

Centre Number	Candidate Number	Name
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CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

**SCIENCE**

**5124/03, 5126/03**

Paper 3 Chemistry

October/November 2003

**1 hour 15 minutes**

Additional Materials: Answer paper

**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.

**Section A**

Answer **all** questions.  
Write your answers in the spaces provided on the question paper.

**Section B**

Answer any **two** questions.  
Write your answers on the lined page provided and, if necessary, continue on separate answer paper.

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.  
A copy of the Periodic Table is printed on page 12.

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	
<b>Section A</b>	
<b>Section B</b>	/
<b>TOTAL</b>	

This document consists of **11** printed pages and **1** lined page.



## Section A

Answer **all** the questions.

Write your answers in the spaces provided on the question paper.

- 1 Give **one** use for each of the substances in Fig. 1.1.

substance	use
calcium carbonate	
chlorine	
hydrogen	
silver salts	
zinc	

Fig. 1.1

[5]

- 2 Chemical reactions sometimes have names. For example, the complete reaction of an acid with an alkali is called 'neutralisation'.  
Fig. 2.1 contains a series of chemical reactions.  
Give the names of these reactions.



Fig. 2.1

- (a) reaction A .....
- (b) reaction B .....
- (c) reaction C .....

[3]

3 (a) Give the number of the Group of the Periodic Table that contains

(i) alkali metals, .....

(ii) halogens. ....

[2]

(b) Group 0 of the Periodic Table contains noble gases. The noble gases are all chemically unreactive.

(i) Complete the table in Fig. 3.1.

name of noble gas	one use of the gas

Fig. 3.1

(ii) Explain why noble gases are chemically unreactive.

.....

.....

[4]

- 4 Phosphorus is an element that does not react with water. Phosphorus will react with one of the gases in air, forming an oxide.

A piece of phosphorus is fastened to a copper wire and left for a few days in the apparatus shown in Fig. 4.1. The water slowly rises up the tube.

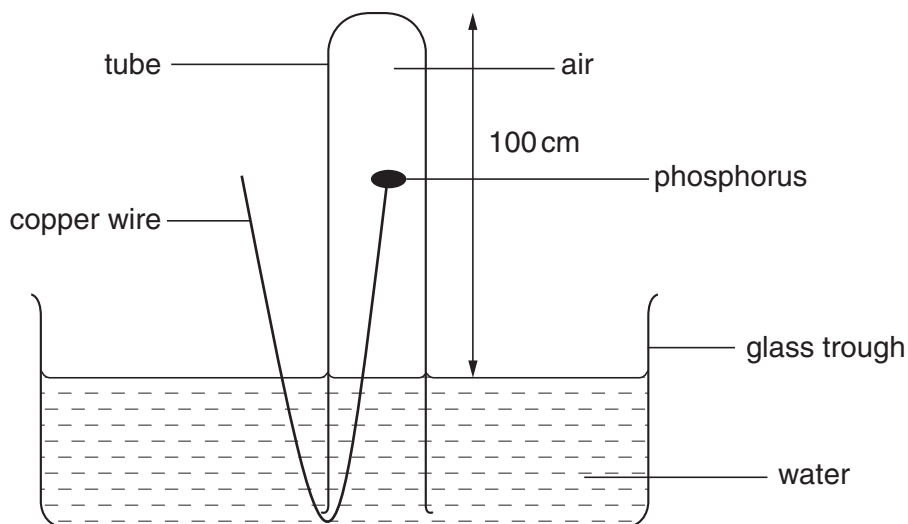


Fig. 4.1

- (a) Name the gas, contained in air, that reacts with phosphorus.

..... [1]

- (b) Approximately how far up the tube will the water rise?

..... [1]

- (c) Name **two** gases that are left in the tube after a few days.

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

- 5 Imagine that three metals are transported to Earth by rocket ship from a far distant planet. On the planet the three metals are called beium, ceium and deium.

On Earth the three metals are dropped into water: deium does not react, but beium and ceium do, liberating a gas **T** which 'pops' when lit.

When beium is mixed with dilute sulphuric acid, a solution of beium sulphate is formed.

When ceium is dropped into a solution of beium sulphate, beium is **not** displaced.

- (a) (i) Name the gas **T** and the compound formed when it is lit.

name of gas .....

compound formed .....

- (ii) Place beium, ceium and deium in order of reactivity, most reactive first.

.....

[3]

- (b) Deium could be the same metal as one of Earth's metals.

- (i) Name one of Earth's metals that might be the same as deium.

.....

