UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

COMBINED SCIENCE **0653/03**

Paper 3 (Extended) **May/June 2009**

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	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **21** printed pages and **3** blank pages.

1 Fig. 1.1 shows part of the human digestive system. 0653/03/M/J/09

For Examiner's Use

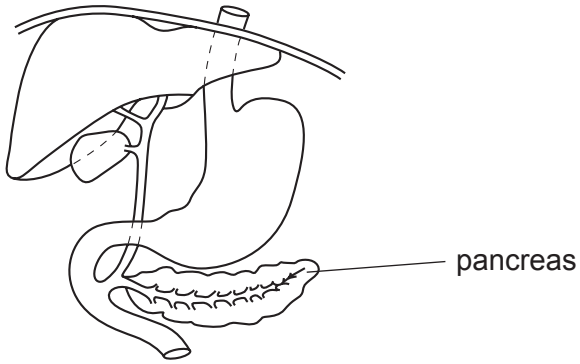

Fig. 1.1

1 (a) On Fig. 1.1, use a label line and a letter to indicate each of the following parts. 0653/03/M/J/09

A the liver

B a region where amylase breaks down starch

C a region where protease breaks down proteins [3]

1 (b) The pancreas produces several enzymes, including lipase. 0653/03/M/J/09

Describe the function of lipase.

.....

.....

..... [2]

1 (c) The pancreas also produces the hormone insulin. 0653/03/M/J/09

(i) State the conditions that stimulate the pancreas to produce insulin.

..... [1]

(ii) Describe the effect of insulin on the liver.

..... [1]

For Examiner's Use

1 **(d)** Digested food is absorbed in the small intestine, and dissolves in the liquid part of the blood in the capillaries in the intestine walls. It is then transported in a vein to the liver.

(i) What is the name for the liquid part of blood? 0653/03/M/J/09

..... [1]

(ii) Describe **one** difference between the structure of a vein and of an artery, and give the reason for this difference.

difference .....

reason ..... [2]

For Examiner's Use

2 The Vikings, who lived in Scandinavia about 1200 years ago, sailed in boats called longships across the sea to Britain.

0653/03/M/J/09

2 (a) (i) They travelled 900 km in 150 hours.

Calculate their average speed for this journey.

State the formula that you use and show your working.

formula

working

..... [2]

(ii) At one stage on their journey they were travelling at 5 km / h.

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Calculate their speed in m / s.

Show your working.

..... [1]

2 (b) At one point in the journey, the longship accelerated at 0.1 m / s^2. The mass of the longship was 8000 kg.

0653/03/M/J/09

Calculate the force required to produce this acceleration.

State the formula that you use and show your working.

formula

working

..... [2]

2 (c) The volume of the wood used to construct the longship was $9\,m^3$. 0653/03/M/J/09

If the density of the wood was $800\,kg/m^3$, calculate the mass of the wood used.

State the formula that you use and show your working.

formula

working

..... [2]

For Examiner's Use

3 **(a)** The names of six elements are shown below. 0653/03/M/J/09

carbon **chlorine** **copper** **neon** **silicon** **sodium**

Choose the element from the list

which is a very reactive non-metal, ...

which forms a green chloride, ...

whose atoms have **all** of their electron energy levels filled. ..... [3]

3 **(b)** Fig. 3.1 shows diagrams of a sodium ion and an oxide ion. 0653/03/M/J/09

(i) Complete the boxes in the left hand column to show a sodium **atom** and an oxygen **atom**.

