Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
General Certificate of Education Ordinary Level

SCIENCE **5124/03, 5126/03**

Paper 3 Chemistry

October/November 2006

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the booklet.
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 pages provided and, if necessary, continue on separate answer paper.

A copy of the Periodic Table is printed on page 16.
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	
Section A	
Section B	
TOTAL	

This document consists of **12** printed pages and **4** lined pages.

Section A

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

Answer **all** the questions.

1 **(a)** Name **three** of the components of clean, dry air.

(i) .....

(ii) .....

(iii) ..... [3]

(b) The air can be polluted by various chemicals.

(i) Give the chemical name for **one** of these pollutants.

.....

(ii) Describe how this pollutant enters the air.

.....

.....

[3]

2 A sample of water contains salt as an impurity. The apparatus shown in Fig. 2.1 is used to produce pure water from the sample.

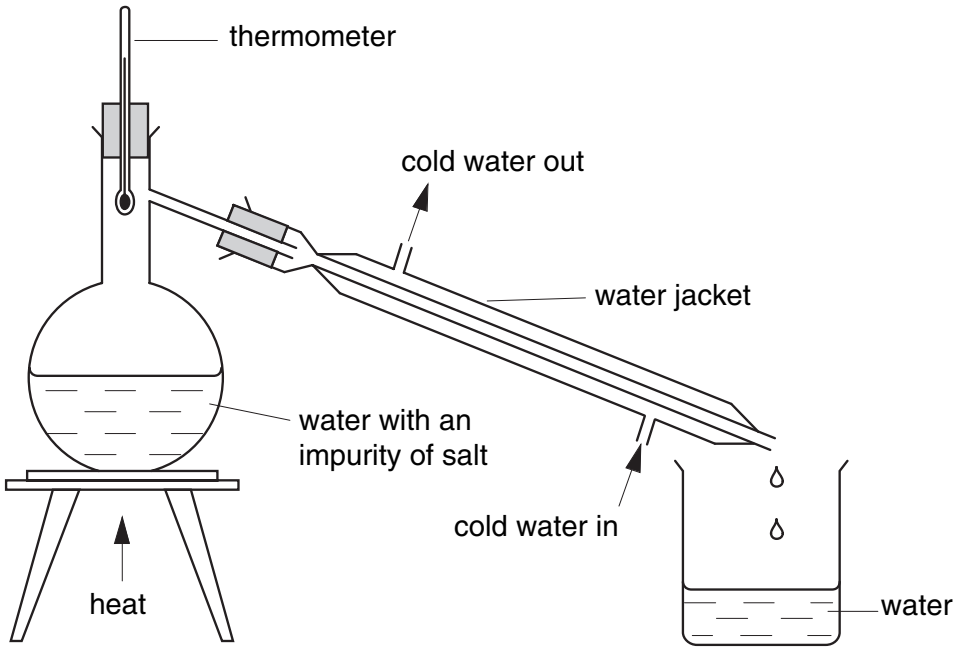


Fig. 2.1

(a) (i) Name the method of purification.

.....

(ii) Suggest the purpose of the water jacket.

.....

[2]

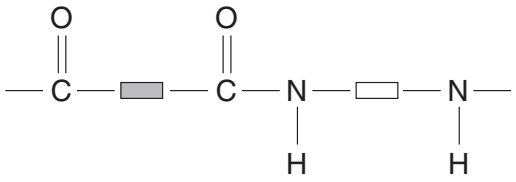
(b) What would be the approximate reading on the thermometer during the purification?

..... [1]

(c) Draw a cross (✗) on Fig. 2.1 where the salt would be left after purification is complete. [1]

3 **(a)** Table 3.1 describes **two** plastics. Complete the table. Part of the table has been completed for you as an example.

Table 3.1

name	repeating unit	use	type of polymerisation used in manufacture
poly(ethene)		making clingfilm	
			condensation polymerisation

[4]

(b) The careless disposal of both plastics and iron or steel causes pollution problems. An article made from one of the plastics in Table 3.1 is likely to cause pollution for a longer period of time than a similar article made from iron or steel. Explain why.

.....

.....

..... [2]

4 A spillage of 19.6 tonnes of sulphuric acid results from an accident to a road tanker. Slaked lime is used to neutralise the acid.

(a) The **unbalanced** chemical equation for the neutralisation is as follows.

$$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 + H_2O$$

Balance this equation. [1]

(b) Calculate the relative molecular mass of slaked lime, $Ca(OH)_2$.

[Relative atomic masses: A_r: H, 1; O, 16; Ca, 40.]

..... [1]

(c) Use the balanced chemical equation to determine

(i) the mass of slaked lime needed to neutralise the 19.6 tonnes of spilt acid,

[Relative atomic masses: A_r: H, 1; O, 16; S, 32; Ca, 40.]

mass = …… tonnes

(ii) the mass of calcium sulphate formed during the neutralisation of the spilt acid.

[Relative atomic masses: A_r: H, 1; O, 16; S, 32; Ca, 40.]

mass = …… tonnes
[3]

(d) What test could be used to show that the acid has all been neutralised?

