UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0215700912

COMBINED SCIENCE **0653/32**

Paper 3 (Extended) **May/June 2013**

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 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.

UNIVERSITY of CAMBRIDGE International Examinations

For Examiner's Use

1 Most of the elements in the Periodic Table can be classified as either metals or non-metals.

Fig. 1.1 shows the elements in Group 4 of the Periodic Table.

carbon
silicon
germanium
tin
lead

Fig. 1.1

(a) (i) Use the classification of metal or non-metal to describe how the Group 4 elements differ from both Group 1 (alkali metals) and Group 7 (halogens).

.....

.....

..... [2]

(ii) Francium and astatine are rare elements which are placed respectively in Group 1 and Group 7 of the Periodic Table.

Predict how the melting points of francium and astatine differ from the other elements in their respective groups.

Explain your predictions briefly.

.....

.....

..... [2]

For Examiner's Use

(b) Fig. 1.2 shows apparatus used to carry out a redox reaction to extract lead from lead oxide, PbO.

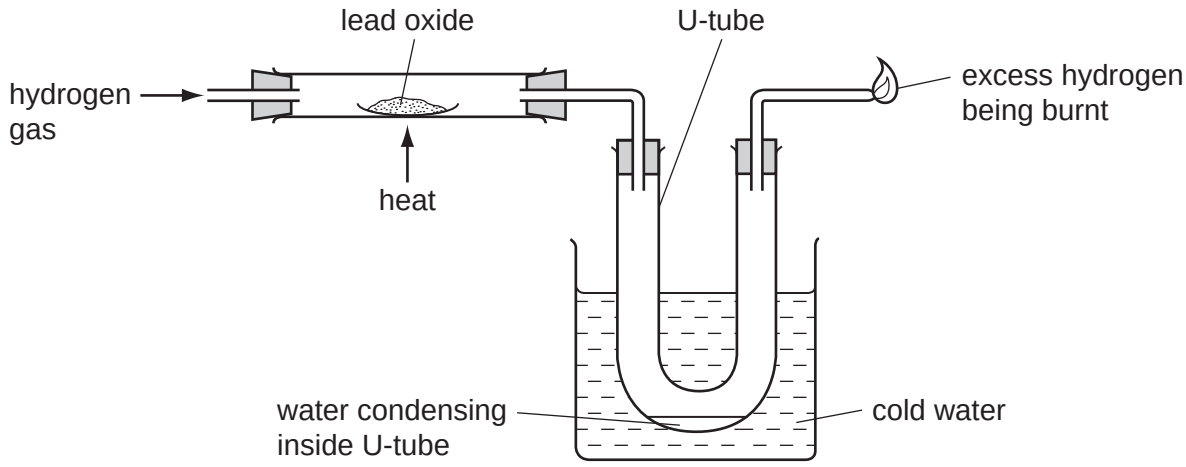


Fig. 1.2

(i) Describe a chemical test and its result which would confirm that the liquid condensing inside the U-tube is water.

.....

.....

..... [2]

(ii) Construct a balanced symbolic equation for the reaction between hydrogen and lead oxide.

..... [2]

(iii) Suggest why the method shown in Fig. 1.2 could **not** be used to extract calcium from calcium oxide.

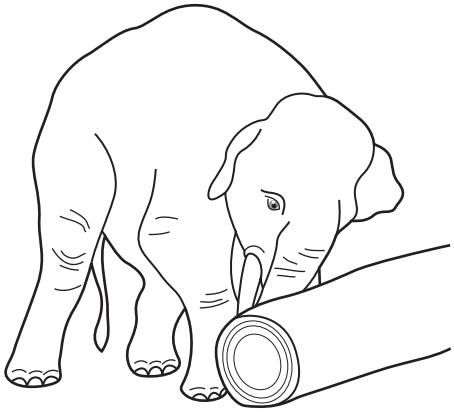
.....

.....

..... [2]

For Examiner's Use

2 **(a)** An elephant of mass 5000 kg exerts a constant force of 1400 N to push a tree trunk along at a steady speed of 1.5 m / s.