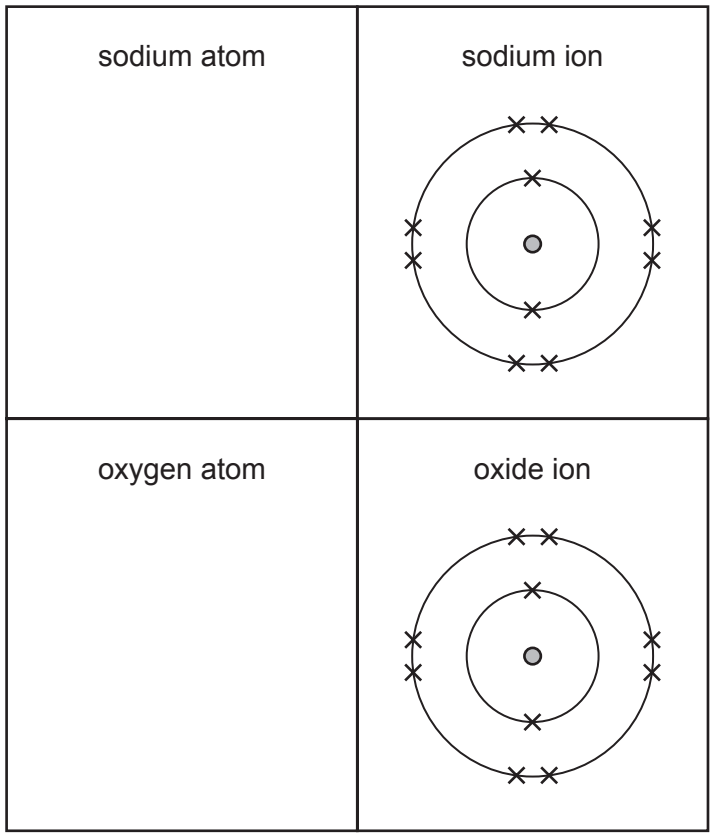

Fig. 3.1

[2]

(ii) Explain why a sodium ion has an electrical charge of 1+. 0653/03/M/J/09

.....

..... [1]

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3 **(c)** Fig. 3.2 shows apparatus a student used to investigate the combustion of hydrogen.

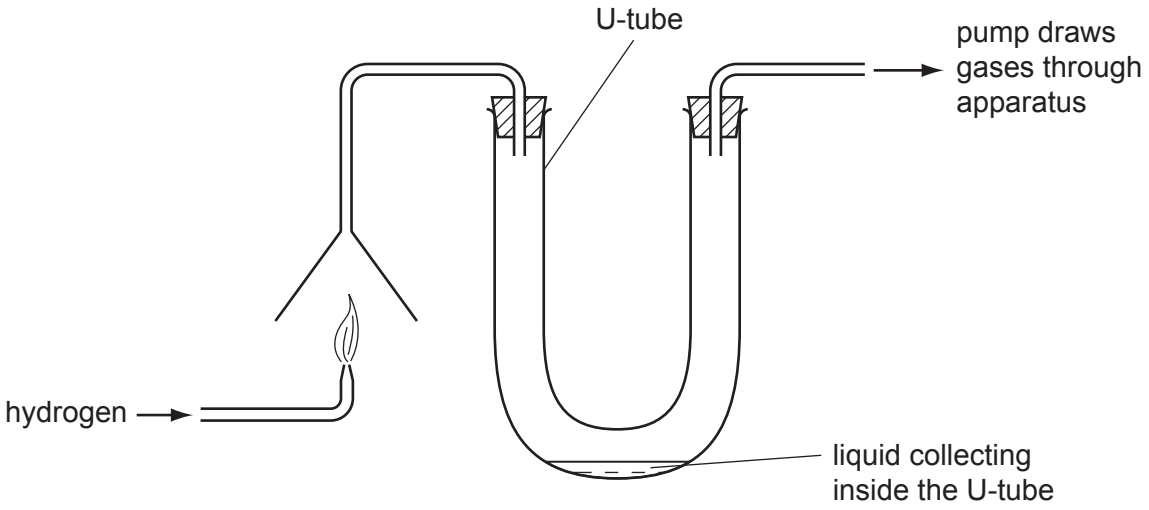

Fig. 3.2

(i) Write a **word** equation for the reaction which is occurring in the flame in Fig. 3.2.

0653/03/M/J/09

..... [1]

(ii) After several minutes the student poured the liquid which had collected inside the U-tube into a beaker.

