up by 2 metres.

(i) Calculate the work done on the rock.

State the formula that you use and show your working.

formula

working

..... [2]

(ii) If the rock was lifted in 2 seconds, calculate the power used.

State the formula that you use and show your working.

formula

working

..... [2]

- 4 Fig. 4.1 shows a section through a human heart, seen from the front.

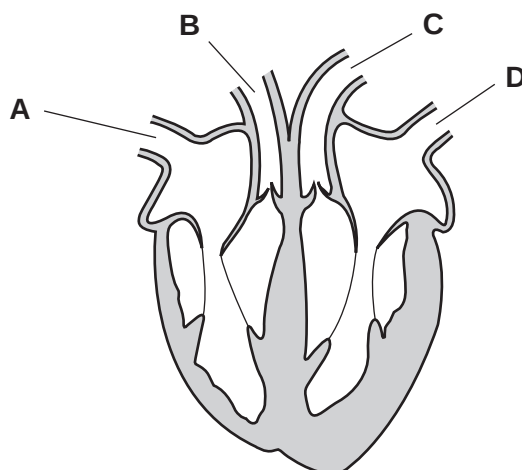


Fig. 4.1

- (a) (i) Name the type of tissue found in the walls of the heart, as shown in the shaded parts in Fig. 4.1.

..... [1]

- (ii) Describe how this tissue is supplied with oxygen.

.....

 [2]

- (iii) Give the letters of the **two** labelled blood vessels that contain oxygenated blood.

..... and [1]

- (b) Plants also have transport systems in which liquids flow through vessels. However, they do not have a pump like the heart.

- (i) Explain what makes water flow up through the xylem vessels in a plant.

.....

 [2]

- (ii) Describe how sugars, made in a plant's leaves, are transported to its roots.

.....

 [2]

- 5 (a) Some fuels are listed below.

animal dung

coal

wood

State **one** reason why coal is an example of a fossil fuel whereas the other two are not.

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

- (b) Fig. 5.1 shows a simplified diagram of fractional distillation and catalytic cracking which are both carried out at an oil refinery. Compounds leaving the fractional distillation column at **M** move into the catalytic cracker.

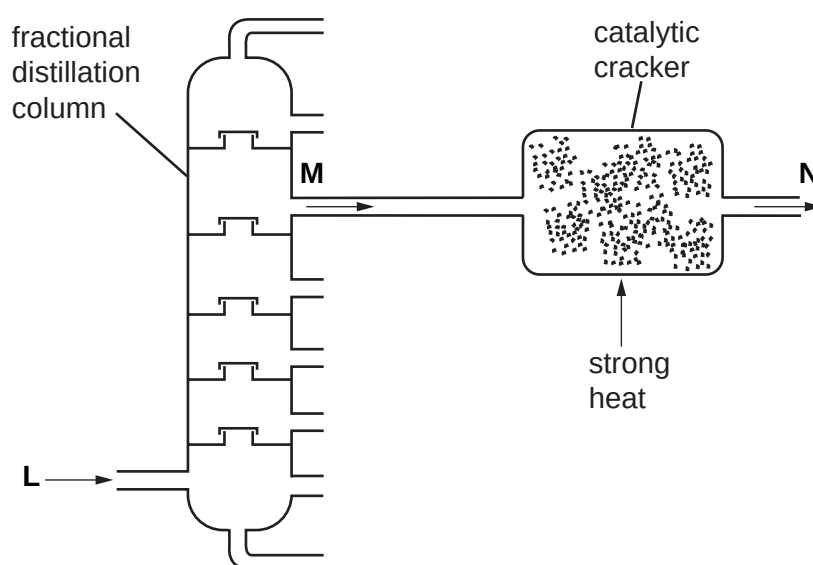


Fig. 5.1

- (i) Name the raw material which enters at **L**. [1]
- (ii) Describe briefly **two** ways, other than colour and odour, in which the mixture of compounds at **M** differs from the mixture of compounds at **L**.
.....
.....
..... [2]
- (iii) Describe briefly **two** ways in which the mixture of compounds at **N** differs from the mixture of compounds at **M**.

