

Centre Number	Candidate Number	Name
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

COMBINED SCIENCE

0653/03

Paper 3

May/June 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.

For Examiner's Use	
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Total	

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.

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



1 (a) Fig. 1.1 shows the structure of a wind-pollinated flower.

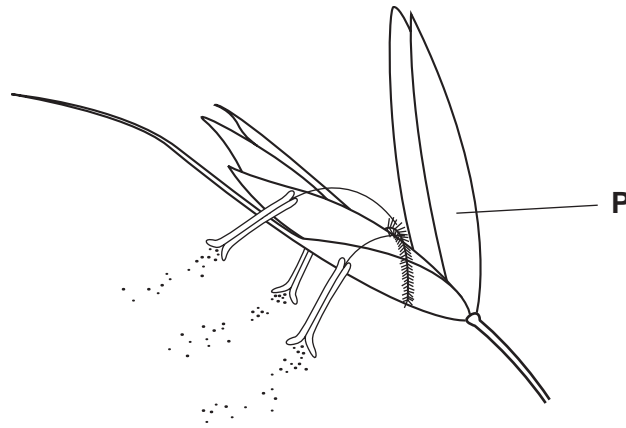


Fig. 1.1

Explain **one** way in which the structure of this flower increases the chance of successful pollination.

.....

.....

..... [2]

(b) Fig. 1.2 shows the structure of a cell that is found inside the plant's leaves.

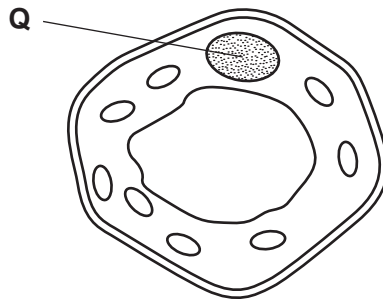


Fig. 1.2

(i) Suggest **one** way in which the structure of this cell differs from a cell in the part labelled **P** in Fig. 1.1. Explain the reason for your suggestion.

.....

.....

..... [2]

(ii) Describe the function of the part labelled **Q** in Fig. 1.2.

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

(c) The leaf cell shown in Fig. 1.2 requires a steady supply of water.

(i) Name the tissue in which water is transported from the roots to the leaves.

..... [1]

(ii) Describe how water is lost from leaf cells, and how this water leaves the leaf and enters the air around it.

.....
.....
.....
..... [3]

- 2 Fig 2.1 shows what is observed when a piece of potassium reacts in a container of chlorine.

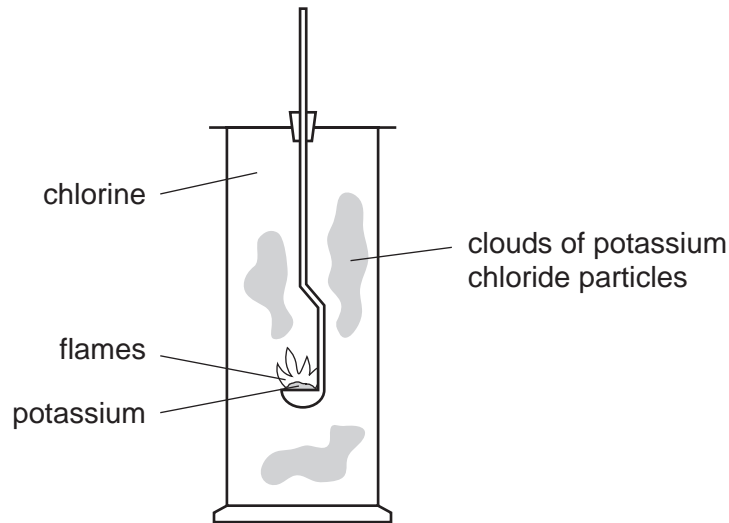


Fig. 2.1

- (a) (i) Write the word equation for the reaction.

..... [1]

- (ii) State which observation in Fig. 2.1 shows that the reaction is *exothermic*.

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

- (b) Potassium chloride can also be made by reacting potassium hydroxide solution with dilute hydrochloric acid.
Write a balanced symbolic equation for this reaction.