(i) Calculate the work done by the elephant when the tree trunk moves 10 m.

State the formula that you use and show your working.

formula

working

..... [2]

(ii) Calculate the kinetic energy of the elephant when it is moving at 1.5 m / s.

State the formula that you use and show your working.

formula

working

..... [2]

(b) The volume of the elephant is $5\,m^3$. Its mass is 5000 kg.

Calculate the density of the elephant.

State the formula that you use and show your working.

formula

working

..... [2]

(c) An elephant can communicate with other elephants using infrasound. This is a very low frequency vibration which it is usually impossible for a human to hear.

(i) Suggest a possible frequency for this vibration and explain why you chose your answer.

frequency ..... Hz

explanation .....

..... [2]

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

.....

..... [1]

(iii) Other animals can communicate using ultrasound.

Suggest how ultrasound differs from infrasound.

.....

..... [1]

[Turn over

For Examiner's Use

3 A pea seed was planted in a pot. When the seed had grown into a young plant, the pot was placed on its side, in a room where light was coming from all sides.

Fig. 3.1 shows the young pea plant three days after the pot had been placed on its side.

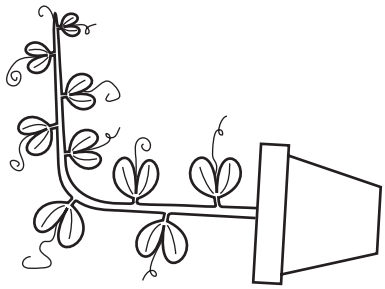


Fig. 3.1

(a) (i) Name the response shown by the pea plant in Fig. 3.1.

.....[1]

(ii) Suggest how this response will help the plant to reproduce sexually when it has grown to maturity.

.....

.....

.....[2]

(b) On one of the days when the pot was placed on its side, a scientist measured

- the increase in length of the upper surface and the lower surface of the stem of the pea plant,
- the concentration of auxin in the cells on the upper surface and lower surface of the stem of the pea plant.

His results are shown in Fig. 3.2.

