O

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8819864863

SCIENCE **5124/03**
5126/03

Paper 3 Chemistry **October/November 2007**

1 hour 15 minutes

Candidates answer Section A on the Question Paper.

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.
DO **NOT** WRITE ON ANY BARCODES.

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.

UNIVERSITY of CAMBRIDGE International Examinations

Section A

For Examiner's Use

Answer **all** the questions.

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

1 **(a)** Rain water is collected in reservoirs. The water needs to be purified before drinking.

Table 1.1 describes three stages in this process.

Complete the table.

Table 1.1

stages in the purification process	purpose of each stage
flocculation	to lump together small, insoluble particles
	to remove the lumps of insoluble particles
chlorination	

[2]

(b) **(i)** Tap water is not pure. It contains dissolved substances. A process can be used to separate these dissolved substances and the water. What is the name of this process?

……

(ii) Water is an oxide. Write its chemical formula.

…… [2]

2 **(a)** Table 2.1 describes the properties of an acid, an alkali and a salt solution.

Complete the table.

Table 2.1

solution	colour with Universal Indicator solution	approximate pH	ions present
sodium hydroxide	blue		Na^+, OH^-
hydrochloric acid	red		
sodium sulphate		7	

[5]

(b) Name two solutions which, when mixed together, form a solution of sodium sulphate.

……

…… [1]

[Turn over

For Examiner's Use

3 **(a)** Fig. 3.1 and Fig. 3.2 show the structures of two allotropes of carbon. In both structures the carbon atoms are shown as black dots.

Fig. 3.1

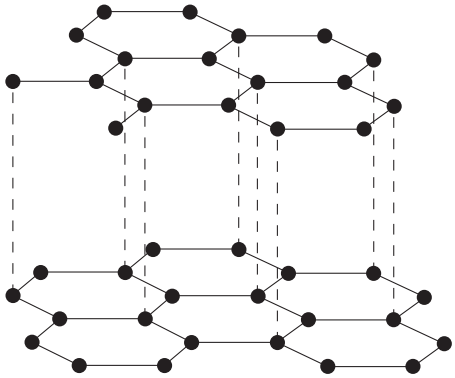


Fig. 3.2

(i) Name the two allotropes.

Fig. 3.1 ……

Fig. 3.2 ……

(ii) The allotrope in Fig. 3.1 is so hard that it can be used for making the tips of drills. The other allotrope is used as a lubricant as it is very slippery. Use the structures to explain these uses.

used for tipping drills

.....

.....

used as a lubricant

.....

..... [4]

(b) Carbon atoms are also found in calcium carbonate.

(i) Calcium carbonate is used to make calcium hydroxide.

Explain why farmers sometimes spread calcium hydroxide on their fields.

.....

.....

(ii) Give **two** other uses of calcium carbonate.

.....

..... [4]

4 In an experiment indigestion tablets are used to investigate rate of reaction. When these tablets react with an acid, carbon dioxide gas is given off.

Ten tablets are added to an excess solution of sulphuric acid at temperature **A**, and the total volume of gas given off is measured at regular intervals.

The procedure is repeated using sulphuric acid at two different temperatures, **B** and **C**.

In each experiment an excess of the same sulphuric acid solution is used.

Fig. 4.1 shows the results of these investigations.

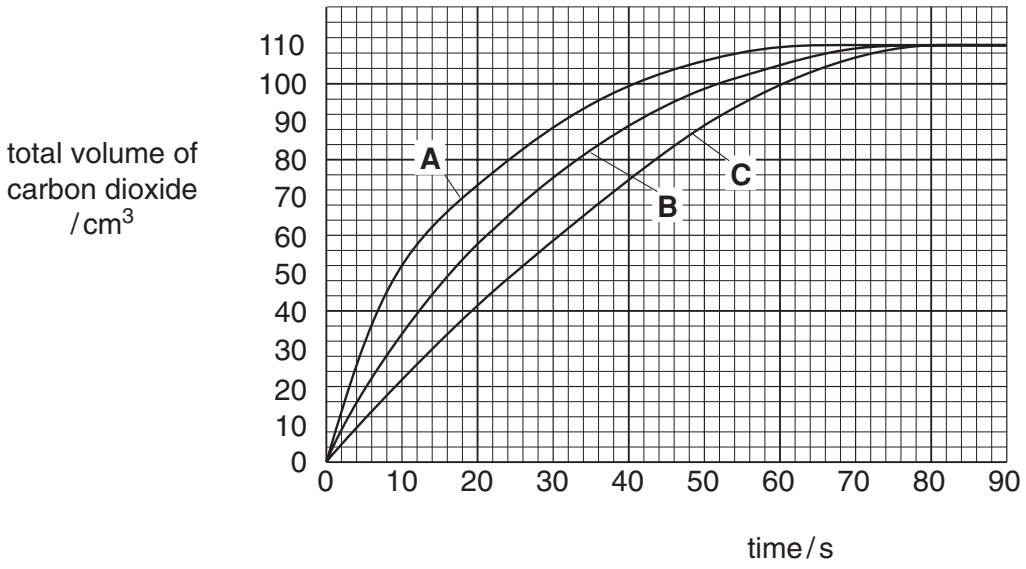


Fig. 4.1

(a) Which of the temperatures **A**, **B** and **C** is the highest?

..... [1]

(b) How are the reactions at temperature **A** and at temperature **C** different after about seventy seconds?

