Centre Number	Candidate Number

Candidate Name _____

CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Ordinary Level

SCIENCE 5124/3

PAPER 3 Chemistry

MAY/JUNE SESSION 2002

1 hour 15 minutes

Additional materials:
Answer paper

TIME 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and on all separate answer paper used.

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 pages provided and, if necessary, continue on separate answer paper.

At the end of the examination,

1. fasten any separate answer paper securely to the question paper;
2. enter the numbers of the **Section B** questions you have answered in the left hand column of the grid below.

INFORMATION FOR CANDIDATES

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.

FOR EXAMINER'S USE	
Section A	
Section B	
TOTAL	

This question paper consists of 11 printed pages and 1 lined page.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

[Turn over

Section A

Answer **all** the questions.

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

1 Classify the substances in Fig. 1.1 as either element, compound or mixture by ticking the appropriate box. The first has been done for you.

substance	element	compound	mixture
copper	✓		
copper(II) oxide			
air			
oxygen			
lime			
steel			

Fig. 1.1

[5]

2 **(a)** What must be present, with water and oxygen, for rust to form?

.....[1]

(b) **(i)** Give two methods of rust prevention.

1. .....

2. .....

(ii) Explain how **one** of the methods you have given in **(i)** prevents rusting.

.....

.....

[3]

3 Fig. 3.1 gives the properties of four substances, **A**, **B**, **C** and **D**.

	melting point	solubility in water	electrical conductivity	
			solid	liquid
A	high	soluble	no	yes
B	high	insoluble	yes	yes
C	low	insoluble	no	no
D	low	reacts with water	yes	yes

Fig. 3.1

(a) Classify these four substances as either an ionic compound, a covalent compound or a metal by ticking the appropriate box in Fig. 3.2.

	ionic compound	covalent compound	metal
A			
B			
C			
D			

Fig. 3.2

[4]

(b) Name a substance which has the same properties as

(i) **A**, ...

(ii) **B**, ...

(iii) **C**. .....

[3]

[Turn over

4 Use your knowledge of the kinetic particle theory to suggest a reason for each of the following.

(a) Wet clothes dry more quickly on warm days than on cold days.

.....

.....[1]

(b) Solid ice loses its shape when it melts.

.....

.....[1]

(c) Sugar dissolves faster in hot water than in cold water.

.....

.....[1]

(d) When salt is dissolved in a glass of water without stirring, all of the water soon tastes salty.

.....

.....[1]

5 The metal lithium reacts with air and water.

(a) Suggest how lithium should be stored.

.....[1]

(b) A student reacted lithium with water using the apparatus shown in Fig. 5.1.