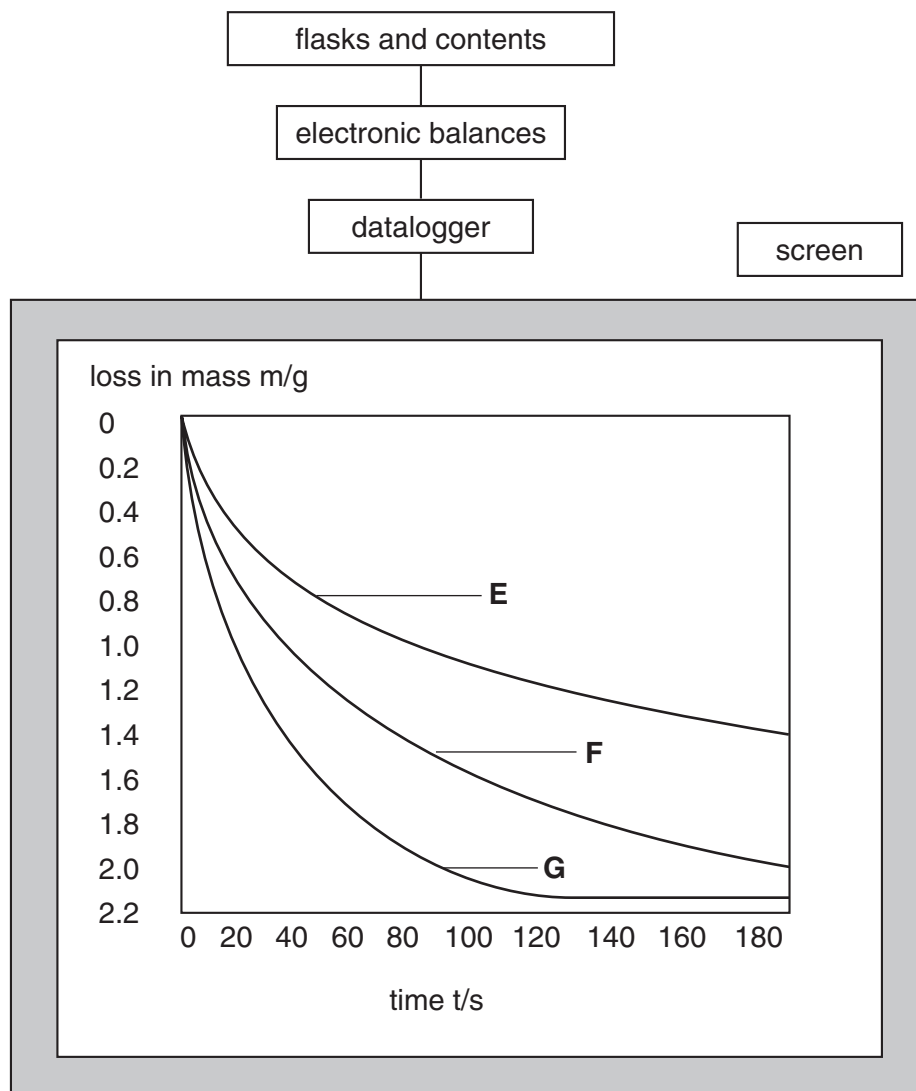
- (ii) In the future people on Earth might need to import this metal from the far distant planet. Suggest why this might be necessary.

.....

.....

[2]

- 6 Three samples of calcium carbonate are placed in flasks for an investigation.  
 In flask **E** is 5 g of calcium carbonate – large lumps.  
 In flask **F** is 5 g of calcium carbonate – medium-sized lumps.  
 In flask **G** is 5 g of calcium carbonate – small lumps.  
 The same volume, an excess, of dilute hydrochloric acid is added to each flask.  
 The flasks are placed on three electronic balances.  
 A datalogger is used to plot the loss of mass of the flasks and their contents against time.  
 The results are shown in Fig. 6.1.



**Fig. 6.1**

- (a) (i) Why do the three flasks and their contents lose mass?

.....

- (ii) How do the rates of reaction change with time?

.....

.....

[2]

(b) In which flask is the reaction fastest at time  $t = 20$  s?

.....

[1]

(c) (i) After how long does the reaction in flask **G** stop?

.....

(ii) Why does this reaction stop?

.....

[2]

(d) Sketch on Fig. 6.1 the curve you would expect if 5 g of powdered calcium carbonate is used instead of 5 g of lumps of calcium carbonate. Label this curve **H**. [2]

(e) What name is given to a reaction in which heat is given out?

.....