..... [2]

- (c) The apparatus shown in Fig. 2.2 can be used to separate potassium chloride into its elements.

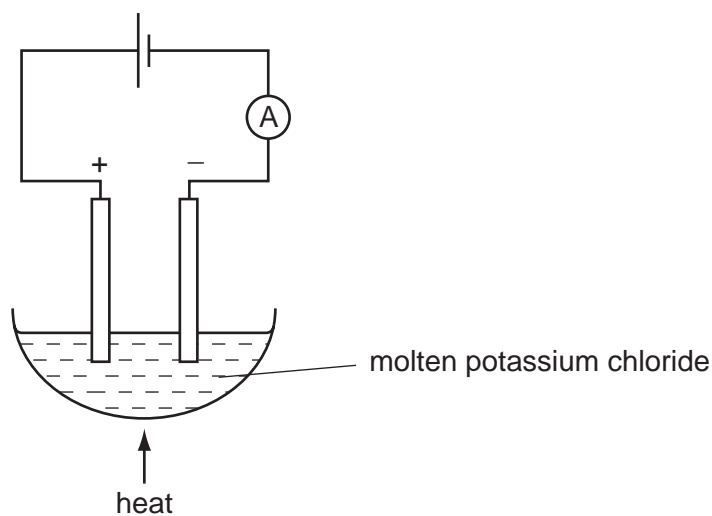


Fig. 2.2

- (i) Explain why potassium ions move towards the cathode.

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

- (ii) Describe how potassium ions change into potassium atoms at the cathode.

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

3 (a) An elephant can communicate with other elephants using infra-sound.
This is a very low frequency vibration, which is usually impossible for a human to hear.

(i) Suggest a possible frequency for this vibration.

..... [1]

(ii) Explain what is happening when these vibrations travel through the air. You may use a diagram to help you to answer this question.

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

(b) A spider climbs vertically upwards along a thread.



(i) The spider weighs 0.02N.

Calculate the work done when it climbs 21 cm up the thread.

Show your working and state the formula that you use.

formula used

working

..... [2]

- (ii) Calculate the power generated by the spider as it climbs up the thread. It climbs 21 cm in 7 seconds.

Show your working and state the formula that you use.

formula used

working

..... [2]

- (iii) The mass of the spider is 2g. It begins to move up the thread with an acceleration of 2cm/s^2 .

Calculate the resultant force causing this acceleration.

Show your working and state the formula that you use.

formula used

working

..... [3]

- (c) A polar bear is a large white furry mammal that lives on the Arctic ice.

Suggest and explain **one** way in which the polar bear is adapted to reduce heat loss in this cold climate.

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

4 In the 1950s, many people in London used coal to heat their houses. In early December 1952, the weather was foggy. The sulphur dioxide released from the burning of the coal stayed trapped in the fog.

(a) Fig. 4.1 shows the concentration of sulphur dioxide in the air, and also the number of people who died, from December 1st to December 15th.

