



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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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.



- 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
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Use

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

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Use

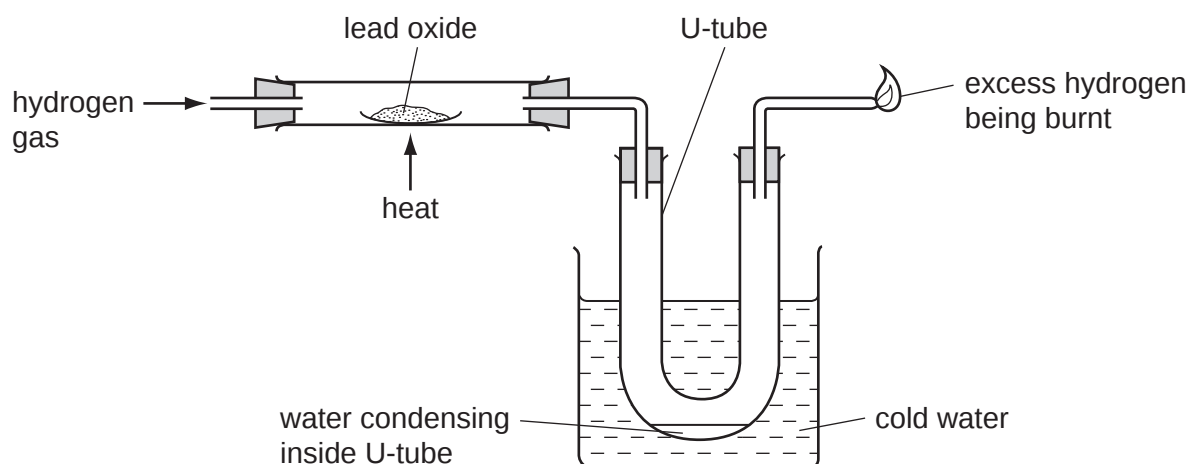
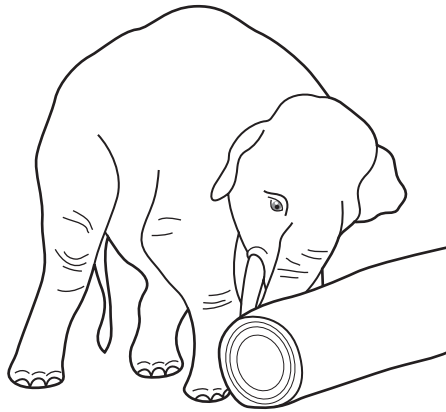


Fig. 1.2

- (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]

- 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.

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- (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]

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.

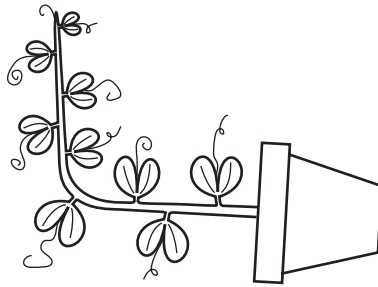


Fig. 3.1

- (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.

