Centre Number	Candidate Number

Candidate Name _____

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

Joint Examination for the School Certificate and General Certificate of Education Ordinary Level

SCIENCE 5124/3, 5126/3

PAPER 3 Chemistry

OCTOBER/NOVEMBER SESSION 2001 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 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 10 printed pages and 2 lined pages.

[Turn over

Section A

Answer **all** the questions.

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

1 The drawings in Fig. 1.1 represent the particles in six different substances at room temperature and pressure.

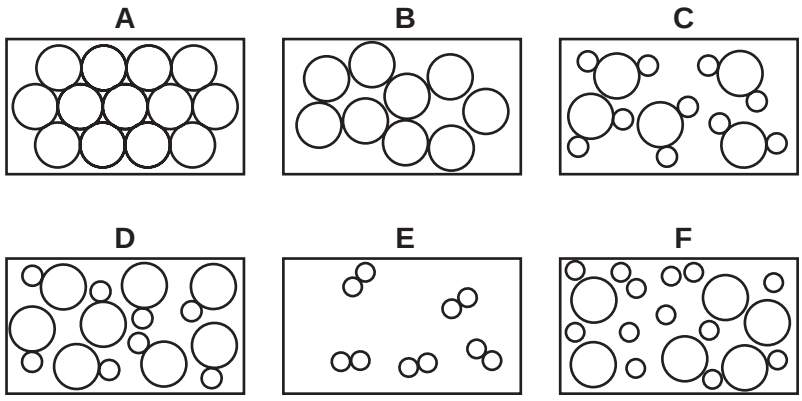


Fig. 1.1

Complete the table to show which **one** of the drawings, **A** to **F**, best represents each of the following substances.

You may use each letter once, more than once or not at all.

substance	copper	a gas	a mixture	hydrogen	water
diagram A–F					

[5]

2 **(a)** **(i)** Some hydrocarbons are saturated and others are unsaturated.

Name **one** example of each.

saturated hydrocarbon .....

unsaturated hydrocarbon ..... [2]

(ii) Give **one** chemical test by which you could distinguish between the two hydrocarbons you have named in **(i)**, and state the result for each substance.

Test .....

Result with saturated hydrocarbon .....

Result with unsaturated hydrocarbon .....[2]

(b) Alcohols react with acids to form esters. Ethyl propanoate is an ester.

(i) Name **two** substances that react to form ethyl propanoate.

alcohol .....

acid ..... [2]

(ii) Give **one** chemical test by which you could distinguish between the two substances you have named in **(i)**, and state the result for each substance.

Test .....

Result for alcohol .....

Result for acid .....[2]

3 **(a)** Uranium is used in nuclear reactors. A sample of uranium is found to consist of two isotopes.

(i) Define *isotopes*. .....

.....[1]

(ii) Fig. 3.1 describes two isotopes of uranium.

Complete the table.

isotope	number of protons in each atom	number of neutrons in each atom	symbol of isotope
uranium-235	92	143	
uranium-233			$^{233}_{92}$U

[4]

Fig. 3.1

(b) Boron is used to make control rods for a nuclear reactor. Naturally occurring boron contains atoms represented by the symbols $^{10}_{5}$B and $^{11}_{5}$B.

(i) Draw a diagram of the electronic structure of a boron atom.

[1]

(ii) Suggest why the relative atomic mass of naturally occurring boron is **not** a whole number.

.....

.....[1]

4 Details of the oxides of elements in Period 3 of the Periodic Table are shown in Fig. 4.1.

group number of element	I	II	III	IV	V	VI	VII	0
formula of oxide	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl_2O	none
approximate melting point of oxide /°C	900	3000	2000	1500	600	20	–20	

Fig. 4.1

(a) (i) Determine the valency of an aluminium atom, Al, in its oxide.

.....[1]

(ii) **Name**, from Fig. 4.1, a basic oxide.

.....[1]

(iii) **Name**, from Fig. 4.1, an amphoteric oxide.