- 1
2 [2]

- (iv) Some of the compounds in the mixture at **N** can be used in a process called addition polymerisation.

Explain why addition polymers can be made from molecules in the mixture at **N** but not from molecules in the mixture at **M**.

You may draw a diagram if it helps you to answer this question.

.....

.....

..... [2]

- (c) A student investigated the combustion products of the liquid fuel ethanol.

He observed that a gas and a colourless liquid were produced.

- (i) The student applied a chemical test to the colourless liquid and found that it was water.

Describe a suitable chemical test for water and its result.

.....

.....

..... [2]

- (ii) Complete the equation below for the combustion of ethanol.



- 6 Fig. 6.1 shows a cube.

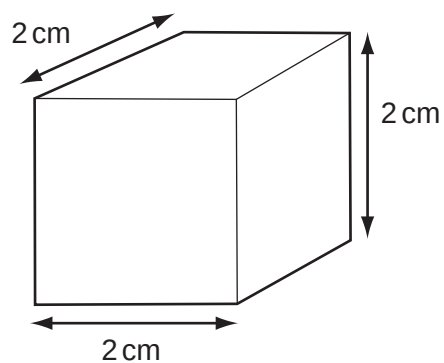


Fig. 6.1

- (a) The mass of the cube is 21.6 g.

Calculate the density of the cube.

State the formula that you use and show your working.

formula

working

..... [3]

- (b) The solid cube is made up of very small particles. Fig. 6.2 shows their arrangement.

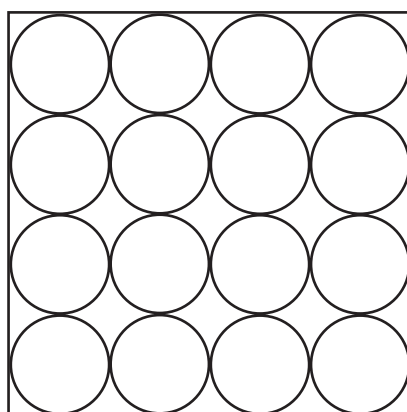
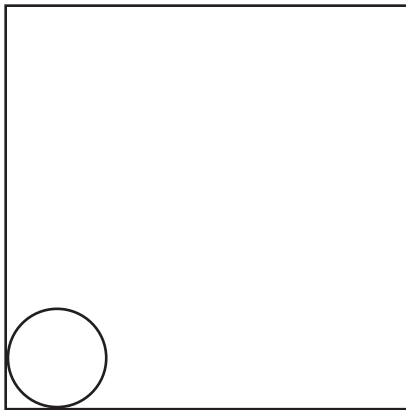
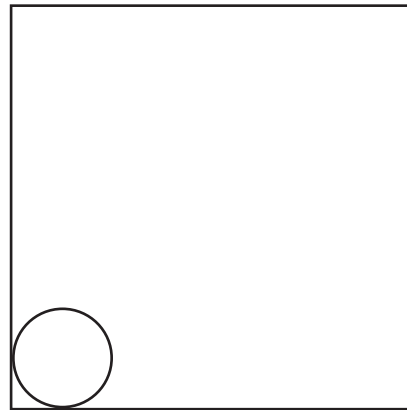


Fig. 6.2

- (i) Complete the diagrams below to show the arrangement of particles in a liquid and in a gas.



liquid



gas

[2]

- (ii) Explain your answer to (b)(i) in terms of forces between particles.

.....

 [2]

- (c) Explain, in terms of particles, why a solid expands when heated.

.....

 [1]

- (d) Describe **one** problem caused by a solid metal expanding when it gets hot.

.....

 [2]

- 7 (a) A student peeled a layer of cells from the inside of an onion bulb. He placed a drop of water on a microscope slide and covered them with a coverslip.

