Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

COMBINED SCIENCE **0653/02**

Paper 2

October/November 2005

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 in the spaces provided on the Question Paper.
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.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic Table is printed on page 20.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

For Examiner's Use	
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2	
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9	
Total	

This document consists of **19** printed pages and **1** blank page.

1 A student was asked to prepare some copper sulphate crystals.
The diagrams, **P**, **Q** and **R**, in Fig. 1.1 show three important steps in the method the student used.

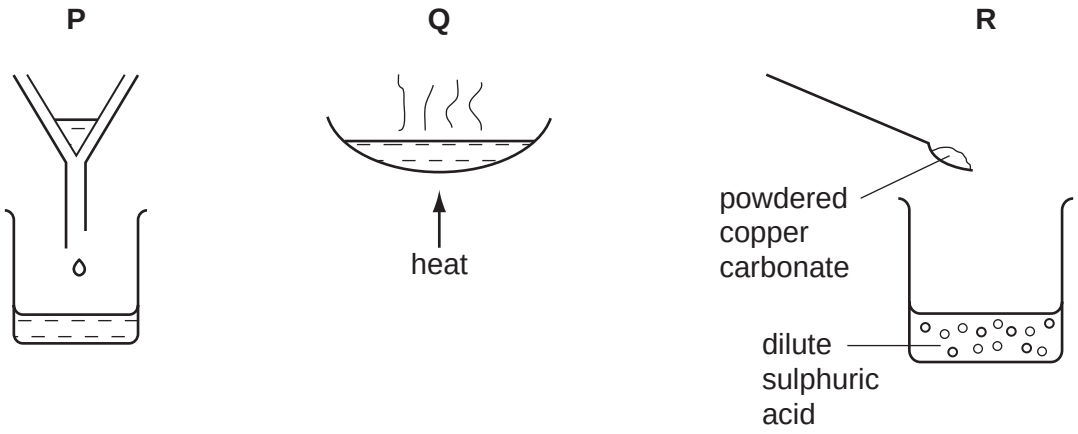


Fig. 1.1

(a) (i) Complete the table, using the letters **P**, **Q** and **R**, to show the order in which these processes should be carried out to produce copper sulphate crystals.

first	
second	
third	

[1]

(ii) Suggest how the student made certain that all of the sulphuric acid had reacted.

.....

..... [1]

(iii) State the chemical formula of sulphuric acid.

..... [1]

(iv) State and explain briefly which one of the elements in copper sulphate solution gives the solution its blue colour.

.....

..... [2]

(b) The student then wrote a short plan of an experiment to produce some metallic copper from the copper sulphate solution that she had made.

Fill in the spaces in her plan using words chosen from the list.

anode	**cathode**	**electrodes**	**electrolysis**
electrolyte	**neutralisation**		**thermal decomposition**

The method I will use is called ..... . In this method, two ..... must be dipped into the copper sulphate solution. Copper metal will form on the surface of the ..... . In this experiment, copper sulphate solution is called the ..... . [4]

2 **(a)** A radioactive source emits alpha radiation.

Name the apparatus you would use to detect the radiation emitted.

.....[1]

(b) Alpha radiation is described as ionising radiation.

(i) Explain the meaning of the term *ionising radiation*.

.....

.....[1]

(ii) Explain why alpha radiation can be harmful to living organisms.

.....

.....[1]

(c) Alpha, beta and gamma radiations have different properties.
Draw lines between the boxes below to link each type of radiation to its properties.

radiation	properties
alpha	• no charge • partly stopped by 2 cm of lead
beta	• negative charge • stopped by 2 cm of lead
gamma	• positive charge • stopped by 6 cm of air

[2]

(d) Electricity can be generated by nuclear fission.

(i) Describe what happens to an atom during nuclear fission.

.....

.....

..... [2]

(ii) Energy from nuclear fission can be converted into electrical energy. The first stage of this is the conversion of nuclear energy into heat energy.

Naming the equipment involved describe how the heat energy is then converted into electrical energy.