[1]

7 Some properties of three solids, **I**, **J** and **K** are given in Fig. 7.1. Use this information to complete the last column of the table.

solid	percentage composition by mass	solid conducts electricity	strong heat in oxygen	element or mixture or compound
<b>I</b>	constant	no	decomposes	
<b>J</b>	varies	no	burns	
<b>K</b>	constant	yes	oxidises to one substance	

Fig. 7.1

[3]

8 Fig. 8.1 shows some of the properties of a blue, crystalline solid.

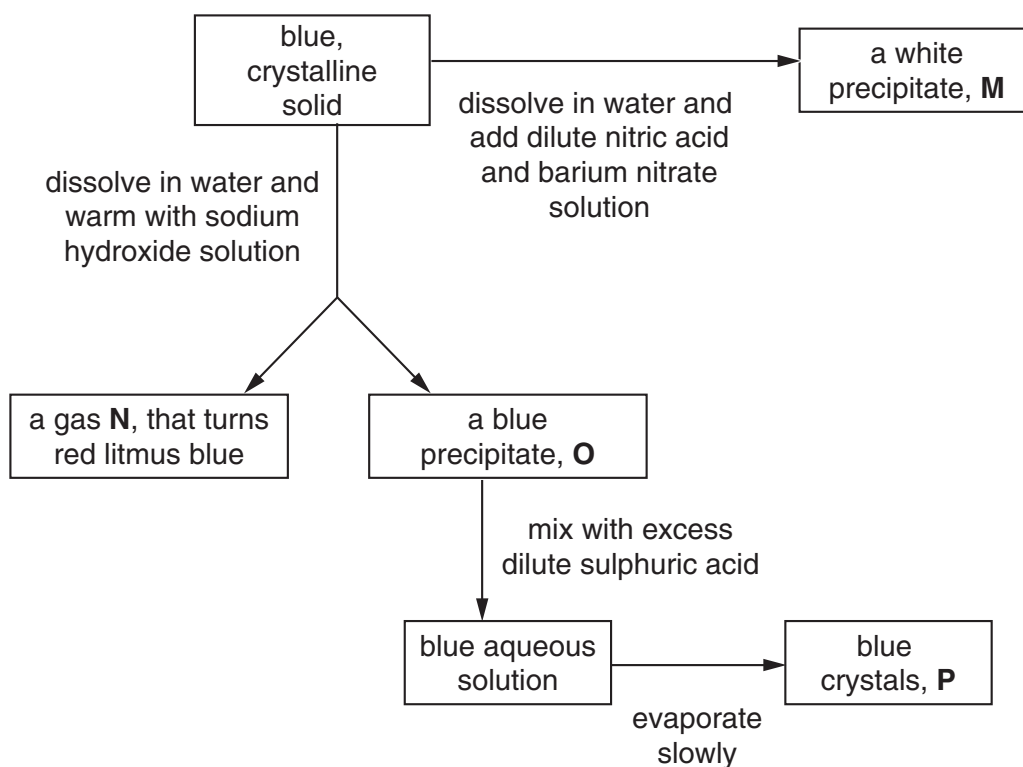


Fig. 8.1

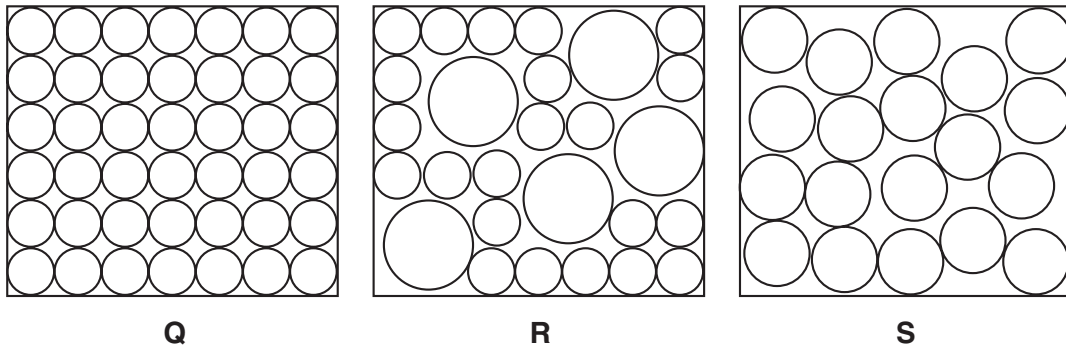
Identify the following.

- (a) substance **M** .....
- (b) substance **N** .....
- (c) substance **O** .....
- (d) substance **P** .....

[4]



- 9 Fig. 9.1 shows the particles in three substances, **Q**, **R** and **S**.



**Fig. 9.1**

- (a) Which of the structures in Fig. 9.1 best represents

- (i) solid copper, .....
- (ii) brass, .....
- (iii) a non-metal? .....