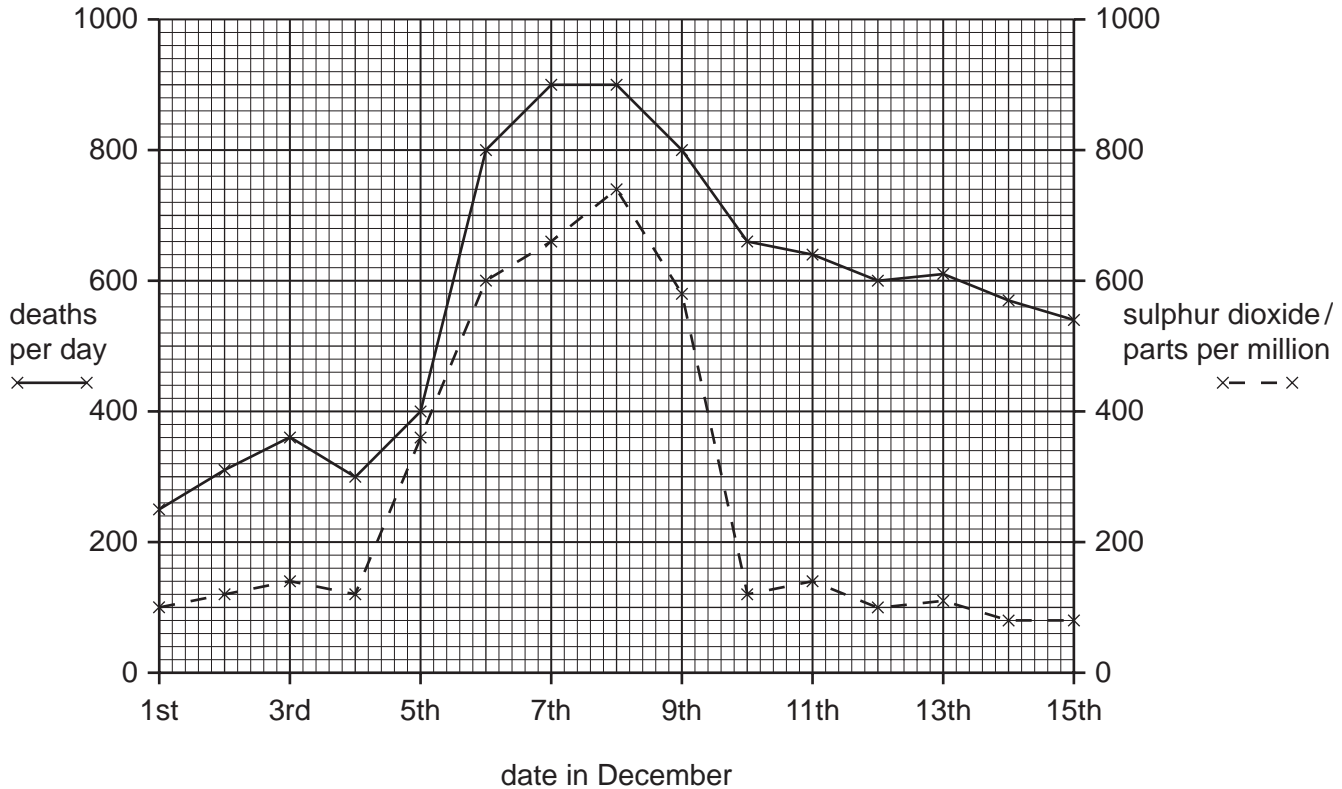


Fig. 4.1

(i) How many more people died on December 8th than on December 1st?

..... [1]

(ii) Explain how the information in the graph in Fig. 4.1 supports the idea that sulphur dioxide is harmful to health.

.....

 [1]

(iii) Suggest why the numbers of deaths were still high on December 15th, even though the concentration of sulphur dioxide had returned to a low level.

.....
 [1]

(b) Explain how the emission of sulphur dioxide into the atmosphere can lead to the formation of acid rain.

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

(c) The combustion of coal also releases soot particles into the atmosphere. Some of these may fall onto plant leaves, forming a coating over them and blocking their stomata.

Explain how this could reduce the rate of growth of the plants.

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

- 5 (a) The full chemical symbols of four elements are shown below.



Use this information to answer (i) to (iii) below.

- (i) Name the element which does not react with any of the others, and explain your answer.

name

explanation

..... [1]

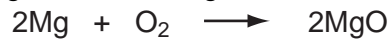
- (ii) Name a pair of elements which combine together to form an *ionic* compound.

..... and [1]

- (iii) Name two elements whose atoms have electrons in three energy levels (shells)

..... and [1]

- (b) Magnesium reacts with oxygen to form magnesium oxide.



A student found that when 4.8g of magnesium were completely oxidised, 8.0g of magnesium oxide were formed.

- (i) Calculate the mass of oxygen which combined with 4.8g of magnesium.

..... [1]

- (ii) The student then burned 2.4g of magnesium in a vessel containing 5.0g of oxygen. Calculate the mass of oxygen left over after all the magnesium had reacted.

Show your working.

..... [2]

- (c) A student investigated factors affecting the rate of reaction between magnesium and dilute hydrochloric acid. She wanted to investigate the effects of changing

- the surface area of the magnesium,
- the temperature of the hydrochloric acid.

The apparatus she used is shown in Fig. 5.1.