Describe **two** observations which the student would make when she added a small piece of sodium to the liquid in the beaker.

0653/03/M/J/09

.....

.....

..... [2]

4 Fig. 4.1 shows an arum lily. Arum lilies have flowers that are pollinated by insects. There are many tiny flowers on a stalk, inside a large white structure called a spathe.

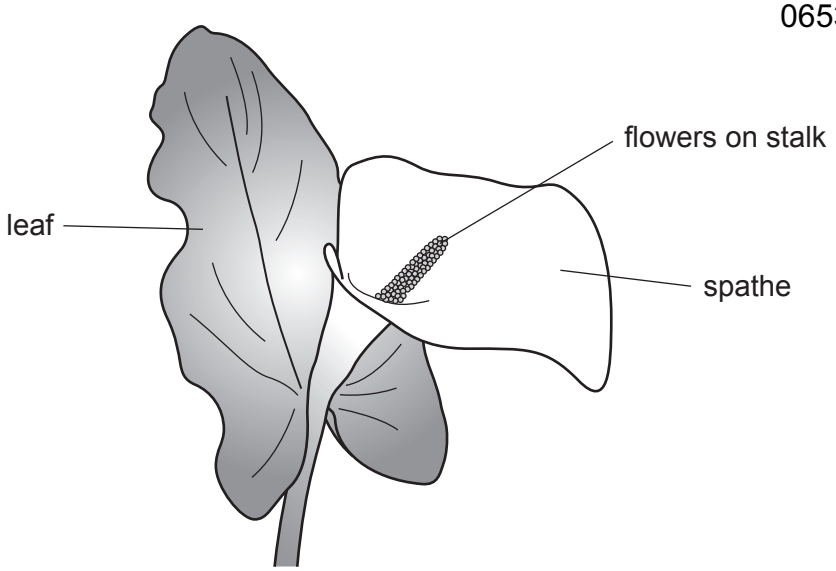

Fig. 4.1

4 (a) (i) Name the part of the flower in which pollen is made.

.....[1]

(ii) What does a pollen grain contain?

.....[1]

4 **(b)** Arum lilies produce heat energy to raise the temperature of the flowers. This helps to attract insects to the flowers. 0653/03/M/J/09

A researcher investigated whether there was a relationship between the temperature of the flowers inside an arum lily spathe and the rate of oxygen use. He took 15 arum lilies, and measured the temperature and rate of oxygen use for each one.

Fig. 4.2 shows his results.

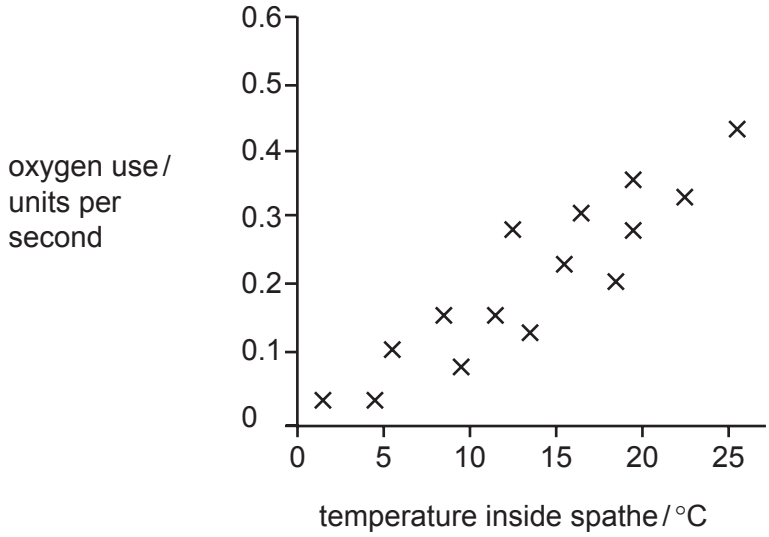

Fig. 4.2

(i) Describe the relationship between the temperature inside the spathe and the rate of oxygen use by the arum lily. 0653/03/M/J/09

.....