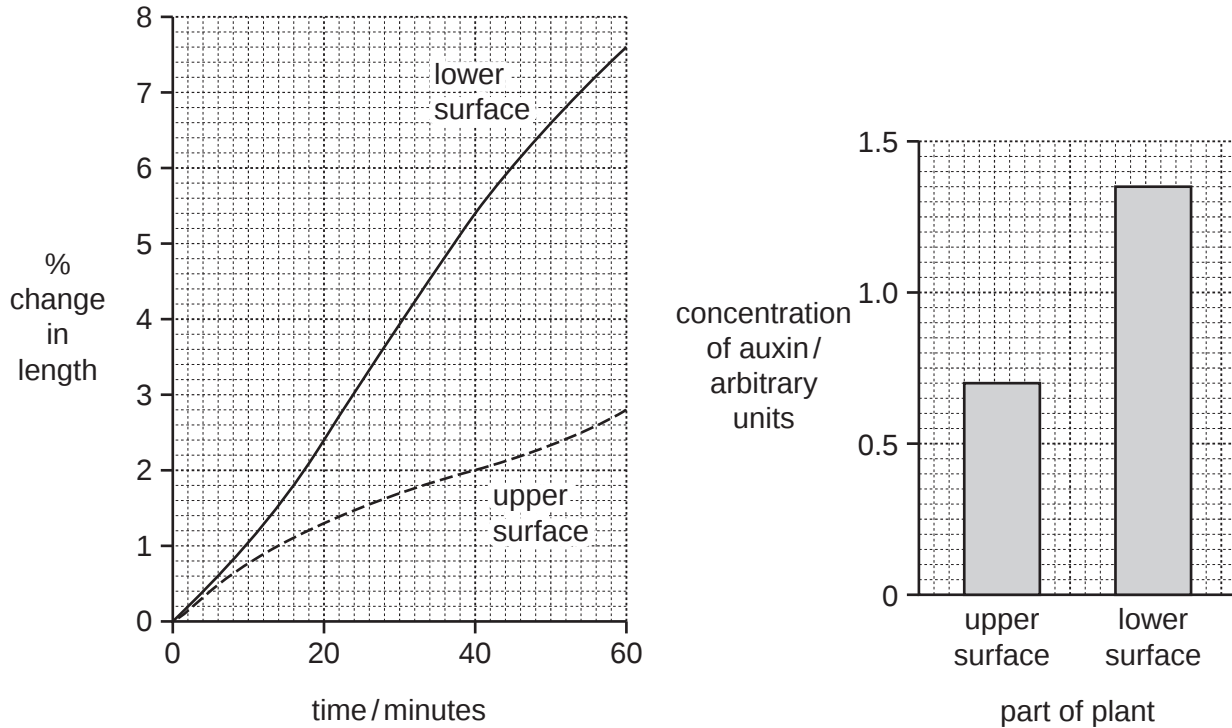


Fig. 3.2

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

.....

.....

.....

.....

.....

.....

..... [3]

4 Fig. 4.1 shows a microwave oven.

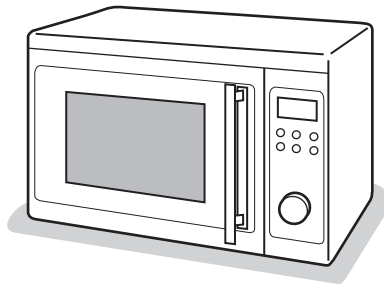


Fig. 4.1

- (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]

For
Examiner's
Use

- (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]

For
Examiner's
Use

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

For
Examiner's
Use

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

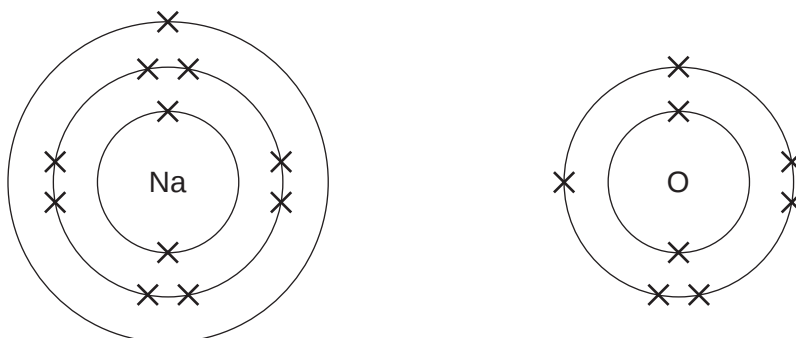


Fig. 5.1

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

.....

.....

.....

.....