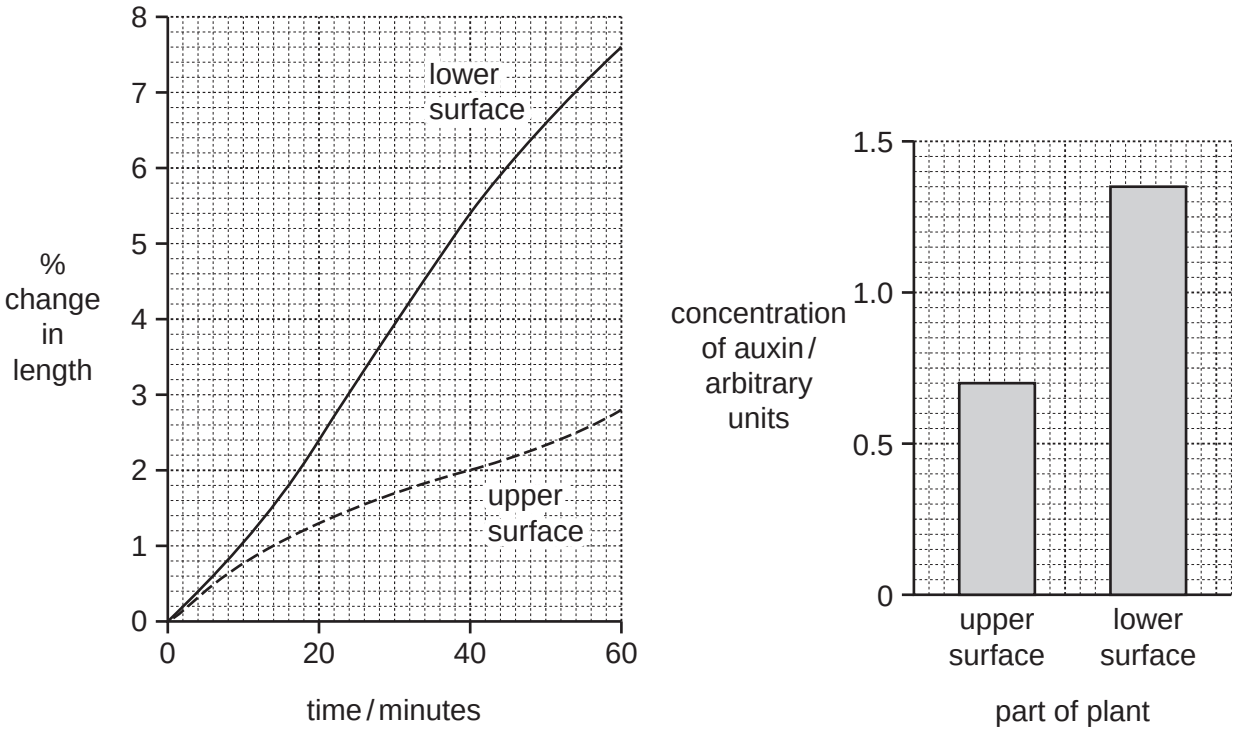


Fig. 3.2

Use the results in Fig. 3.2 to explain what has caused the stem of the pea plant to grow upwards.

.....

.....

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.....

..... [3]

4 Fig. 4.1 shows a microwave oven.

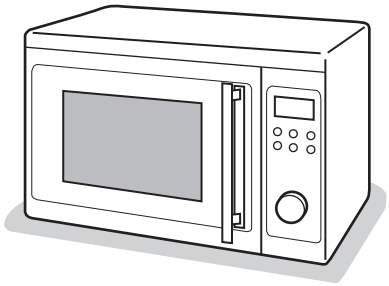

Fig. 4.1

(a) (i) Microwaves cook food by transferring energy to the food.

Choose words from the list to complete the sentences below. You may use each word once, more than once, or not at all.

chemical	**conduction**	**convection**
potential	**radiation**	**thermal**

Microwaves are absorbed by the outer layers of food.

The microwave energy is transferred to water and fat molecules in these layers, increasing the ..... energy of these layers.

..... energy is mostly transferred to the centre of solid food by ..... . [2]

(ii) State **one** use for microwaves other than cooking.

..... [1]

(b) The following label is found on a cooker that combines a microwave oven and a grill.

voltage	220 V
microwave oven power	0.60 kW
grill power	1.20 kW

Some meat is cooked using both the microwave oven and the grill. Both are switched on at full power for 30 minutes.

Calculate the total energy transferred by the cooker.

Show your working.

..... [3]

(c) Electrical lighting is now being designed so that it is more efficient and can operate using less electrical energy.

Explain why reducing the amount of energy used by electrical lighting could reduce the amount of carbon dioxide emitted into the atmosphere.

.....

.....

.....

..... [2]

[Turn over

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5 **(a)** When sodium is burned in air, a mixture of solid products, which contains the ionic compound sodium oxide, is produced.

Fig. 5.1 shows diagrams of a sodium atom and an oxygen atom as they exist just before sodium oxide starts to form.

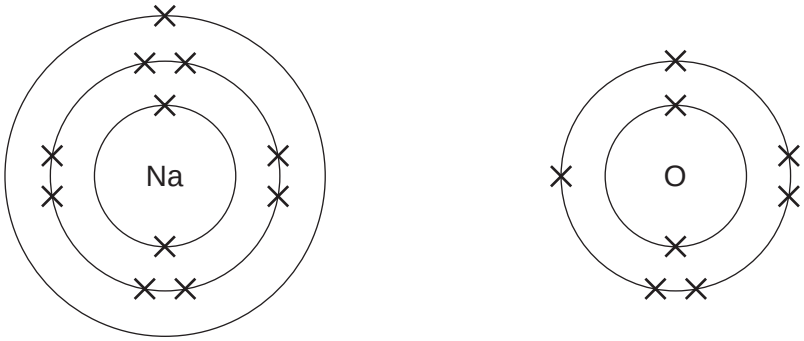

Fig. 5.1

Describe how sodium and oxygen atoms become bonded together. Your answer should explain why the formula of sodium oxide is Na_2O.