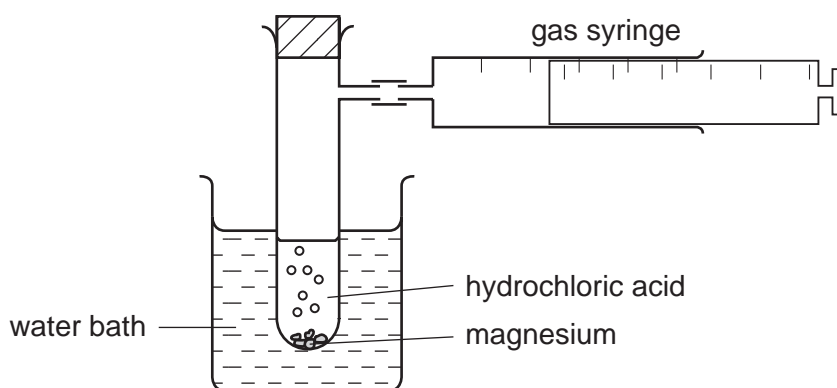


Fig. 5.1

Results of four of her experiments are shown in Table 5.1. In each experiment she used 2.0g of magnesium and 20.0 cm³ of hydrochloric acid.

Table 5.1

experiment	temperature of acid / °C	volume of gas collected / cm ³	time taken to collect gas / minutes	rate of reaction / cm ³ per minute
1	18	50	2	25
2	18	65	2	32.5
3	28	100	2	
4	41	105	1	

(i) Name the gas given off in this reaction.

..... [1]

(ii) State **one** other important factor (variable) which the student must keep the same in each experiment.

..... [1]

(iii) Complete the two remaining boxes in Table 5.1. [1]

(iv) Suggest which pair of experiments the student carried out in order to observe the effect on reaction rate of changing the surface area of the magnesium.

Explain your answer briefly.

.....

 [2]

- 6 (a) Fig. 6.1 shows a fish tank containing one fish.

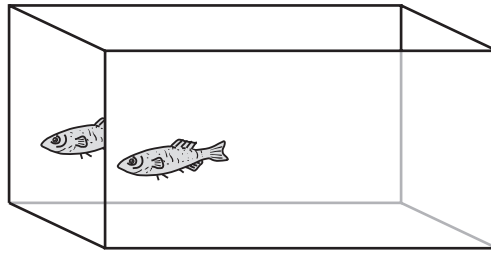


Fig. 6.1

If observed from the corner, there appear to be two fish in the tank.

Fig. 6.2 shows the tank from above.

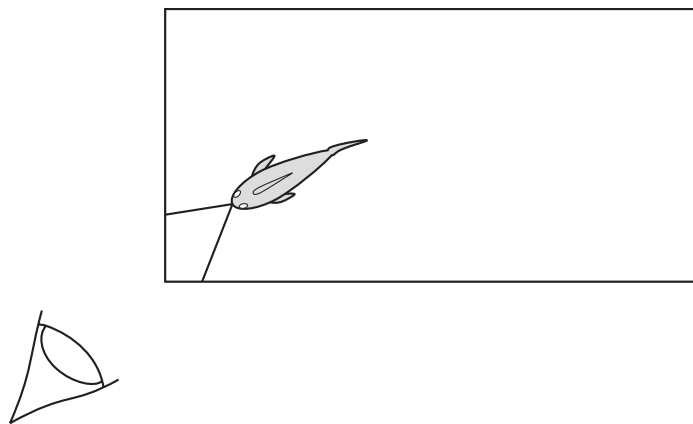


Fig. 6.2

- (i) Two rays of light have been drawn from the fish.
Continue the rays of light in Fig. 6.2 to show how the light waves reach the eye. [1]
- (ii) Use the diagram to explain why the observer can see two fish.
You may wish to add to Fig. 6.2 to help you answer this question.

[2]

- (b) An electric heater is designed to heat the fish tank. The circuit containing this heater is shown in Fig. 6.3.