Fig. 7.1 shows what he saw when viewing the cells through a microscope.

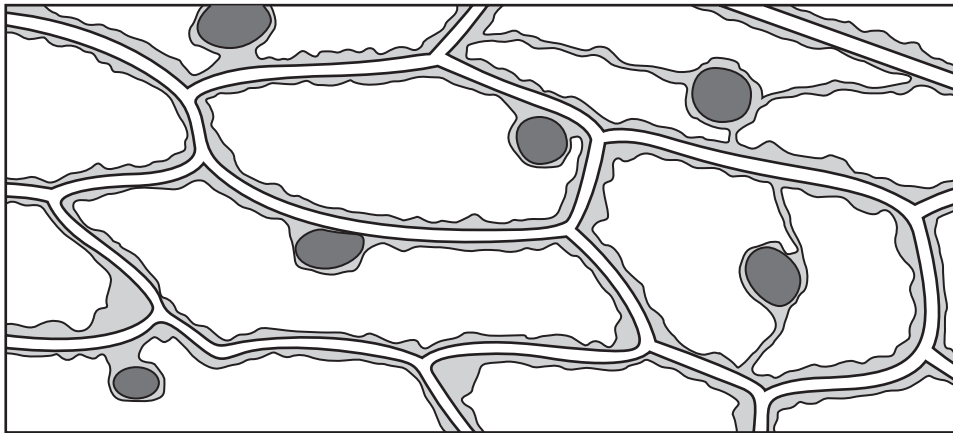


Fig. 7.1

- (i) The cells in Fig. 7.1 are similar to each other.

Give the name for a group of similar cells.

.....

[1]

- (ii) State **two** ways in which the cells in Fig. 7.1 differ from animal cells.

1

2 [2]

- (b) The student replaced the water on the slide with a drop of concentrated sugar solution. He waited for five minutes and then looked at the cells through the microscope again.

Fig. 7.2 shows what he saw.

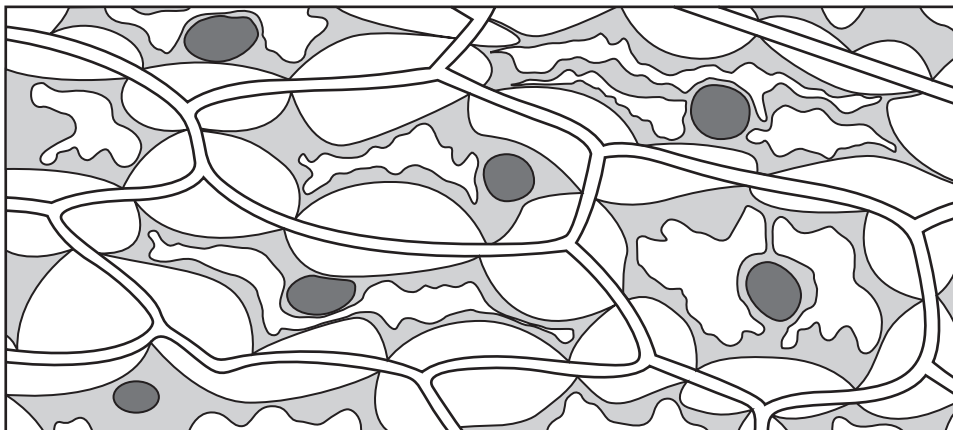


Fig. 7.2

- (i) On Fig. 7.2, label a partially permeable membrane.
- (ii) Using your knowledge of osmosis, explain what has happened to the cell in Fig. 7.2.

.....

.....

.....

.....

..... [3]

- (c) Onion cells often contain stores of starch. When a person eats an onion, the starch is digested.

Describe how starch is digested in the human alimentary canal.

.....

.....

.....

..... [3]

- 8 (a) A student used the apparatus in Fig. 8.1 to investigate the rate of a reaction.