..... [1]

(ii) Suggest an explanation for this relationship. 0653/03/M/J/09

.....

.....

..... [2]

For Examiner's Use

4 **(c)** The high temperature of the flowers inside the spathe of the lily, and the bright white of the spathe, each help to attract insects to the flowers. 0653/03/M/J/09

Insects are able to detect the electromagnetic radiation coming from the flowers and the spathe.

(i) Name the type of electromagnetic radiation emitted by 0653/03/M/J/09

the flowers that are at a high temperature, ...

the bright white spathe. ..... [2]

(ii) State **one** similarity between these two types of electromagnetic radiation.
0653/03/M/J/09

..... [1]

4 (d) The leaves of arum lilies contain palisade cells, which are typical plant cells containing chloroplasts. 0653/03/M/J/09

In the space below, draw and label a diagram of a palisade cell. Include these structures in your labels:

cell membrane	**cell wall**	**chloroplast**
cytoplasm	**nucleus**	**vacuole**

[4]

5 **(a)** Fig. 5.1 shows industrial apparatus used for the fractional distillation of petroleum (crude oil).

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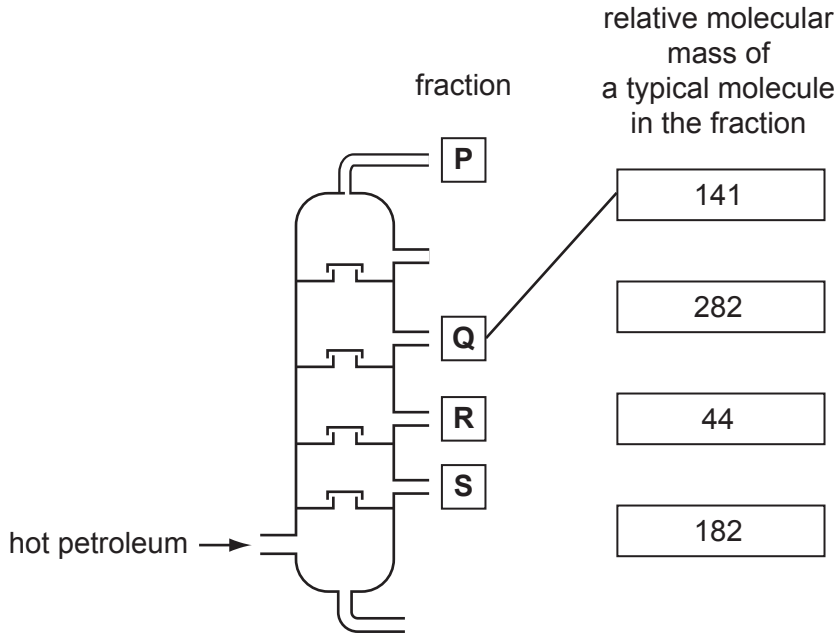

Fig. 5.1

(i) Draw lines on Fig. 5.1 connecting the fractions **P**, **Q**, **R** and **S** to the relative molecular mass of a typical molecule in the fraction. The line for fraction **Q** has been drawn for you. [1]

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(ii) A hydrocarbon has a relative molecular mass of 58 and contains 10 hydrogen atoms per molecule.

0653/03/M/J/09

Deduce the number of carbon atoms in each molecule of this hydrocarbon.

Use the Periodic Table on page 24 to find the relative atomic masses you need to answer this question.

Show your working.

.....

.....

..... [2]

For Examiner's Use

5 **(b)** Fig. 5.2 shows the displayed formulae of four hydrocarbon molecules, **L**, **M**, **N** and **O**.

Some of these molecules have been made by cracking hydrocarbons from petroleum.