..... [3]

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

For
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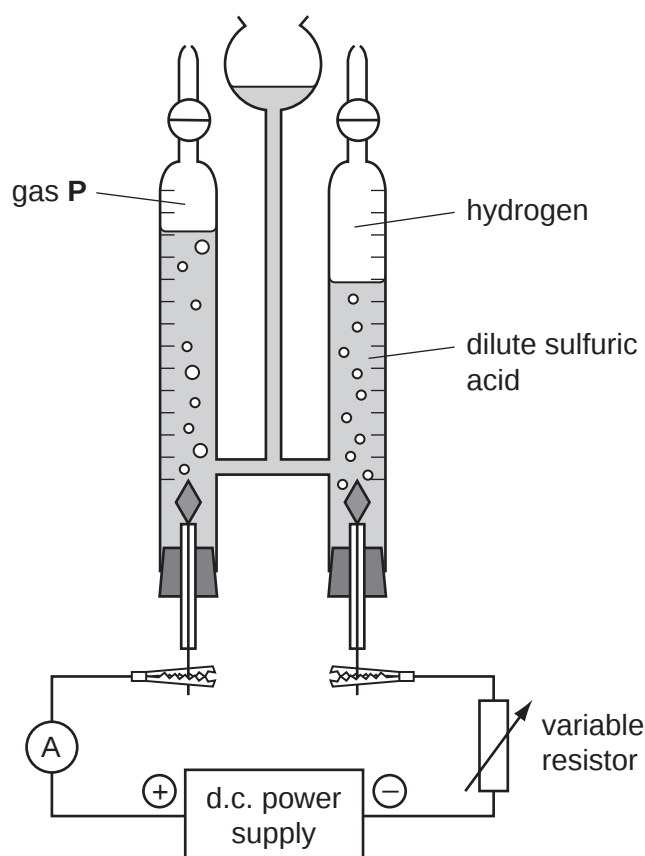


Fig. 5.2

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]

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

Show your working and state the units.

For
Examiner's
Use

..... [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]

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

For
Examiner's
Use

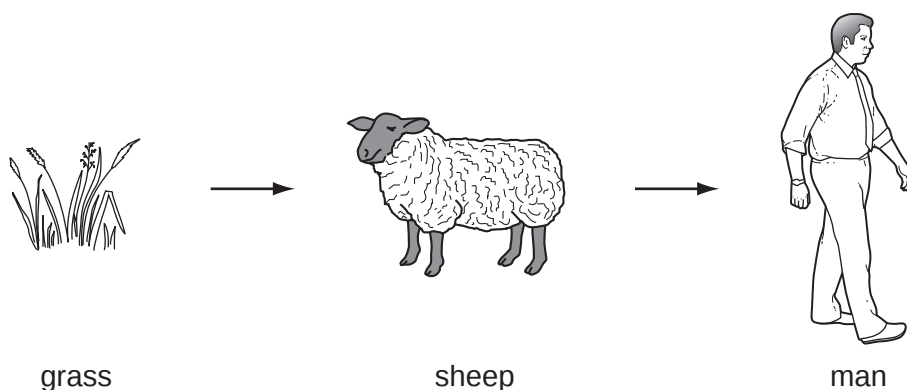


Fig. 6.1

- (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*

- 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.

For
Examiner's
Use

[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 1200Ω is connected in series with another resistor of 2400Ω .

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?

*For
Examiner's
Use*

Explain your answer.

800 Ω

1200 Ω

1600 Ω

2400 Ω

3600 Ω

combined resistance

explanation

..... [2]

- 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.