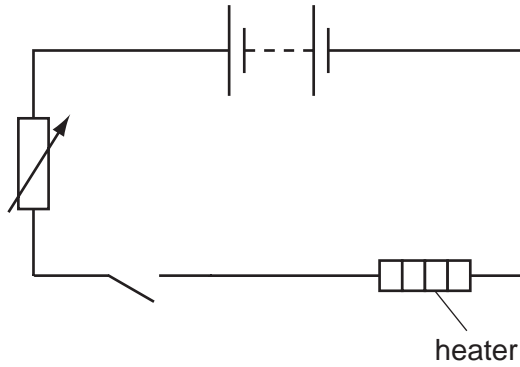


Fig. 6.3

The current flowing through the heater is 0.5 A and the voltage across it is 5.0V.
Calculate the resistance of the heater.
Show your working and state the formula that you use.

formula used

working

..... [2]

- (c) The electric heater is placed at the bottom of the fish tank rather than at the top.
Explain why this is more effective for heating the water in the tank.

.....

 [2]

- 7 Fig. 7.1 shows the structure of the human alimentary canal.

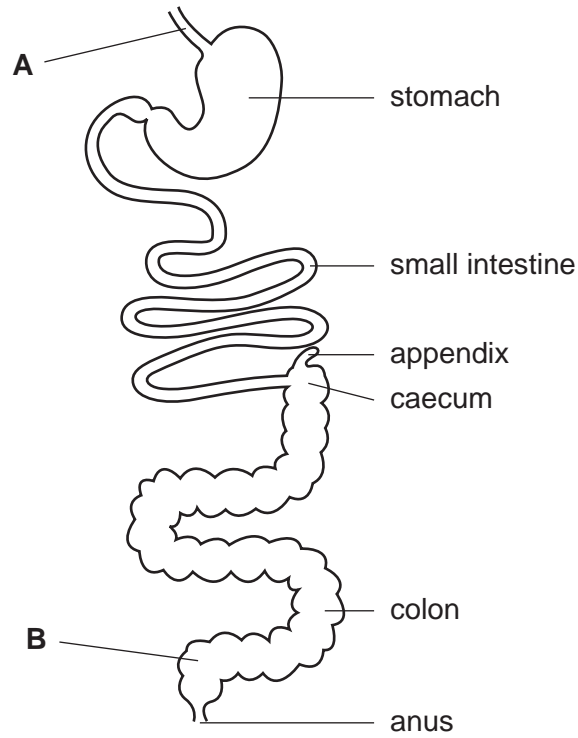


Fig. 7.1

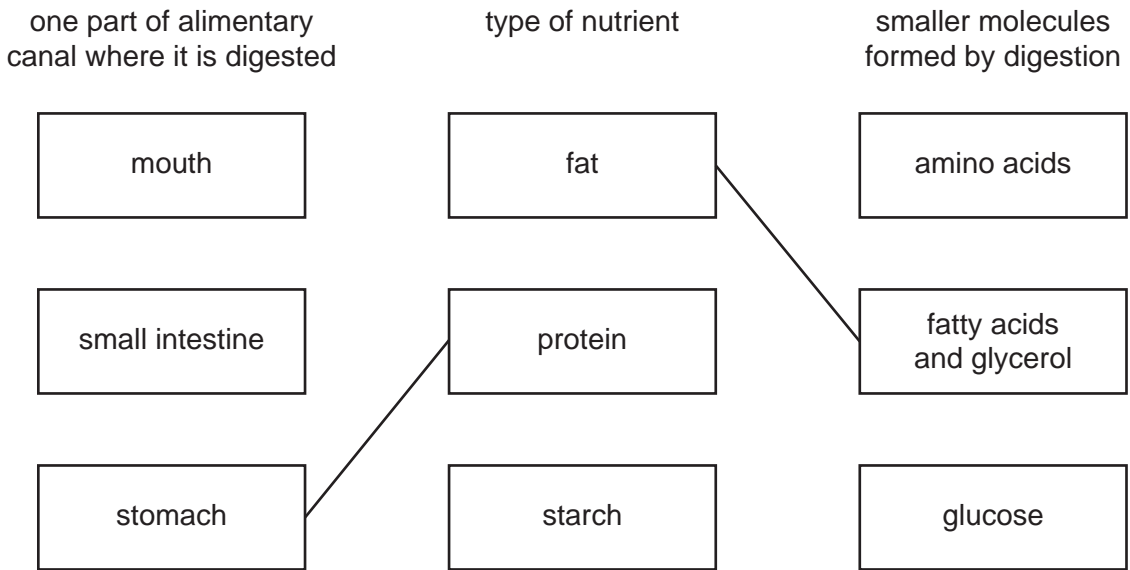
- (a) Name the parts labelled **A** and **B**.