.....

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.....

..... [3]

(b) Fig. 5.2 shows apparatus a student used to investigate the electrolysis of dilute sulfuric acid.

For Examiner's Use

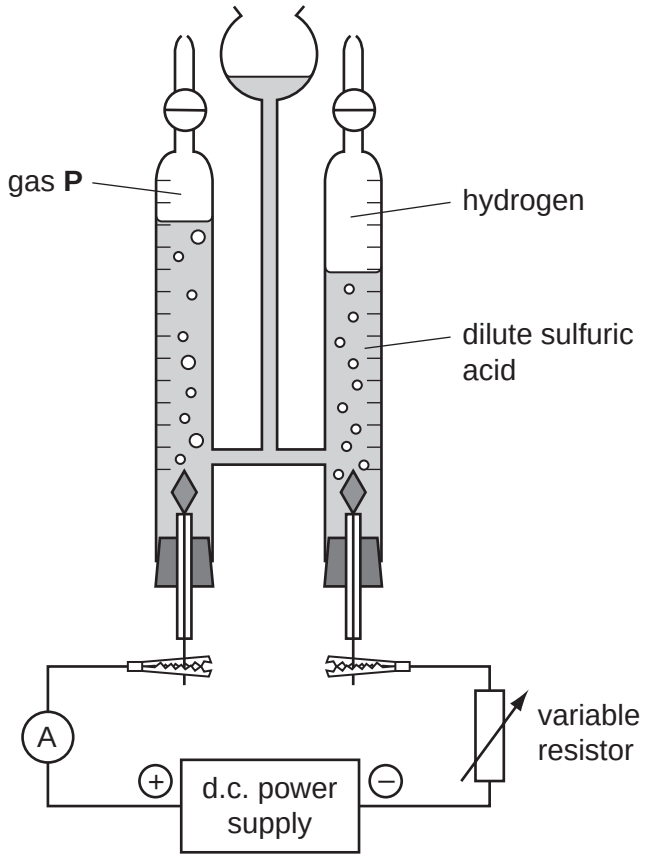

Fig. 5.2

The variable resistor was included in the electrolysis circuit so that the student could alter the current.

Table 5.1 shows some of the measurements the student made in his investigation.

Table 5.1

experiment number	current / A	time current was passed / seconds	volume of hydrogen collected / cm^3
1	0.48	400	24
2	0.24	400	12

(i) The student thought that gas **P** could be oxygen.

Describe the test that the student should use to find out whether or not gas **P** is oxygen.

.....

..... [1]

For Examiner's Use

(ii) Calculate the rate at which hydrogen was produced in experiment **1**.

Show your working and state the units.

..... [2]

(iii) All dilute solutions of acids contain hydrogen ions, H^+.

Describe, in terms of electrons, ions and atoms, what happens when hydrogen ions collide with the surface of the negative electrode.

.....

.....

..... [2]

(iv) Use your knowledge of electric current to suggest an explanation for the difference in the results for experiments **1** and **2**.

.....

.....

.....

..... [2]

For Examiner's Use

6 Fig. 6.1 shows a food chain. The arrows show how energy flows from one organism to another, along the chain.

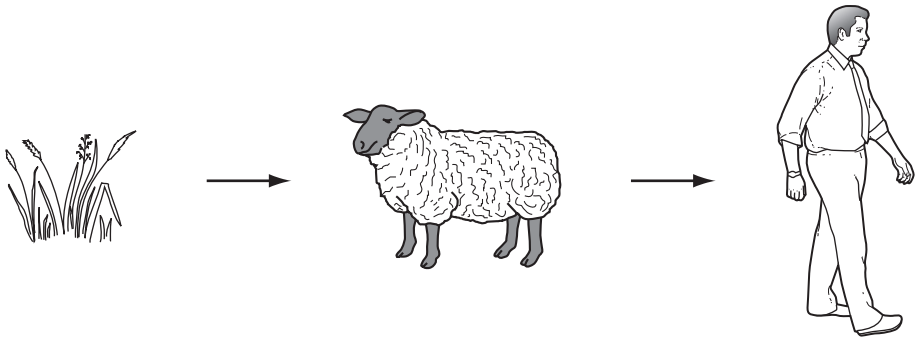

Fig. 6.1

(a) The grass is the producer in this food chain.