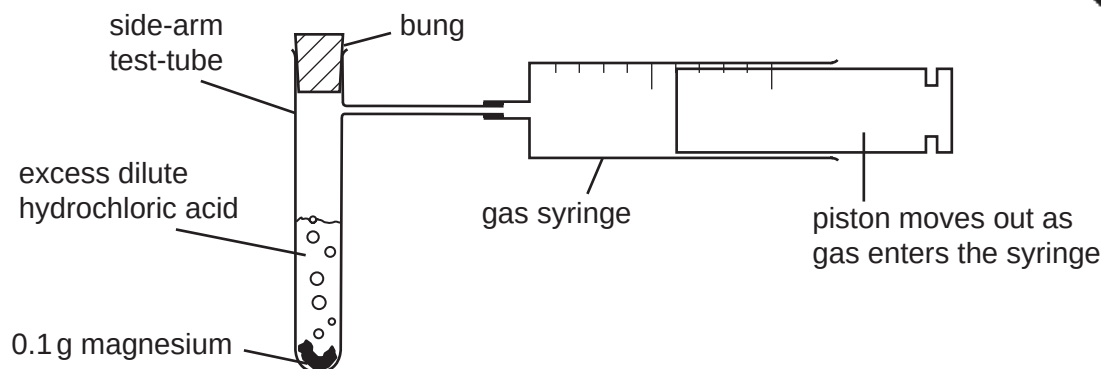


Fig. 8.1

The student dropped the magnesium into the acid contained in the side-arm test-tube and put in the bung. A stopwatch was used to time how long it took for 50 cm^3 of gas to collect in the syringe.

The student carried out four experiments **A**, **B**, **C** and **D**, and the results are shown in Table 8.1.

Table 8.1

experiment	time for 50 cm^3 of gas to collect in the gas syringe / seconds
A	36
B	18
C	144
D	72

- (i) Explain how the results show that experiment **B** had a higher rate of reaction than experiment **A**.

.....
[1]

- (ii) The only variable (factor) which was different between the four experiments **A**, **B**, **C** and **D** was the concentration of the dilute hydrochloric acid.

Using the letters **A**, **B**, **C** and **D**, list the experiments in order of decreasing acid concentration.

..... (highest concentration)

.....

.....

..... (lowest concentration)

[1]

- (iii) Fig. 8.2 shows a piece of magnesium in a beaker of dilute hydrochloric acid. Hydrogen ions, present in all aqueous acids, are shown by the symbol $\bullet$.

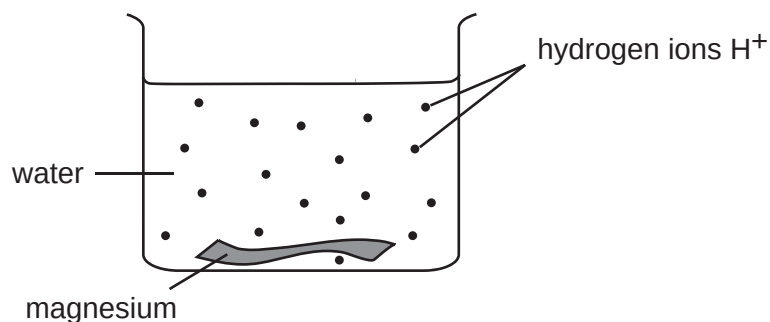


Fig. 8.2

Explain, in terms of ions, why the rate of reaction will change when the concentration of the acid is changed.

.....

.....

.....

.....

.....

..... [3]

- (b) Magnesium reacts with hydrochloric acid to form magnesium chloride and hydrogen gas.

The chemical formula for magnesium chloride is $MgCl_2$. Use the Periodic Table on page 20 to calculate the relative formula mass of magnesium chloride.

Show your working.

..... [2]

- 9 (a) Fig. 9.1 shows a teacher with a torch (flash light). He switches the torch on and points it at the mirror.



Fig. 9.1

A ray of light from the torch reflects off the mirror.