A

B [2]

- (b) The boxes below contain the name of a nutrient, a part of the alimentary canal in which it is digested, and the name of the molecules which are formed during digestion.

Draw lines to connect the nutrient to the appropriate part of the alimentary canal and to the molecules which are formed. Two lines have been drawn for you.



[2]

- (c) Fig. 7.1 shows that the small intestine is the longest part of the alimentary canal. Suggest how this helps it to carry out its functions effectively.

.....

 [2]

- (d) Glucose is a good energy food. Athletes often drink liquids containing glucose to provide them with energy quickly.

- (i) Describe how glucose provides energy for an athlete's muscles.

.....

 [2]

- (ii) Describe how you can test a drink to find out if it contains a reducing sugar, such as glucose.

.....

 [2]

- 8 (a) When it has been buried, compressed and heated underground for millions of years, wood is converted into a common type of solid fuel.
Name the solid fuel formed from wood over millions of years.

..... [1]

- (b) Fig. 8.1 shows an experiment carried out on some small pieces of wood.

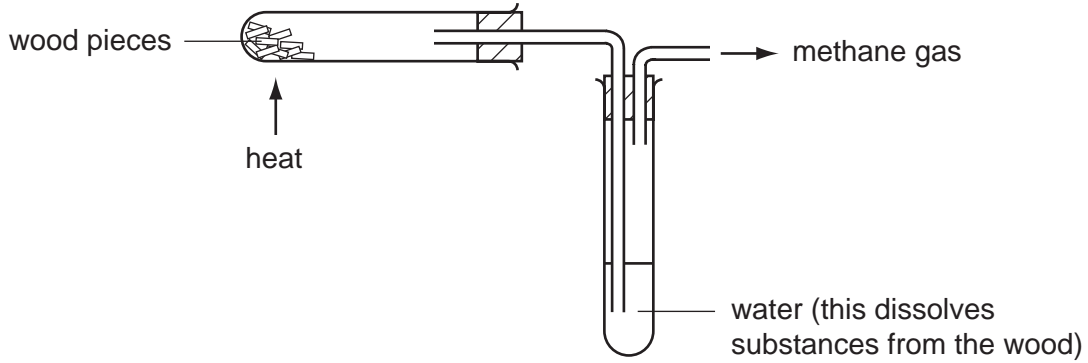


Fig. 8.1

The wood in the experiment does not catch fire. Suggest the type of chemical reaction that is occurring.

Explain your answer briefly.

type of reaction

explanation

..... [2]

- (c) Propane, C_3H_8 , is a gaseous hydrocarbon fuel.

- (i) When propane is shaken with bromine solution, the mixture remains orange.
Explain what this observation shows about the bonding in propane molecules.

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

- (ii) The equation below shows the complete combustion of propane. Complete the balancing of the equation.

[1]



- (iii) Calculate the formula mass of propane. Show your working.

..... [2]

- 9 (a) Fig. 9.1 shows a toy bird suspended from a ceiling by a spring.



Fig. 9.1

- (i) The upward force of the spring has been labelled **A**.
Draw another arrow on the diagram to show the direction of the other force acting on the bird.
Label it **B**. [1]

- (ii) The bird is not moving. What can be stated about the sizes and directions of forces **A** and **B**?

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

- (b) The toy bird is made of a thin piece of aluminium.
On Fig. 9.1 write the letter **C** where the centre of mass is likely to be. [1]

(c) The mass of the toy bird is 7.5 g and its volume is 3.0 cm³.

(i) Suggest how you could measure the volume of the bird.

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

(ii) Calculate the density of the bird.