Explain how plants produce a supply of chemical energy at the start of the food chain.

.....

.....

.....

.....

.....

..... [4]

(b) Energy is lost between the trophic levels in a food chain.

Describe **one** way in which energy is lost from this food chain.

.....

.....

..... [2]

(c) **(i)** The cells in the man's body use respiration to release useful energy from nutrients that he has absorbed.

State the balanced equation for aerobic respiration.

..... [2]

(ii) A person living in a very cold climate generally needs to eat more than a person living in a hot climate.

Explain why.

.....

.....

.....

..... [3]

For Examiner's Use

For Examiner's Use

7 **(a)** A circuit for a torch (flashlight) contains two cells, a lamp and a switch.

Using the correct symbols, draw a circuit diagram for the torch.

[2]

(b) Torches are usually powered by electrical cells. They can also be powered by energy from the Sun (solar energy).

Solar energy is a renewable energy resource.

Name **one** other renewable energy resource and **one** non-renewable energy resource.

renewable energy resource .....

non-renewable energy resource ..... [1]

(c) **(i)** A resistor of 1200 Ω is connected in series with another resistor of 2400 Ω.

Calculate the combined resistance of these two resistors.

State the formula that you use and show your working.

formula

working

..... [2]

(ii) If the two resistors had been connected in parallel, which of the values below could be the combined resistance of the two resistors?

Explain your answer.

800 Ω 1200 Ω 1600 Ω 2400 Ω 3600 Ω

combined resistance .....

explanation .....

..... [2]

For Examiner's Use

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8 **(a)** A student added a solution of the same dilute acid to each of the test-tubes **P** to **T** shown in Fig. 8.1.

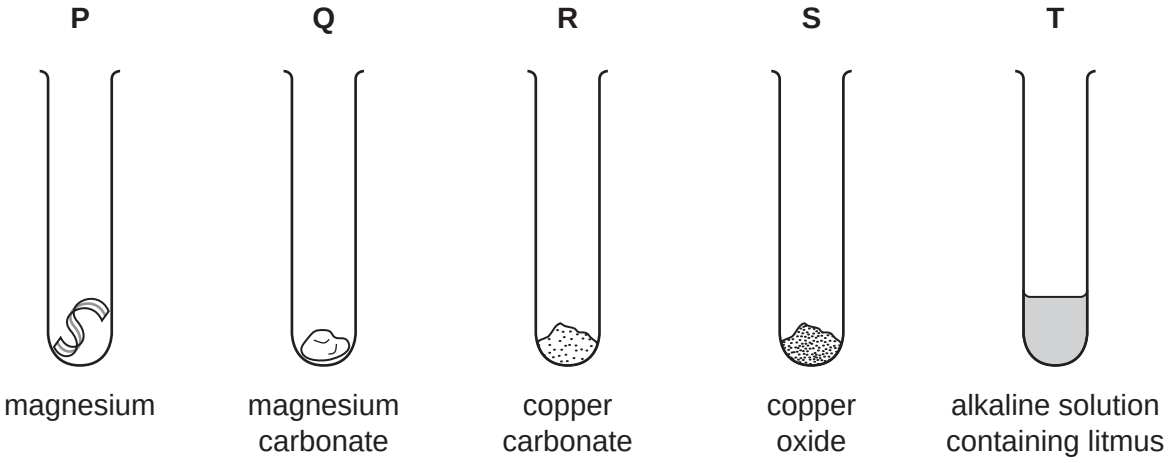

Fig. 8.1

Complete Table 8.1 by matching the test-tubes, **P**, **Q**, **R**, **S** and **T**, with the observations which are made when the dilute acid reacts with the contents.