Use a ruler to draw a ray of light

- (i) from the torch to the mirror,
 - (ii) reflecting off the mirror. [2]
- (b) A torch contains two cells providing a total voltage of 3.0 V across the lamp. When the torch is lit, the current flowing through the lamp is 0.3 A .
- (i) Calculate the resistance of the lamp.

State the formula that you use and show your working.

formula

working

..... [2]

- (ii) To measure the current through the lamp and the voltage across the lamp, the student set up the circuit in Fig. 9.2.

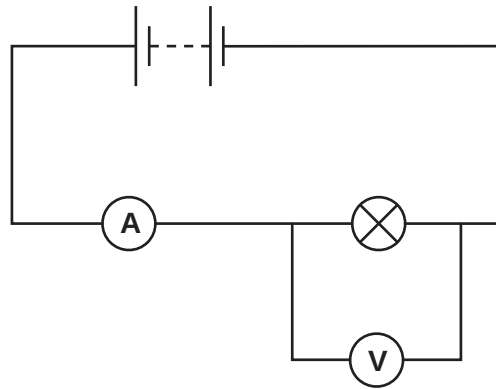


Fig. 9.2

The student sketched a graph of current against voltage for the lamp. This is shown in Fig. 9.3.

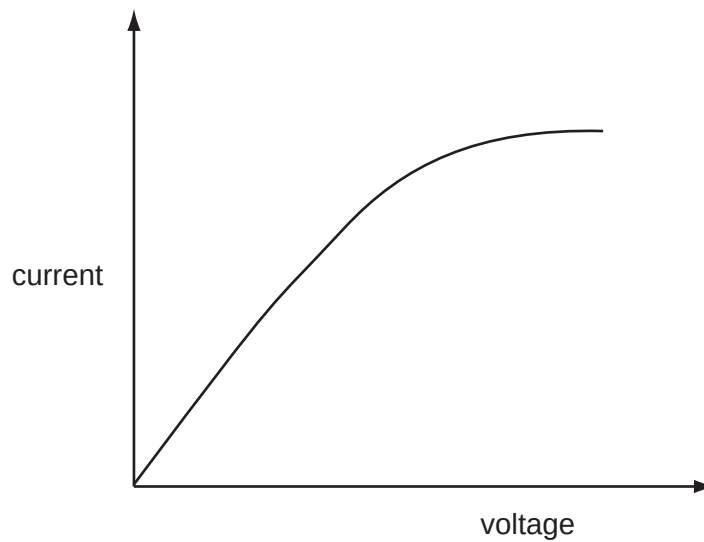


Fig. 9.3

Does the lamp obey Ohms Law?

Explain your answer.

.....
 [2]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
												1 H Hydrogen 1					
7 Li Lithium 3	9 Be Beryllium 4																
23 Na Sodium 11	24 Mg Magnesium 12																
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	101 Ru Ruthenium 44	101 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	127 Te Tellurium 52	131 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	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															
58-71 Lanthanoid series																	
90-103 Actinoid series																	
175 Lu Lutetium 71																	
173 Yb Ytterbium 70																	
169 Tm Thulium 69																	
167 Er Erbium 68																	
165 Ho Holmium 67																	
162 Dy Dysprosium 66																	
159 Tb Terbium 65																	
157 Gd Gadolinium 64																	
152 Eu Europium 63																	
150 Sm Samarium 62																	
144 Nd Neodymium 60																	
141 Pr Praseodymium 59																	
140 Ce Cerium 58																	
238 U Uranium 92																	
238 Pa Protactinium 91																	
232 Th Thorium 90																	
238 Np Neptunium 93																	
238 Pu Plutonium 94																	
238 Am Americium 95																	
238 Cm Curium 96																	
238 Bk Berkelium 97																	
238 Cf Californium 98																	
238 Es Einsteinium 99																	
238 Fm Fermium 100																	
238 Md Mendelevium 101																	
238 No Nobelium 102																	
238 Lr Lawrencium 103																	

a

X

b

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

Key

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

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).