.....

.....

.....

..... [3]

3 Racing cyclists train hard to be good at their sport, and eat a carefully planned diet.

(a) A cyclist is a living organism, but a bicycle is not.

State two characteristic activities of a living organism such as a cyclist, that are **not** shared by a bicycle.

1. .....

2. ..... [2]

(b) Professional cyclists eat a diet rich in carbohydrates and proteins.

State how each of these types of nutrients helps a cyclist to be good at this sport.

carbohydrates

.....

proteins

..... [2]

(c) Some professional cyclists who have taken part in international competition have carried out a procedure called blood doping. Anyone who is found to have done this is now disqualified.

Blood doping involves putting extra red blood cells into the cyclist's blood.

Table 3.1 shows how this affects the cyclist's blood and ability to exercise.

Table 3.1

	before blood doping	after blood doping
concentration of haemoglobin in the blood / g per cm^3	14	18
length of time the cyclist could run on a treadmill at top speed / seconds	793	918

(i) What effect does blood doping have on the concentration of haemoglobin in the blood?

.....

..... [1]

(ii) Explain why blood doping has this effect.

.....

.....

.....

..... [2]

(iii) Using the information in Table 3.1, and your own knowledge, suggest how blood doping can help a cyclist to win a race.

.....

.....

.....

.....

..... [3]

4 The chemical symbols for two elements are shown below.

$$^{65}_{30}Zn \qquad ^{16}_{8}O$$

(a) Complete the table which refers to one atom of each element.

element	number of protons	number of neutrons	number of electrons
zinc			
oxygen			

[3]

(b) The apparatus shown in Fig. 4.1 was used to burn zinc powder in oxygen.

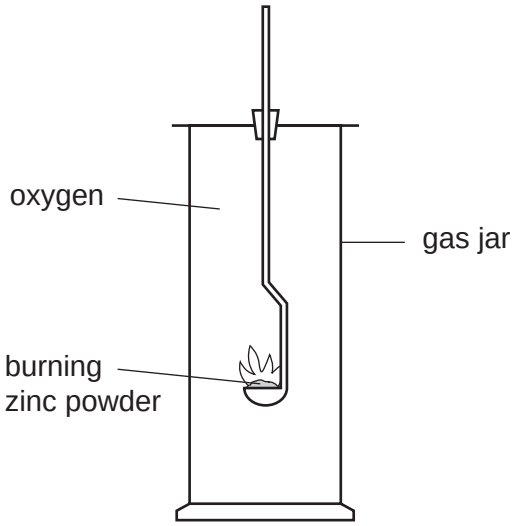


Fig. 4.1

When the reaction had finished, a white solid, **X**, remained in the gas jar.

(i) Name the white solid **X**.

.....

[1]

(ii) Name the type of chemical reaction in which **X** is formed.

.....

[1]

(iii) Explain why the mass of product **X** is greater than the original mass of zinc used in the experiment.

.....

.....

.....

[1]

(c) Some types of steel fence are galvanised in order to prevent the steel from rusting.

(i) Explain briefly what is meant by the term *galvanised*.

.....

..... [1]

(ii) Galvanising protects the steel from reacting with substances that cause rusting. Name two of these substances.

1. .....

2. ..... [2]

[Turn over

5 Fig. 5.1 shows a caterpillar crawling across a large leaf.
The caterpillar is moving at a speed of 1 mm / s.

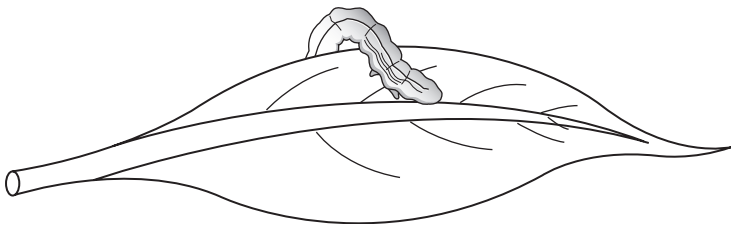


Fig. 5.1

A student measured this speed by measuring the distance covered by the caterpillar during one minute.