Some of the observations apply to more than one of the test-tubes. You may use each letter once, more than once or not at all.

Table 8.1

observations	test-tube(s)
The mixture turns red when excess acid has been added.	
A colourless gas is given off.	
A blue solution is formed.	
A colourless gas which pops when ignited is given off.	

[4]

[Turn over

For Examiner's Use

(b) The student used the apparatus shown in Fig. 8.2 to investigate neutralisation reactions involving two acids, **A** and **B**.

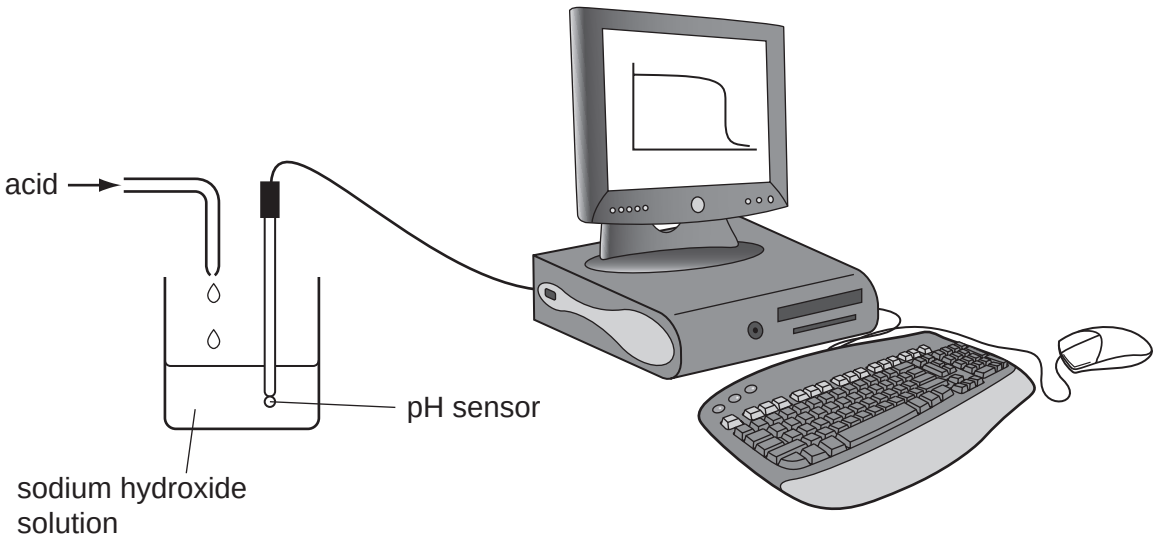

Fig. 8.2

In each experiment, 25.0 cm^3 of the same solution of sodium hydroxide were placed into a beaker. The acid was added at a constant rate until it was in excess.

The measurements were displayed on the computer screen as a graph of pH of the reaction mixture against volume of acid that had been added.

The results for the two acids are shown in Fig. 8.3.