.....[1]

(iv) Explain why elements in Group 0 do **not** form oxides.

.....

.....[1]

(b) (i) Give the **formula** of an oxide from Fig. 4.1 which is **not** a solid at 19 °C.

.....[1]

(ii) What additional fact is needed to decide whether the oxide named in **(i)** is a liquid or a gas at 19 °C?

.....[1]

(c) (i) Chlorine has a proton number of 17. Oxygen has a proton number of 8.

Draw a 'dot and cross' diagram of the electronic structure of chlorine(I) oxide, Cl_2O. Show only the outer electrons.

[4]

(ii) Explain why chlorine(I) oxide has a low melting point.

.....

.....

.....[2]

5 Copper(II) oxide catalyses the decomposition of aqueous hydrogen peroxide.

Oxygen is formed during the decomposition.

(a) (i) What is a *catalyst*?

.....

.....[1]

(ii) Give a chemical test for oxygen.

.....

.....[2]

(b) A student decided to study the rate of decomposition of aqueous hydrogen peroxide. He did this by adding exactly 1.0 g of copper(II) oxide to the solution and weighing the mixture at timed intervals. He recorded the losses of mass in a table, Fig. 5.1. He missed out the reading at 180 s.

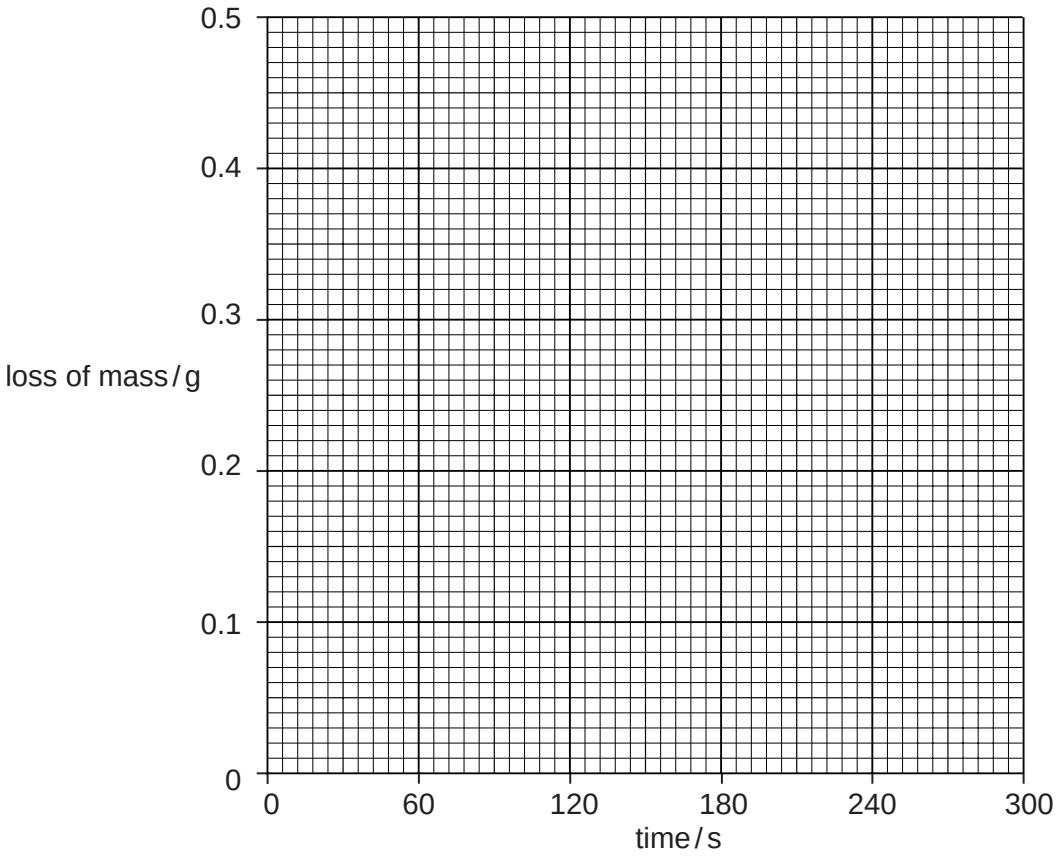
time /s	0	30	60	120	180	240	300
loss of mass /g	0	0.2	0.3	0.4		0.5	0.5

Fig. 5.1

(i) Why did the mixture lose mass?