(a) State a suitable piece of apparatus to measure

(i) the distance moved, ... [1]

(ii) the time taken. ..... [1]

(b) If the caterpillar is moving at a constant speed, calculate how far the caterpillar will travel in one minute.

Show your working and state the formula that you use.

formula used

working

..... mm [2]

(c) Fig. 5.2 is a graph showing the speed of the caterpillar measured over 300 seconds.

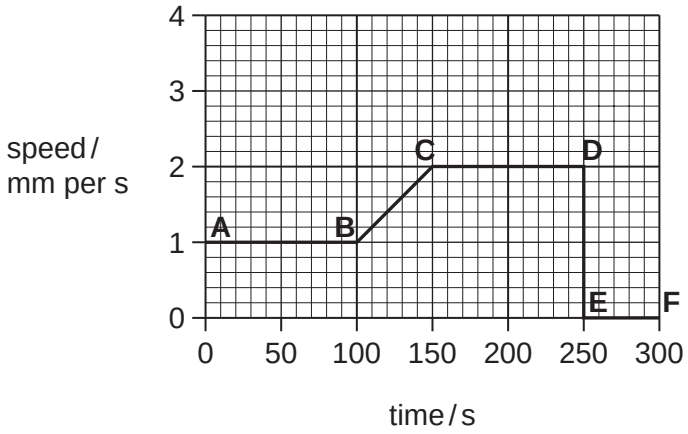


Fig. 5.2

(i) How can you tell that the caterpillar is moving at a constant speed between **A** and **B**?

.....

..... [1]

(ii) After how many seconds does the caterpillar stop moving?

..... [1]

(iii) Between which times is the caterpillar accelerating?
Explain your answer.

.....

..... [2]

6 **(a)** Fig. 6.1 shows a section through a leaf.

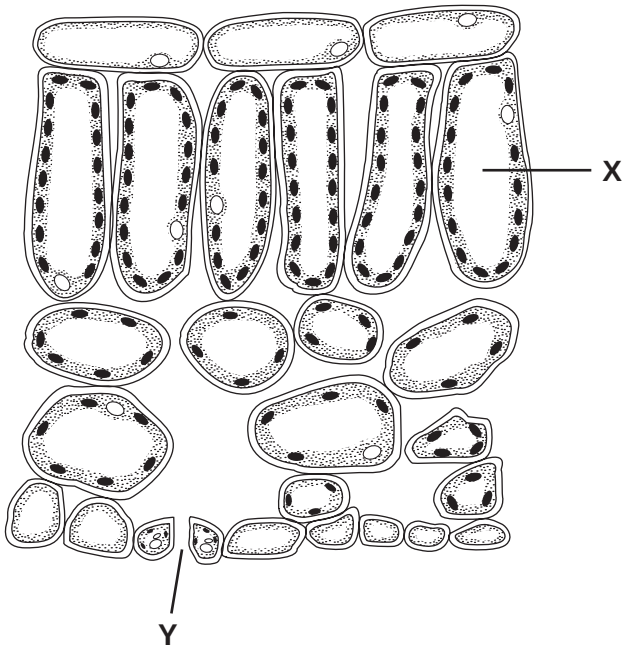


Fig. 6.1

(i) On Fig. 6.1 draw an arrow to show how carbon dioxide travels to cell **X**. [1]

(ii) Describe and explain **one** way in which cell **X** is adapted for photosynthesis.

.....

.....

..... [2]

(iii) In hot, dry weather the pore labelled **Y** closes.

Suggest how this helps the plant to survive.

.....

.....

..... [2]

(b) The leaves of tomato plants are sometimes eaten by insect pests.
Fig. 6.2 shows some of the ways in which the tomato plants and insects both contribute to the carbon cycle.