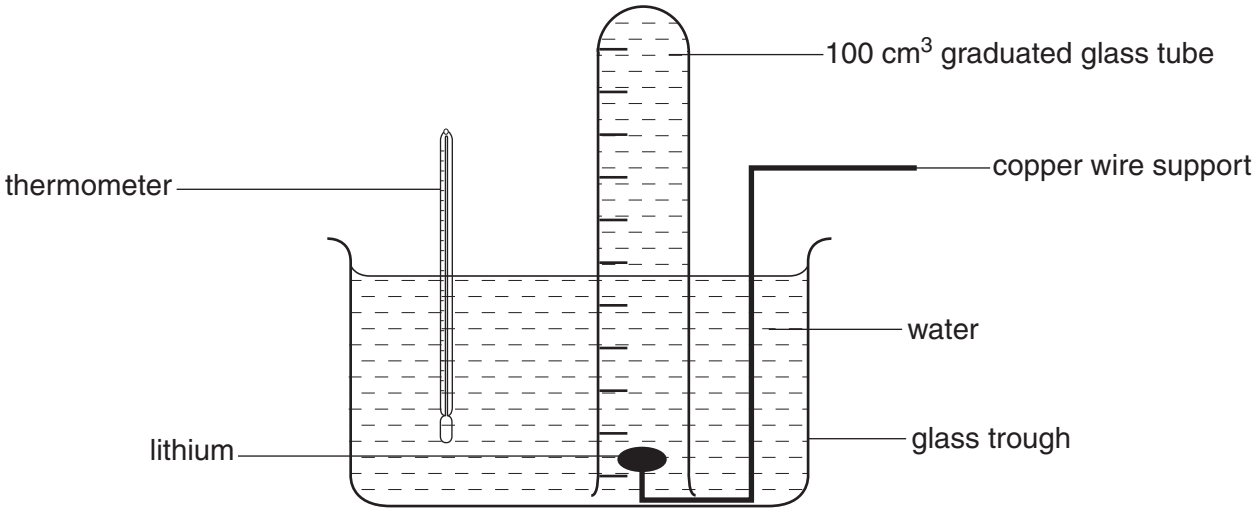


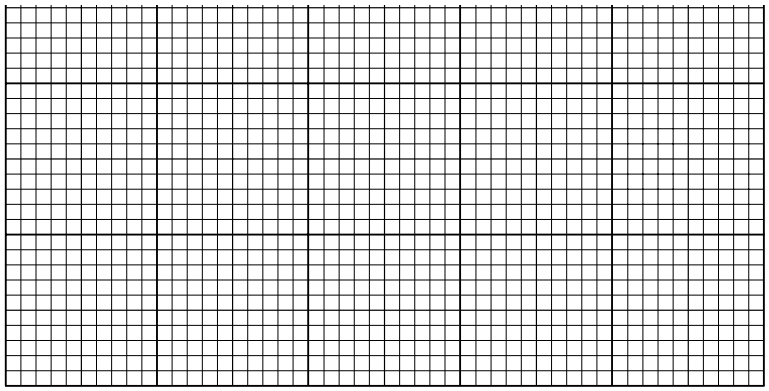
Fig. 5.1

The student measured the volume of gas at intervals of 30 seconds. The results are shown in Fig. 5.2.

time / s	0	30	60	90	120	150
volume / cm^3	0	40	60	74	86	96

Fig. 5.2

Plot a graph of these results on the grid below. Use the vertical axis to plot volume.



[2]

(c) Tick a box in Fig. 5.3 to show when the **rate of reaction** was greatest.

at time / s	5	35	65	95	125
greatest rate of reaction					

Fig. 5.3

[1]

(d) How can the student find the time taken for the reaction to stop?

.....[1]

(e) The temperature of the water increased during the reaction. How would you classify the reaction?

.....[1]

(f) **(i)** Name the gas liberated in this reaction. .....

(ii) Describe a test to confirm the presence of this gas.

.....

.....[3]

(g) **(i)** Universal Indicator is added to the solution in the trough at the end of the experiment.

What colour will you see? .....

(ii) What ions, present in this solution, cause this change?

.....

[2]

6 Polymers are produced from monomers.

(a) Draw the part of a polymer molecule formed by joining the three monomer molecules shown in Fig. 6.1.

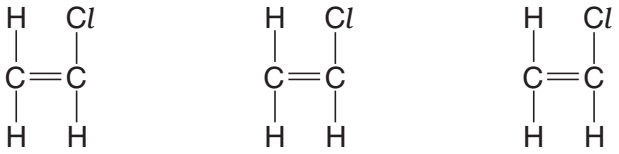


Fig. 6.1

[1]

(b) When *Terylene* is produced as a result of condensation polymerisation, some far smaller molecules of another compound are formed.

Name this compound.

.....[1]

(c) Give one use for *Terylene*.

.....[1]

(d) State one disadvantage of the large-scale use of plastics.

.....[1]

7 The element bismuth is manufactured by reducing its oxide, Bi_2O_3, with carbon.

(a) (i) Give the full name of this oxide.

.....

(ii) Calculate the relative molecular mass of this oxide.

[Relative atomic masses, A_r: O, 16; Bi, 209]

.....

[2]

(b) (i) Balance the chemical equation shown below for the reduction process.

$$Bi_2O_3(s) + C(s) \rightarrow Bi(s) + CO(g)$$

(ii) What does the symbol '(g)' indicate?

.....

(iii) Calculate the maximum mass of bismuth that can be prepared from 932 tonnes of the oxide.