[3]

- (b) Use the structures in Fig. 9.1 to help you to suggest why a wire made of an alloy is more difficult to stretch than a wire made of a pure metal.

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

- (c) (i) Why do metals conduct heat better than non-metals?

.....  
 .....

- (ii) Give two other differences between metals and non-metals.

.....  
 .....

[3]

## Section B

Answer any **two** questions.

Write your answers on the lined page provided and, if necessary, continue on separate answer paper.

- 10 (a) (i)** Describe how crystalline sugars can be used to produce a solution of ethanol in water. Explain why the temperature must not be allowed to rise above 50 °C.
- (ii)** Explain why an acid will form in the resulting ethanol solution if it is left open to the air for some time. [5]
- (b)** Write the full structural formula for ethanol. Calculate its percentage of carbon by mass. [Relative atomic masses  $A_r$ : H,1; C,12; O,16] [5]
- 11** Sodium hydroxide solution is an alkali and dilute sulphuric acid is an acid.
- (a) (i)** Give **two** properties of all alkalis and **three** properties of all acids.
- (ii)** What ions cause these properties? [7]
- (b)** Sulphuric acid can be neutralised by sodium hydroxide. Write a chemical equation and an ionic equation to represent this neutralisation. [3]
- 12 (a)** Define
- (i)** proton number,
- (ii)** mass number. [2]
- (b)** An element contains atoms of an isotope that has mass number 36 and proton number 16.
- (i)** Draw diagrams to show the nuclear and electronic structures of an atom of this isotope.
- (ii)** Identify the element by using the Periodic Table on page 12. Give the element's symbol and the number of the Group in which it appears.
- (iii)** Decide whether the element is a metal or a non-metal, and explain how you made this decision. [8]



**DATA SHEET**  
**The Periodic Table of the Elements**

Group																								
I	II	III	IV	V	VI	VII	O																	
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4	1 <b>H</b> Hydrogen 1	11 <b>B</b> Boron 5	12 <b>C</b> Carbon 6	14 <b>N</b> Nitrogen 7	16 <b>O</b> Oxygen 8	19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10																
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12	27 <b>Al</b> Aluminium 13	28 <b>Si</b> Silicon 14	31 <b>P</b> Phosphorus 15	32 <b>S</b> Sulphur 16	35.5 <b>Cl</b> Chlorine 17	40 <b>Ar</b> Argon 18																	
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	45 <b>Sc</b> Scandium 21	48 <b>Ti</b> Titanium 22	51 <b>V</b> Vanadium 23	52 <b>Cr</b> Chromium 24	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	59 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36							
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	89 <b>Y</b> Yttrium 39	91 <b>Zr</b> Zirconium 40	93 <b>Nb</b> Niobium 41	96 <b>Mo</b> Molybdenum 42	101 <b>Ru</b> Ruthenium 44	103 <b>Rh</b> Rhodium 45	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	112 <b>Cd</b> Cadmium 48	115 <b>In</b> Indium 49	119 <b>Sn</b> Tin 50	122 <b>Sb</b> Antimony 51	127 <b>I</b> Iodine 53	128 <b>Te</b> Tellurium 52	131 <b>Xe</b> Xenon 54								
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	139 <b>La</b> Lanthanum 57	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum 73	184 <b>W</b> Tungsten 74	190 <b>Os</b> Osmium 76	192 <b>Ir</b> Iridium 77	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold 79	201 <b>Hg</b> Mercury 80	204 <b>Tl</b> Thallium 81	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth 83	209 <b>Po</b> Polonium 84	210 <b>At</b> Astatine 85	210 <b>Rn</b> Radon 86								
87 <b>Fr</b> Francium	88 <b>Ra</b> Radium	89 <b>Ac</b> Actinium																						
*58-71 Lanthanoid series										†90-103 Actinoid series														
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20px; text-align: center;">a</td> <td style="width: 20px; text-align: center;"><b>X</b></td> <td style="width: 20px; text-align: center;">b</td> </tr> </table>										a	<b>X</b>	b	<p>a = relative atomic mass X = atomic symbol b = proton (atomic) number</p>											
a	<b>X</b>	b																						
140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71	232 <b>Th</b> Thorium 90	238 <b>U</b> Uranium 92	238 <b>Pa</b> Protactinium 91	94 <b>Pu</b> Plutonium	95 <b>Am</b> Americium	96 <b>Cm</b> Curium	97 <b>Bk</b> Berkelium	98 <b>Cf</b> Californium	99 <b>Es</b> Einsteinium	100 <b>Fm</b> Fermium	101 <b>Md</b> Mendelevium	102 <b>No</b> Nobelium	103 <b>Lr</b> Lawrencium

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).