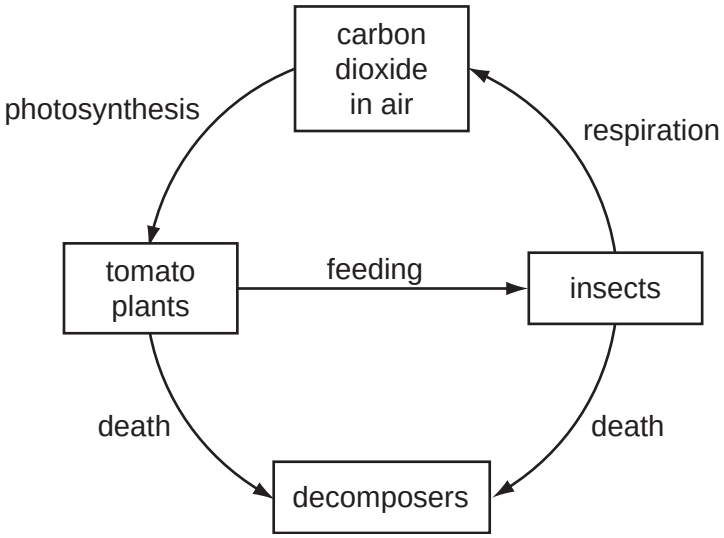


Fig. 6.2

(i) On the diagram, draw and label **two** more arrows to show how carbon dioxide is returned to the air. [2]

(ii) Using the information on Fig. 6.2, explain why destroying the plants on large areas of the Earth could contribute to global warming.

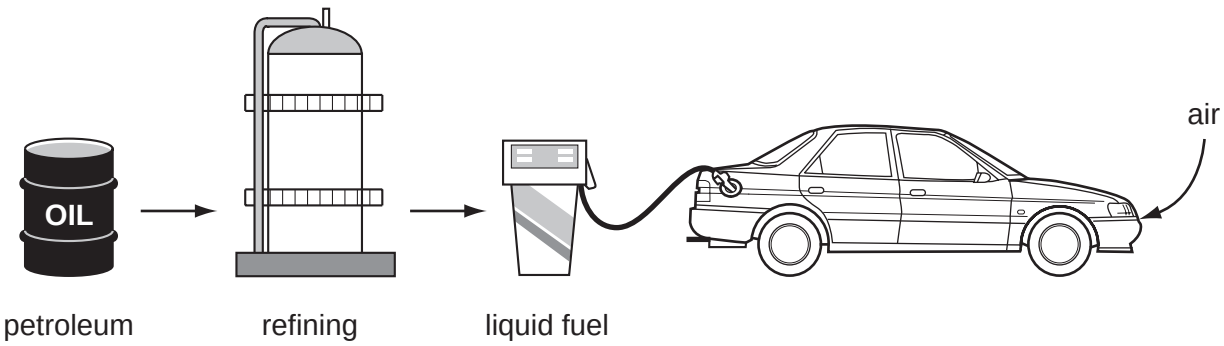
.....

.....

.....

..... [3]

7 Petroleum (crude oil) is obtained from the Earth's crust, and is the raw material for liquid fuel used in cars.



(a) Name the process used at an oil refinery to separate petroleum into useful materials, such as gasoline and diesel for use as fuel for cars.

..... [1]

(b) Petroleum contains some compounds containing sulphur.

(i) Name three compounds which would be produced by the **complete** combustion of gasoline that contained some sulphur compounds.

1. .....

2. .....

3. ..... [3]

(ii) Explain why it is important that sulphur compounds are removed from gasoline before it is used as a fuel for cars.

.....

.....

..... [2]

(c) Fig. 7.1 shows a catalytic converter on a car. This device contains a metal catalyst. When exhaust gases from the car's engine pass through the converter, chemical reactions take place which reduce the amount of poisonous gases released into the air.