.....

..... [1]

(e) The calcium sulphate formed in this neutralisation is insoluble in water. Suggest why this is important.

.....

..... [1]

5 Fig. 5.1 shows part of the Periodic Table of the elements. Use information from Fig. 5.1 to answer the questions that follow. The elements are represented by their chemical symbols.

Group																	
I	II											III	IV	V	VI	VII	0
							H										He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr

Fig. 5.1

(a) Give the symbol for

(i) a halogen, ……

(ii) an alkali metal. …… [2]

(b) Oxygen, sulphur and selenium are in Group VI. At room temperature oxygen is a gas and sulphur is a solid. Predict whether selenium is, at room temperature, a gas or a liquid or a solid.

..... [1]

(c) The trend in reactivity in Group VI is similar to that in Group VII. Suggest which is the most reactive element in Group VI.

..... [1]

(d) Write the formula for a compound that is formed when

(i) an element from Group I reacts with an element from Group VI,

.....

(ii) an element from Group II reacts with an element from Group VI.

..... [2]

6 Fig. 6.1 shows details of four alcohols.

alcohol	molecular formula	molecular mass	boiling point / °C
methanol	CH_3OH	32	65
ethanol	C_2H_5OH	46	79
propan-1-ol	C_3H_7OH	60	97
butan-1-ol	C_4H_9OH	74	117

Fig. 6.1

(a) The four alcohols in Fig. 6.1 are members of the same homologous series. The next in this series of alcohols is pentan-1-ol.

(i) Predict the approximate boiling point of pentan-1-ol.

.....

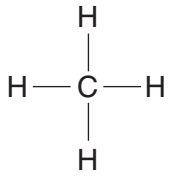
(ii) Determine the relative molecular mass of pentan-1-ol.

[Relative atomic masses: A_r: H, 1; C, 12; O, 16.]

.....

[2]

(b) The structural formula for methane is drawn as



Draw the structural formula for ethanol, C_2H_5OH.

[2]

(c) Ethanol, C_2H_5OH, is burnt as a fuel.

(i) Name **two** of the products of burning ethanol in excess oxygen.

.....

.....

(ii) Write a chemical equation for this burning of ethanol. State symbols are **not** required.

.....
[4]

7 Four metals are represented by the letters **A**, **B**, **C** and **D**: these are **not** chemical symbols. Their reactions with cold water and dilute hydrochloric acid are summarised in Fig. 7.1.

metal	reaction with cold water	reaction with dilute hydrochloric acid
A	none	none
B	none	slow
C	fast	fast
D	slow	fast

Fig. 7.1

(a) Place the metals **A**, **B**, **C** and **D** in order of reactivity.

most reactive .....

.....

.....

least reactive ..... [1]

(b) Which of the metals **A**, **B**, **C** or **D** could be

(i) sodium, ...

(ii) copper? ..... [2]

(c) Suggest which of the metals **A**, **B**, **C** and **D** would probably be the easiest to extract from its naturally occurring ore.

..... [1]

8 Hydrogen peroxide solution decomposes in the presence of a catalyst, producing oxygen gas.

The rate of this reaction can be found by plotting total volume of oxygen evolved against time.

This graph is shown in Fig. 8.1.

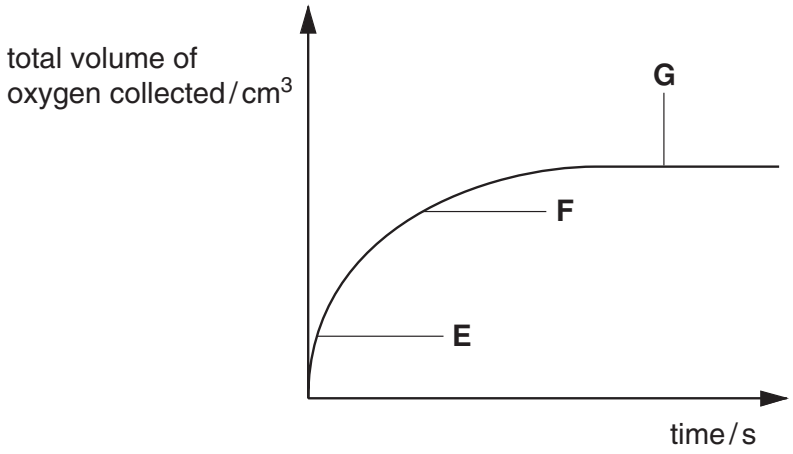


Fig. 8.1

(a) Describe the rate of decomposition at points **E**, **F** and **G**.

(i) **E**, ...

(ii) **F**, ...

(iii) **G**. ..... [3]

(b) How does the rate of decomposition depend upon the number of molecules of hydrogen peroxide present in the solution?

..... [1]

Section B

Answer any **two** questions.

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

9 Substance **H** is a mixture of three sodium salts. Fig. 9.1 shows a description written by students of how they attempted to identify the three salts.