0653/03/M/J/09

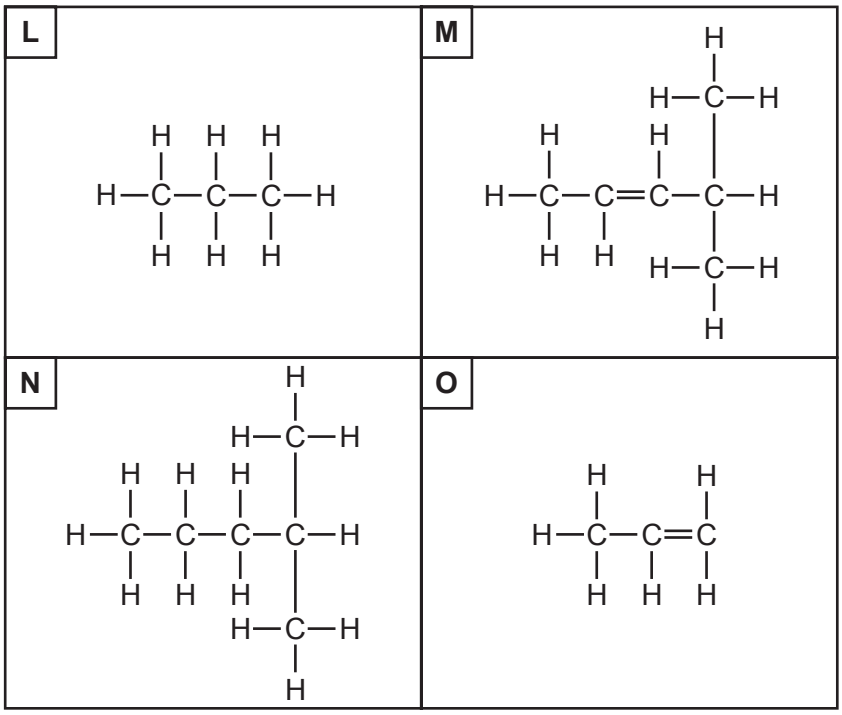

Fig. 5.2

(i) Describe briefly how the process of cracking is carried out.

0653/03/M/J/09

.....

.....

..... [2]

(ii) Explain which of the hydrocarbons shown above react with bromine solution.

Describe the colour change which is observed.

0653/03/M/J/09

.....

.....

.....

..... [3]

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Please turn over for Question 6.

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6 **(a)** A hotel has a lift (elevator). It moves through a vertical height of 3 m between each floor.

0653/03/M/J/09

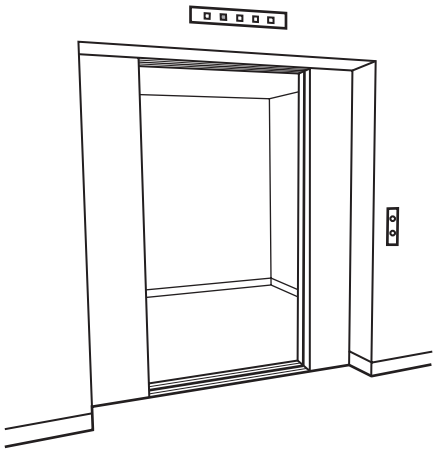

Fig. 6.1

(i) A passenger travels in the lift. The passenger has a mass of 80 kg and weighs 800 N. The mass of the empty lift is 1200 kg.

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Calculate the total weight of the passenger and lift.

Show your working.

..... [1]

(ii) Calculate the work done when the lift and passenger move up three floors, from Floor 1 to Floor 4.

0653/03/M/J/09

State the formula that you use and show your working.

formula

working

..... [2]

(iii) Calculate the power needed to move the lift and passenger up three floors from Floor 1 to Floor 4 in 20s.

State the formula that you use and show your working.

formula

working

..... [2]

6 (b) The lights in a room are connected in parallel as shown in Fig. 6.2.

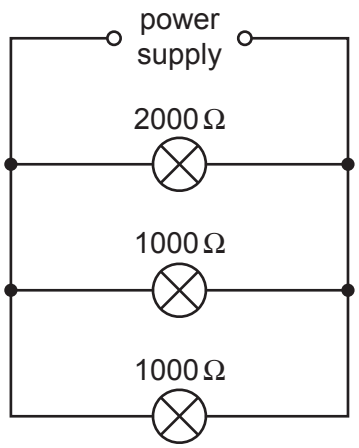


Fig. 6.2

Calculate the combined resistance of these three lights.