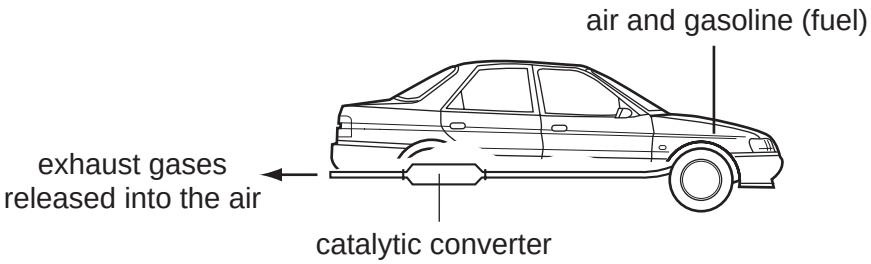


Fig. 7.1

(i) Explain the meaning of the term *catalyst*.

.....

.....

..... [2]

(ii) Suggest from which section of the Periodic Table the elements used to make the catalyst should be chosen.

..... [1]

8 **(a)** A student set up the circuit shown in Fig. 8.1.

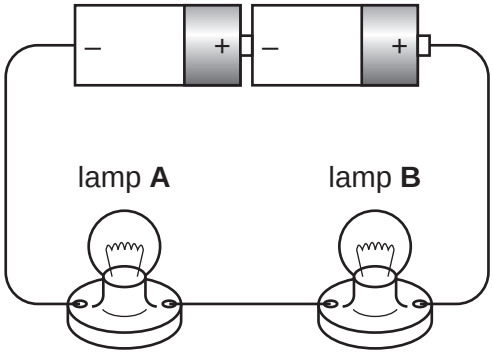


Fig. 8.1

Redraw this diagram as a circuit diagram using the correct electrical symbols.

[3]

(b) The student noticed that neither lamp **A** nor lamp **B** lit up. She found nothing wrong with lamp **A**, but the filament in lamp **B** was broken.

(i) Explain why lamp **A** did not light up.

.....

..... [1]

(ii) She replaced lamp **B** with a new lamp. The resistance of each lamp was 4 ohms when lit.

Calculate the combined resistance of both lamps in the working circuit.

..... ohms [1]

(c) Electricity can be generated by many methods, including the use of solar energy.

(i) State one non-renewable fuel that is used to generate electricity.

.....

[1]

(ii) Name the process that produces energy within the Sun.

.....

[1]

(iii) Energy is transferred from the Sun to the Earth by radiation.
Explain why energy cannot be transferred from the Sun to the Earth by conduction.

.....

.....

[1]

[Turn over

9 **(a)** Fig. 9.1 shows the male reproductive system.

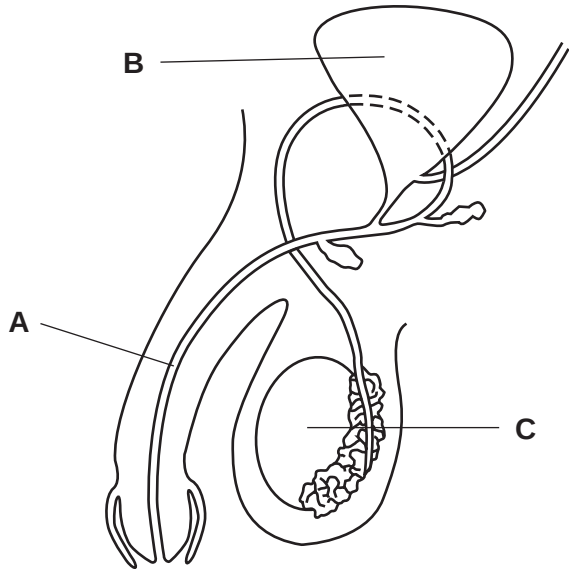


Fig. 9.1

(i) Name the part labelled **A**.

A ..... [1]

(ii) State the functions of parts **B** and **C**.

B .....

C ..... [2]

(b) Some organisms are able to reproduce both asexually and sexually.

(i) Describe the differences between asexual reproduction and sexual reproduction.

.....

.....

..... [2]

(ii) Describe **one** way in which a plant reproduces asexually.

.....

.....

..... [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 Sulphur 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															

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

*58-71 Lanthanoid series
90-103 Actinoid series

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.).