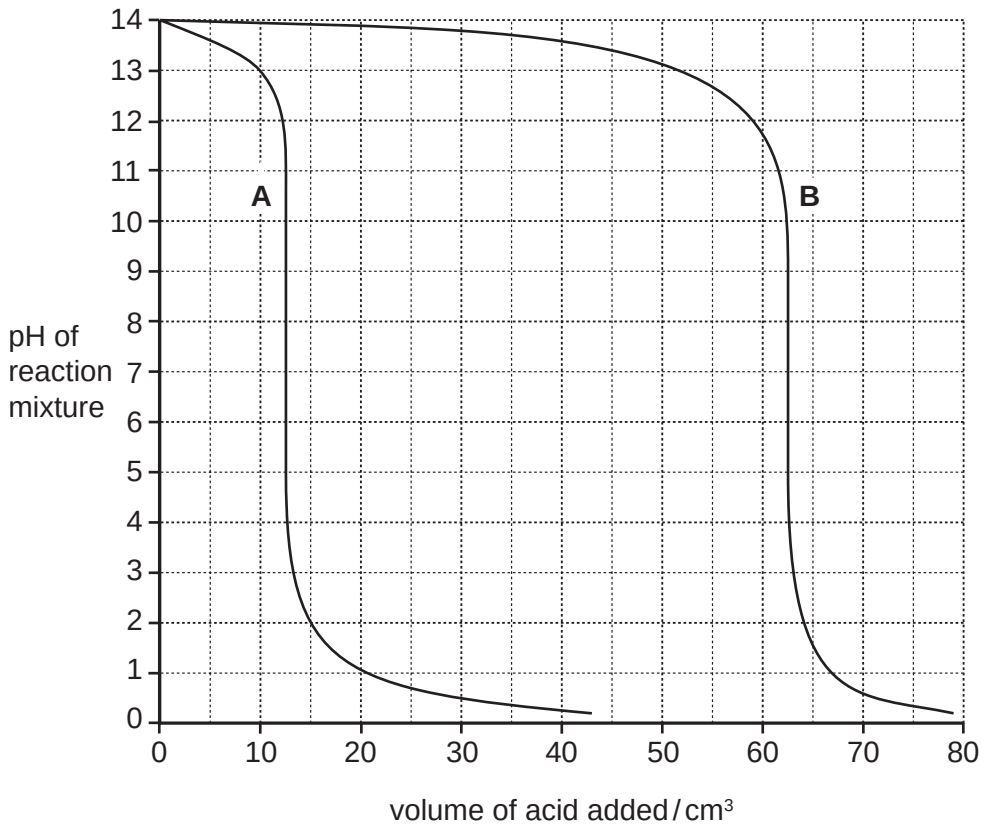

Fig. 8.3

(i) Describe how the pH of the mixture in the beaker changes as the volume of acid **A** increases.

.....

.....

..... [2]

(ii) The student found that 12.5 cm^3 of acid **A** and 62.5 cm^3 of acid **B** were needed to neutralise the sodium hydroxide in the beaker.

Explain how the student obtains these results from the graph shown in Fig. 8.3.

.....

..... [1]

(iii) State and explain briefly which acid, **A** or **B**, was the more concentrated.

acid .....

explanation .....

..... [1]

For Examiner's Use

9 Fig. 9.1 shows a section through a small blood vessel.

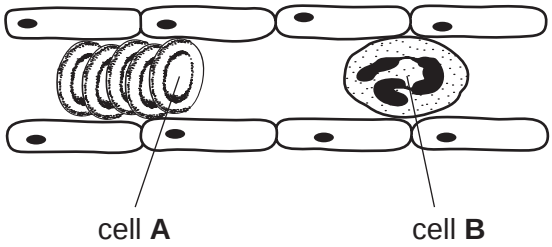

Fig. 9.1

(a) Cell **A** is a red blood cell.

(i) Outline **two** ways in which this cell differs from a liver cell.

1 .....

2 ..... [2]

(ii) Describe the function of a red blood cell.

.....

.....

..... [2]

(b) Describe the function of cell **B**.

.....

.....

..... [2]

(c) As people get older, their risk of developing coronary heart disease increases.

(i) Explain what is meant by *coronary heart disease*.

.....

.....

..... [2]

(ii) List **two** factors, other than getting older, that increase the risk of developing coronary heart disease.

1 ..... 2 ..... [2]

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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	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
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	**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	**Pa** Protactinium 91	238 **U** Uranium 92	**Np** Neptunium 93	**Pu** Plutonium 94	**Am** Americium 95	**Cm** Curium 96	**Bk** Berkelium 97	**Cf** Californium 98	**Es** Einsteinium 99	**Fm** Fermium 100	**Md** Mendelevium 101	**No** Nobelium 102	**Lr** Lawrencium 103

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 dm^3 at room temperature and pressure (r.t.p.).