State the formula that you use and show your working.

formula

working

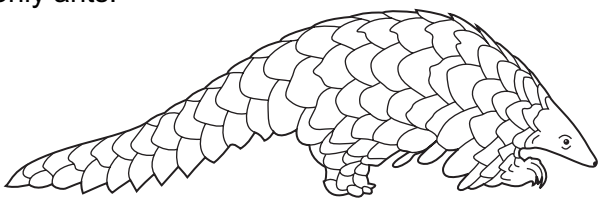
..... [3]

7 Read the following description of a food web.

0653/03/M/J/09

For Examiner's Use

- Ants collect leaves from trees and take them into their nests.
- A fungus grows on the leaves and breaks them down.
- The ants eat the leaves, and also the fungus.
- Small birds eat the ants, and hawks eat the small birds.
- Pangolins eat only ants.

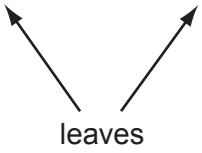


a pangolin

Fig. 7.1

7 **(a)** In the space below, complete a food web that includes all of the organisms described.

0653/03/M/J/09



[2]

7 **(b)** **(i)** Name the producer in this food web. 0653/03/M/J/09

.....

[1]

For Examiner's Use

(ii) Name a decomposer in this food web. 0653/03/M/J/09

.....

[1]

7 **(c)** Using the idea of energy flow between trophic levels, explain why there are fewer hawks than small birds in an ecosystem. 0653/03/M/J/09

.....

.....

.....

[2]

8 Fig. 8.1 shows a room heated by a wall heater. 0653/03/M/J/09

For Examiner's Use

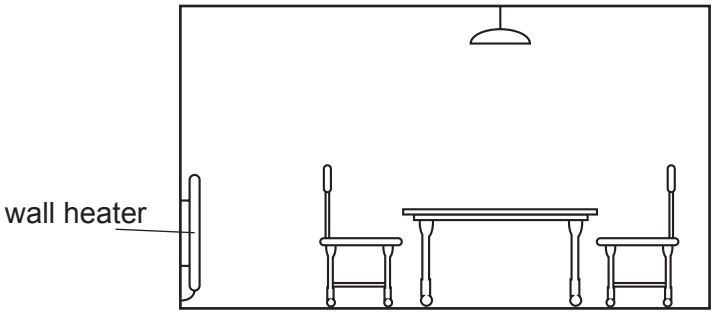


Fig. 8.1

8 (a) (i) Name the method by which heat travels through the metal casing of the heater.
0653/03/M/J/09

..... [1]

(ii) Name the method by which heat circulates around the room. 0653/03/M/J/09

..... [1]

(iii) On Fig. 8.1 show, using arrows, how the heat circulates around the room from the heater. [1]
0653/03/M/J/09

8 (b) The heater is made of iron, a solid. It contains water, a liquid and air, a gas.

Complete the diagrams in Fig. 8.2 to show the arrangement of particles in a solid, a liquid and a gas. One particle has been drawn for you on each diagram.
0653/03/M/J/09

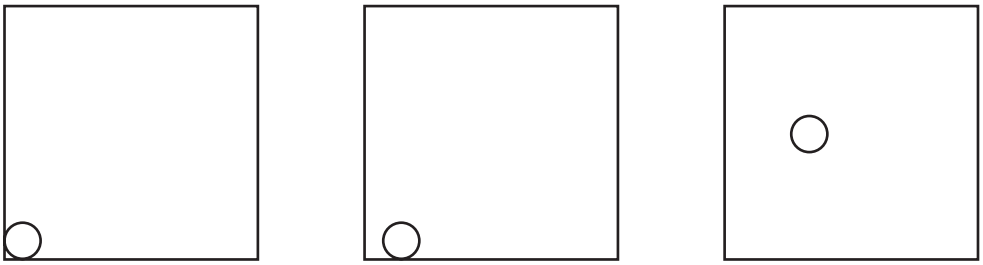


Fig. 8.2

[3]

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8 **(c)** Fig. 8.3 shows a man in a room looking into a mirror, as seen from above.