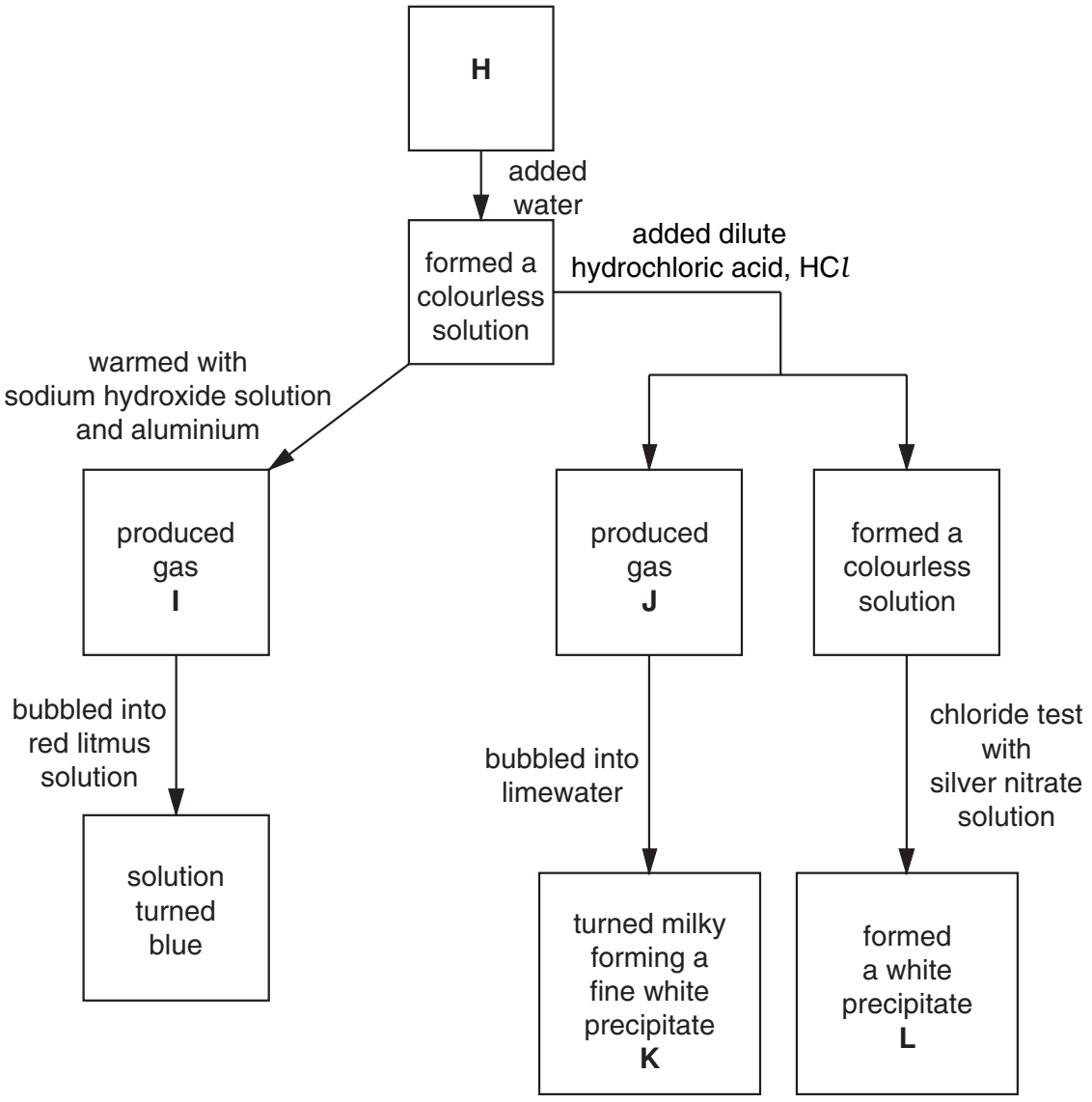


Fig. 9.1

(a) (i) Name the gases **I** and **J** and the white precipitates **K** and **L**. [4]

(ii) The formation of white precipitate **L** shows the presence of chloride ions.

Why does this not prove that chloride ions are present in substance **H**? [2]

(b) What two sodium salts must be present in the substance **H**? [2]

(c) Write a chemical equation to represent any **one** of the reactions shown in Fig. 9.1.
State symbols are **not** required. [2]

10 **(a)** Name a mixture that is gaseous, a compound that is a liquid and an element that is a solid, at room temperature and pressure. [3]

(b) For **each** of the substances you have identified in **(a),**

(i) name the atoms within the substance which are bonded together as molecules, if any,

(ii) describe how the particles move within that substance. [7]

11 **(a)** Iron is manufactured in a blast furnace using an iron ore, coke and limestone.

Name the ore and give the formula for the main iron compound in this ore. [2]

(b) Describe the essential chemical reactions that take place in the blast furnace. Include chemical equations in your description. [5]

(c) The properties of a metal can be changed by alloying the metal with other elements.

Name an alloy, state its components and give one of its uses. [3]

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 Radius 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.).