For
Examiner's
Use

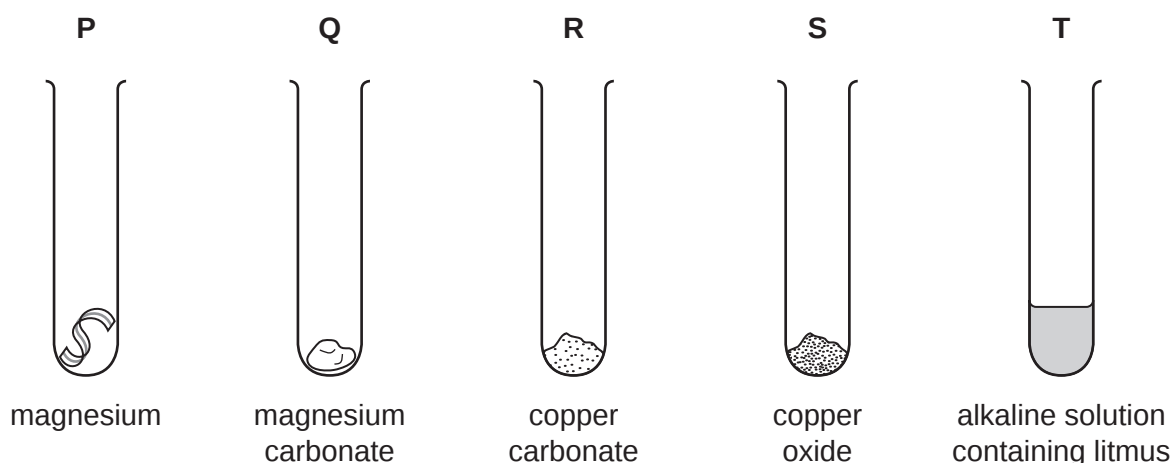


Fig. 8.1

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]

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

For
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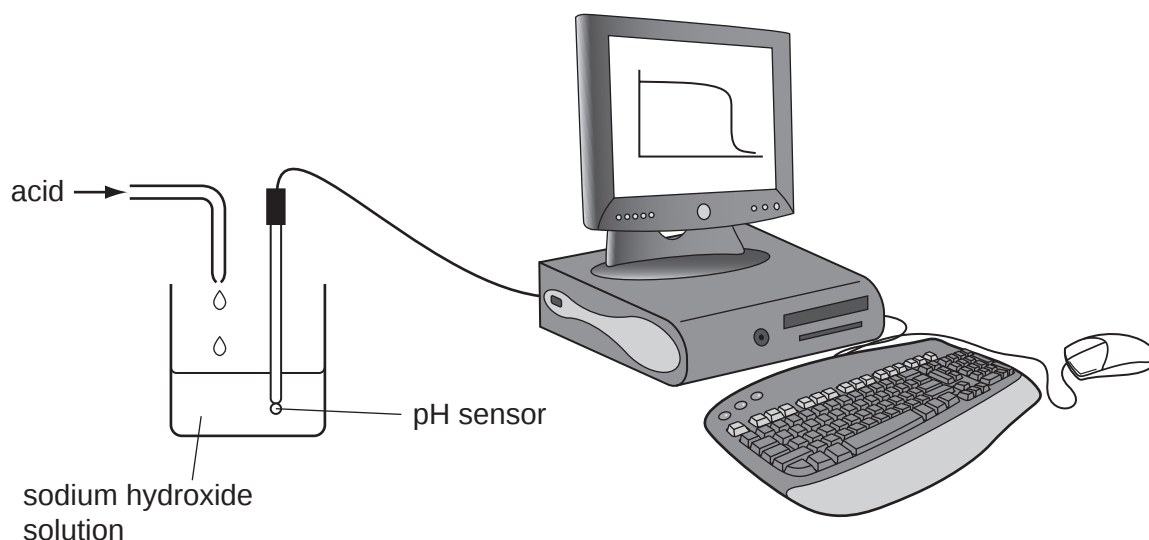


Fig. 8.2

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.