0653/03/M/J/09

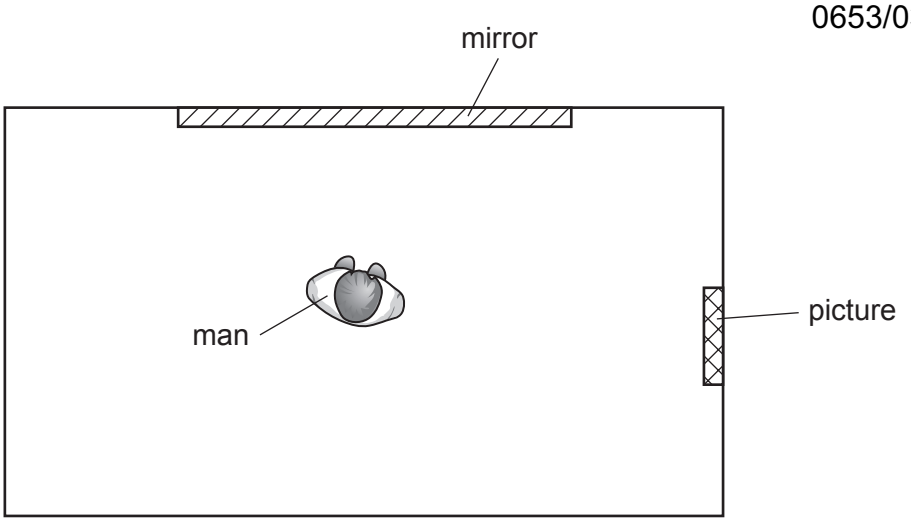


Fig. 8.3

(i) The man can see an image of the picture in the mirror. Make an accurate drawing on Fig. 8.3 to show a ray of light which enables the man to see this image. [2]

0653/03/M/J/09

(ii) On Fig. 8.3, clearly label the angle of incidence (*i*) and the angle of reflection (*r*) of the ray at the mirror. 0653/03/M/J/09 [1]

(iii) Mirrors produce virtual images. 0653/03/M/J/09

Explain the meaning of the term *virtual image*.

.....

..... [1]

For Examiner's Use

9 **(a)** Fig. 9.1 shows the main steps in a method used by a student to make a salt. The student reacted the oxide of a metal in dilute sulfuric acid. 0653/03/M/J/09