[4]

8 Fig. 8.1 shows the properties and reactions of several substances.

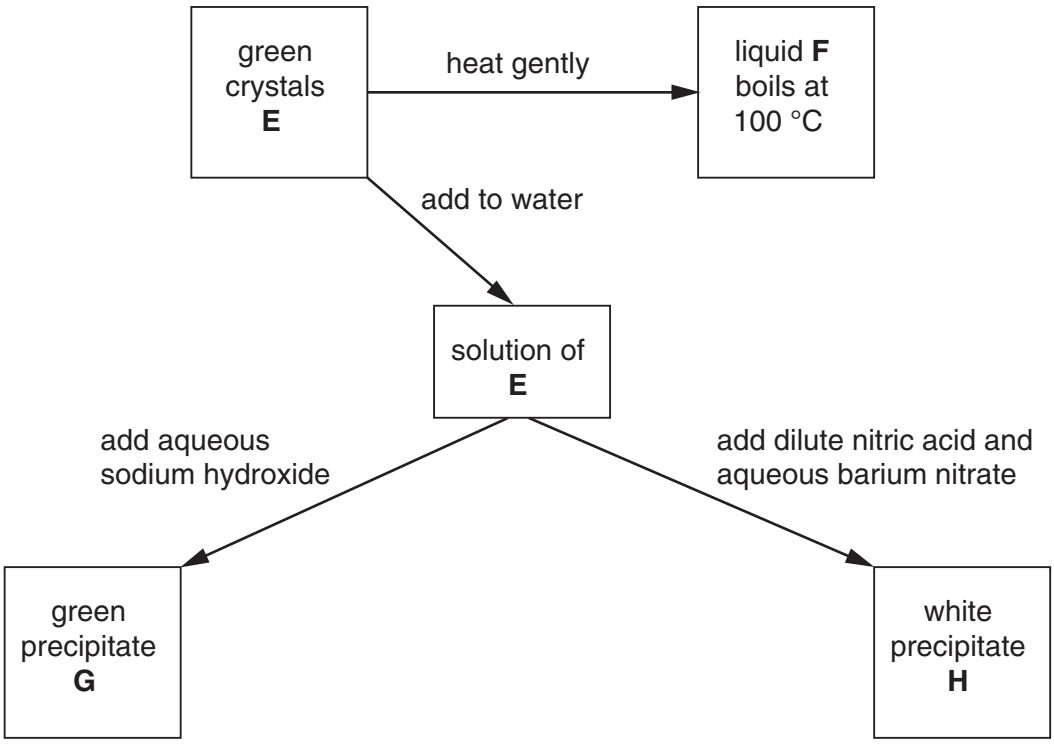


Fig. 8.1

Identify

(a) the white precipitate **H**, ...[1]

(b) the green precipitate **G**, ...[1]

(c) the liquid **F**, ...[1]

(d) the green crystals **E**. .....[1]

Section B

Answer any **two** questions.

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

9 **(a)** Describe the fractional distillation of crude oil (petroleum). [5]

(b) Suggest reasons why substances like crude oil can be separated into different fractions by fractional distillation but **not** substances like limestone, $CaCO_3$. [3]

(c) Methane, CH_4, can be produced from crude oil. What is the mass of 12 000 dm^3 of this gas at room temperature and pressure?

[Relative atomic masses, A_r: H, 1; C, 12] [2]

10 **(a)** Describe how crystals of copper(II) sulphate can be prepared from copper(II) oxide and sulphuric acid. Write the equation for the reaction. [7]

(b) Crystals of copper(II) sulphate have the formula $CuSO_4.5H_2O$. Calculate the percentage of water of crystallisation in the crystals.

[Relative atomic masses, A_r: H, 1; O, 16; S, 32; Cu, 64] [3]

11 **(a)** Describe the reactions, if any, of the metals calcium, copper and sodium with cold water. Use these reactions to place the metals in order of reactivity, most reactive first. Write the equation for any **one** of these reactions. [8]

(b) Aluminium **does not** react with cold water. Does this give a true indication of the reactivity of this element? Explain your answer. [2]

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 = 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.).