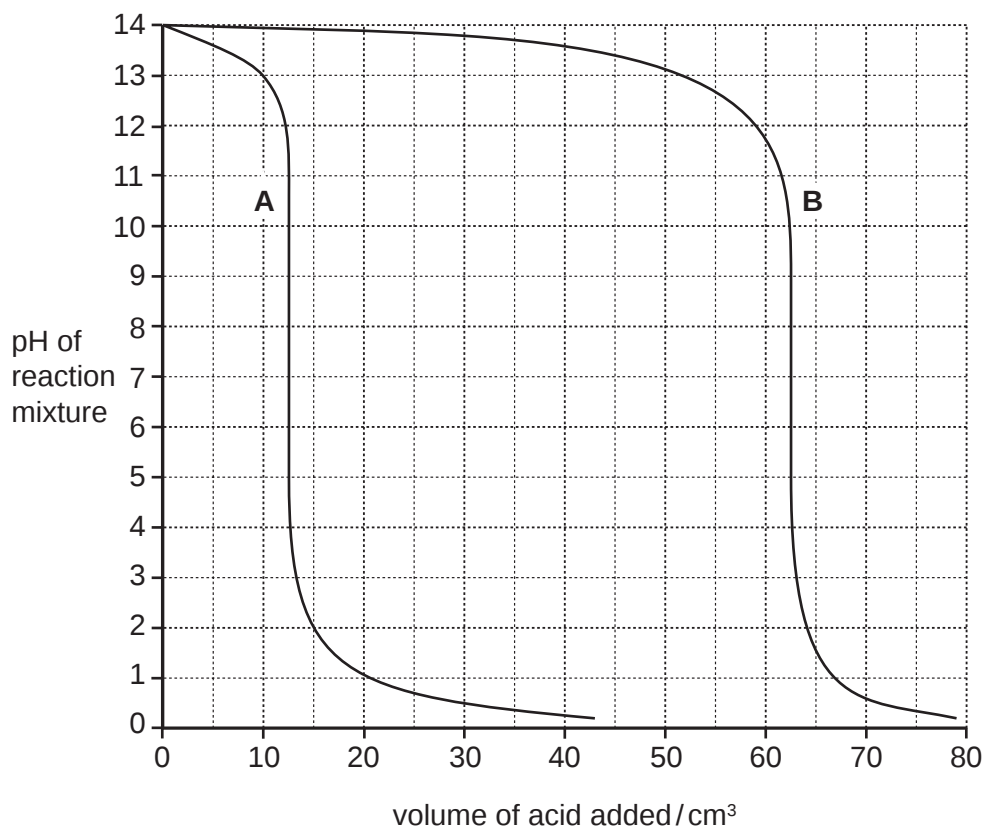


Fig. 8.3

- (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]

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

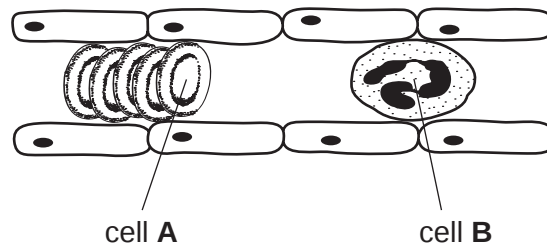


Fig. 9.1

- (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]

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											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	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 Xe Xenon 54							
133 Cs Cesium 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																						
140 Ce Cerium 58																						
141 Pr Praseodymium 59																						
144 Nd Neodymium 60																						
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175 Lu Lutetium 71																						
173 Yb Ytterbium 70																						
173 No Nobelium 102																						
101 Md Mendelevium 101																						
100 Fm Fermium 100																						
98 Es Einsteinium 99																						
98 Cf Californium 98																						
97 Bk Berkelium 97																						
96 Cm Curium 96																						
95 Am Americium 95																						
94 Pu Plutonium 94																						
93 Np Neptunium 93																						
92 U Uranium 92																						
91 Pa Protactinium 91																						
90 Th Thorium 90																						
232 Th Thorium 90																						
238 U Uranium 92																						
238 Pu Plutonium 94																						
238 Am Americium 95																						
238 Cm Curium 96																						
238 Bk Berkelium 97																						
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238 Sm Samarium 62																						
238 Eu Europium 63																						
238 Gd Gadolinium 64																						
238 Tb Terbium 65																						
238 Dy Dysprosium 66																						
238 Ho Holmium 67																						
238 Er Erbium 68																						
238 Tm Thulium 69																						
238 Yb Ytterbium 70																						
238 Lu Lutetium 71																						
238 La Lanthanum 57																						
238 Ce Cerium 58																						
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238 Pr Praseodymium 59																						

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

Key

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

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