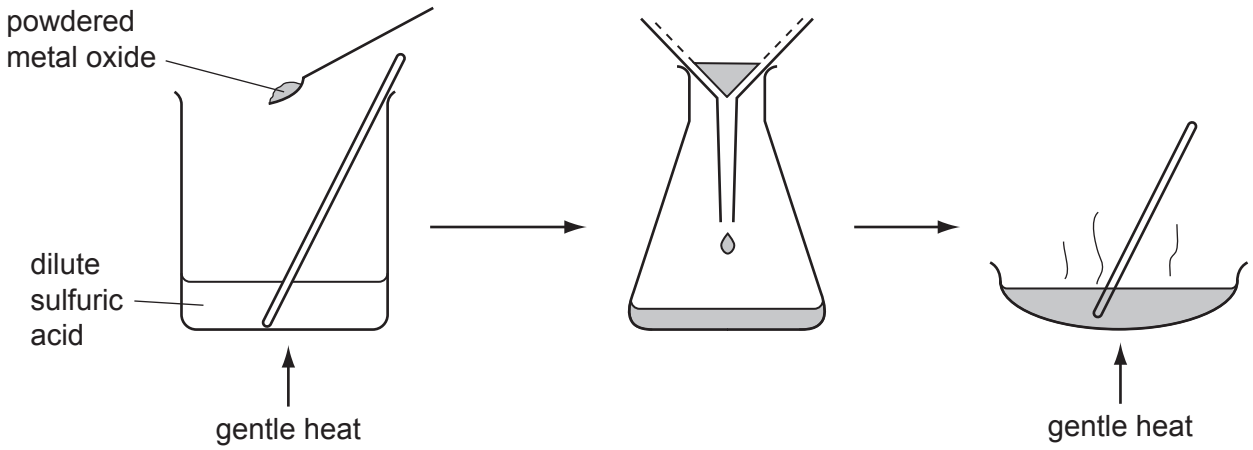


Fig. 9.1

(i) Suggest why the student heated the reaction mixture. 0653/03/M/J/09

.....

..... [1]

(ii) Suggest **one** way the student could make sure that all of the dilute sulfuric acid was neutralised. 0653/03/M/J/09

.....

.....

..... [2]

9 **(b)** Complete the symbolic equation for the reaction of calcium oxide with hydrochloric acid.

$CaO \rightarrow CaCl_2$ 0653/03/M/J/09

[2]

For Examiner's Use

9 **(c)** Fig. 9.2 shows the electrolysis of copper sulfate solution. 0653/03/M/J/09

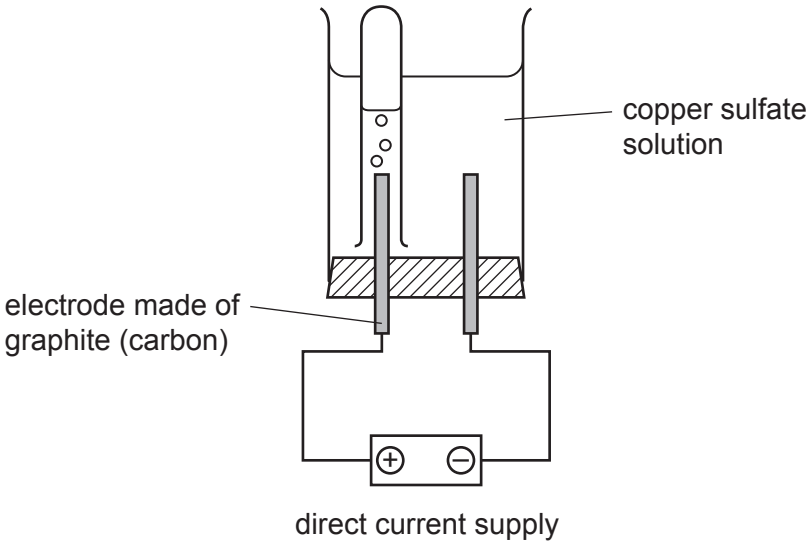


Fig. 9.2

(i) The electrolyte in this reaction contains copper ions, Cu^{2+}. 0653/03/M/J/09

Describe and explain how copper ions from the electrolyte are converted into copper atoms on the surface of the cathode.

.....

.....

..... [2]

(ii) A student reads in a Chemistry textbook that oxygen is produced at an anode made of carbon when copper sulfate solution is electrolysed. 0653/03/M/J/09

When she tests the gas in her experiment with a glowing splint, it does **not** re-light. However the gas does turn limewater milky.

Suggest what might have happened to cause these observations.

0653/03/M/J/09

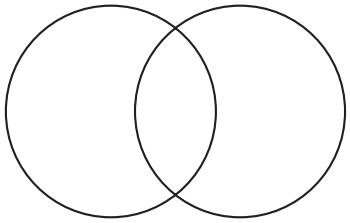
.....

.....

..... [2]

(iii) Complete the diagram of an oxygen molecule to show the outer electrons of each atom.

0653/03/M/J/09



[1]

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DATA SHEET
The Periodic Table of the Elements

	Group																	
	I	II									III	IV	V	VI	VII	0
																4 **He** Helium 2
						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	**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	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
†90-103 Actinoid series	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 = 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.).