Show your working and state the formula that you use.

formula used

working

..... [2]

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DATA SHEET
The Periodic Table of the Elements

Group																																																																																																																																															
I	II	III	IV	V	VI	VII	O																																																																																																																																								
7 Li Lithium 3	9 Be Beryllium 4	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td>1 H Hydrogen 1</td> <td colspan="17"></td> </tr> </table>																1 H Hydrogen 1																		11 B Boron 5	12 C Carbon 6	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulphur 16	17 Cl Chlorine 17	18 Ar Argon 18	19 F Fluorine 9	20 Ne Neon 10	21 Sc Scandium 21	22 Ti Titanium 22	23 V Vanadium 23	24 Cr Chromium 24	25 Mn Manganese 25	26 Fe Iron 26	27 Co Cobalt 27	28 Ni Nickel 28	29 Cu Copper 29	30 Zn Zinc 30	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36	37 Rb Rubidium 37	38 Sr Strontium 38	39 Y Yttrium 39	40 Ca Calcium 20	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45	46 Pd Palladium 46	47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54	55 Cs Caesium 55	56 Ba Barium 56	57 La Lanthanum 57	58 Ce Cerium 58	59 Pr Praseodymium 59	60 Nd Neodymium 60	61 Pm Promethium 61	62 Sm Samarium 62	63 Eu Europium 63	64 Gd Gadolinium 64	65 Tb Terbium 65	66 Dy Dysprosium 66	67 Ho Holmium 67	68 Er Erbium 68	69 Tm Thulium 69	70 Yb Ytterbium 70	71 Lu Lutetium 71	72 Hf Hafnium 72	73 Ta Tantalum 73	74 W Tungsten 74	75 Re Rhenium 75	76 Os Osmium 76	77 Ir Iridium 77	78 Pt Platinum 78	79 Au Gold 79	80 Hg Mercury 80	81 Tl Thallium 81	82 Pb Lead 82	83 Bi Bismuth 83	84 Po Polonium 84	85 At Astatine 85	86 Rn Radon 86	87 Fr Francium 87	88 Ra Radium 88	89 Ac Actinium 89	90 Th Thorium 90	91 Pa Protactinium 91	92 U Uranium 92	93 Np Neptunium 93	94 Pu Plutonium 94	95 Am Americium 95	96 Cm Curium 96	97 Bk Berkelium 97	98 Cf Californium 98	99 Es Einsteinium 99	100 Fm Fermium 100	101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103	104 Rf Rutherfordium 104	105 Db Dubnium 105	106 Sg Seaborgium 106	107 Bh Bohrium 107	108 Hs Hassium 108	109 Mt Meitnerium 109	110 Ds Darmstadtium 110	111 Rg Roentgenium 111	112 Cn Copernicium 112	113 Nh Nihonium 113	114 Fl Flerovium 114	115 Mc Moscovium 115	116 Lv Livermorium 116	117 Ts Tennessine 117	118 Og Oganesson 118
1 H Hydrogen 1																																																																																																																																															
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	146 Pm Promethium 61	147 Sm Samarium 62	150 Eu Europium 63	152 Gd Gadolinium 64	157 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	176 Hf Hafnium 72	178 Ta Tantalum 73	180 W Tungsten 74	182 Re Rhenium 75	186 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	210 Rn Radon 86	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89	232 Th Thorium 90	232 Pa Protactinium 91	238 U Uranium 92	238 Np Neptunium 93	244 Pu Plutonium 94	244 Am Americium 95	244 Cm Curium 96	247 Bk Berkelium 97	251 Cf Californium 98	257 Es Einsteinium 99	258 Fm Fermium 100	259 Md Mendelevium 101	259 No Nobelium 102	261 Lr Lawrencium 103	261 Rf Rutherfordium 104	261 Db Dubnium 105	261 Sg Seaborgium 106	261 Bh Bohrium 107	261 Hs Hassium 108	261 Mt Meitnerium 109	261 Ds Darmstadtium 110	261 Rg Roentgenium 111	261 Cn Copernicium 112	261 Nh Nihonium 113	261 Fl Flerovium 114	261 Mc Moscovium 115	261 Lv Livermorium 116	261 Ts Tennessine 117	261 Og Oganesson 118																																																																																

*58-71 Lanthanoid series
90-103 Actinoid series

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

Key

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