.....[1]

(ii) On Fig. 5.2, draw a graph of loss of mass against time.



[2]

Fig. 5.2

(iii) Use your graph to estimate the missing reading.

.....[1]

(iv) What was the reaction rate at 300 seconds?

.....[1]

(c) Copper(II) oxide is insoluble in water.

(i) Describe how you would separate, collect and weigh what remains of the copper(II) oxide after the decomposition.

.....

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.....[4]

(ii) Is the mass of the copper(II) oxide left after this catalytic decomposition more than 1.0 g, less than 1.0 g or exactly 1.0 g?

.....[1]

Section B

Answer any **two** questions.

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

6 **(a)** Define *relative atomic mass*. [2]

(b) Tungsten metal, W, is manufactured by reducing tungsten(III) oxide, WO_3, with carbon.

$$WO_3 + 3C \longrightarrow 3CO + W$$

Calculate

(i) the mass of carbon needed to reduce 116 g of tungsten(III) oxide, [3]

(ii) the maximum mass of tungsten that can be formed. [3]

[Relative atomic masses are listed in the Periodic Table on page 12.]

(c) State and explain how the reactivity of tungsten with oxygen compares with the reactivity of carbon with oxygen. [2]

7 **(a)** Give **two** uses of ammonia. [2]

(b) Fig. 7.1 shows some of the properties and reactions of aqueous ammonia and some other substances.

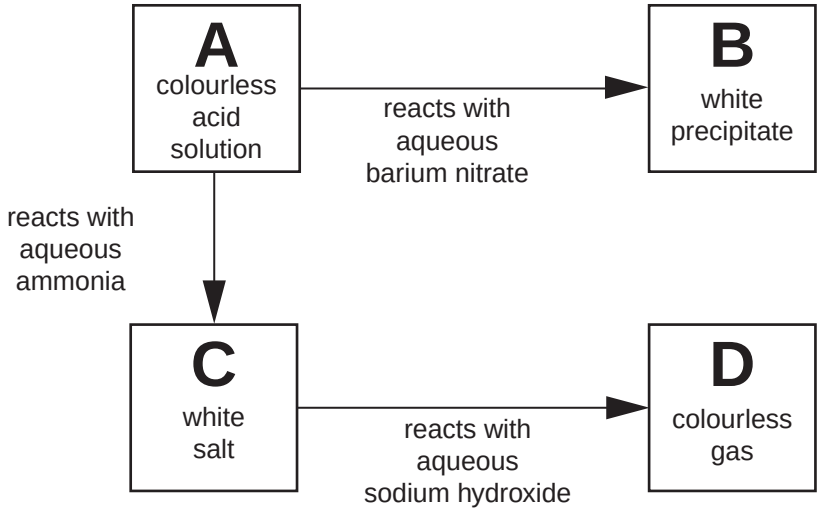

Fig. 7.1

(i) Suggest the identity of the substances **A**, **B**, **C** and **D**. [5]

(ii) Write the equation, including state symbols, for any **one** of the reactions in Fig. 7.1. [3]

8 Chlorine, bromine and iodine are placed in this order in Group VII of the Periodic Table.

(a) State **four** ways in which the physical or chemical properties of chlorine, bromine and iodine are similar. [4]

(b) **(i)** Describe the trends in physical properties of chlorine, bromine and iodine. [3]

(ii) How is the trend in chemical reactivity of chlorine, bromine and iodine shown by displacement reactions? Give an equation for a reaction in which one element displaces another from one of its compounds. [3]

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

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