..... [1]

(c) Draw on Fig. 4.1 the curve that you would expect if the experiment were repeated at temperature **C** but with **five** tablets. [2]

(d) Use your knowledge of kinetic particle theory to explain why rates of reaction vary with change in temperature.

.....

..... [2]

5 **(a)** Fig. 5.1 shows the partly drawn structural formula of ethane and of ethene.

Complete the drawings.

ethane ethene

Fig. 5.1 [2]

(b) **(i)** Fig. 5.2 shows part of a molecule of the polymer, PVC.

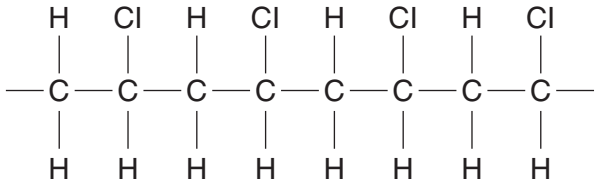


Fig. 5.2

Deduce and draw the structural formula of the monomer from which PVC is made.

(ii) Polymers such as PVC can cause long-term pollution problems. Explain why.

..... [3]

For Examiner's Use

6 **(a)** Calcium, copper and zinc are three metals.

(i) Table 6.1 describes the reaction of these metals with cold water and steam. Put a tick (✓) if a reaction will take place and a cross (✗) if a reaction will not take place. The first has been done for you as an example.

Table 6.1

metal	reaction of metal with cold water	reaction of metal with steam
calcium	✓	✓
copper		
zinc		

(ii) Place these three metals in order of chemical reactivity, with the most reactive first.

most reactive metal .....

.....

least reactive metal .....

(iii) Before experimenting with aluminium to place it in the above series, the surface of the aluminium must first be scraped. Why is this necessary?

..... [4]

(b) Give **two** reasons why it is important to recycle metals.

.....

..... [2]

7 Fig. 7.1 contains information about substances **D**, **E**, **F** and **G**.

For Examiner's Use

solid **D**	gas **E**
D is white. It is formed by burning zinc in oxygen. The product is yellow when hot and white when cold.	**E** is colourless. It has a constant composition. When magnesium is burnt in the gas, two solids are formed, one white and one black.
solid F	**solid G**
F has a constant composition. It burns in oxygen to form only one product.	**G** is blue. It dissolves in water and its solution can be separated into three dyes by chromatography.

Fig. 7.1

Classify the substances as either an element or a compound or a mixture. Now complete Table 7.2 by placing a tick (✓) in one box in each row.

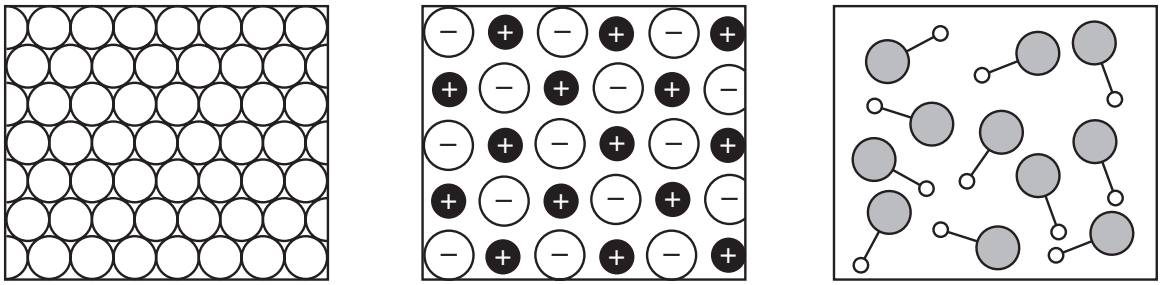
Table 7.2

substance	element	compound	mixture
D			
E			
F			
G			

[4]

8 The diagrams in Fig. 8.1 show the arrangement of particles in copper, sodium chloride and hydrogen chloride at room temperature.

For Examiner's Use



solid
copper

solid
sodium chloride

gaseous
hydrogen chloride

Fig. 8.1

(a) (i) Which of these substances has the lowest melting point?

……

(ii) Explain why this substance has a low melting point.

.....

..... [2]

(b) (i) At room temperature only **one** of the three substances conducts electricity.

Name this substance.

……

(ii) At very high temperatures a second of these substances will conduct electricity.

Name this substance and predict why it will conduct electricity at very high temperatures but **not** at room temperature.

.....

..... [4]

Section B

Answer any **two** questions.

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

9 **(a)** **(i)** In industry, petroleum (crude oil) is separated into several useful substances using a fractionating tower. Describe and explain this separation process.

(ii) Explain why all of the substances in petroleum (crude oil) do not reach the higher parts of the tower. [7]

(b) Methane is separated from natural gas. Methane burns in oxygen to form carbon dioxide and water.

(i) Write the chemical equation for this reaction of methane with oxygen.

(ii) 3 dm^3 of methane are burned in an excess of oxygen. Calculate the volume of oxygen, measured at room temperature and pressure, which reacts with this methane. [3]

10 An element has an isotope with the nucleon number of 7. Each neutral atom of this isotope has three electrons and a nucleus containing two different types of particle.

(a) **(i)** Give the names of these particles and the number of each particle present in each nucleus. [4]

(ii) Compare the masses and compare the electrical charges of these particles. [3]

(b) The element has another isotope with atoms that have a nucleon number of six. Compare and contrast the nuclei of these **two** isotopes. [3]

11 Fig. 11.1 describes reactions involving a metallic salt.

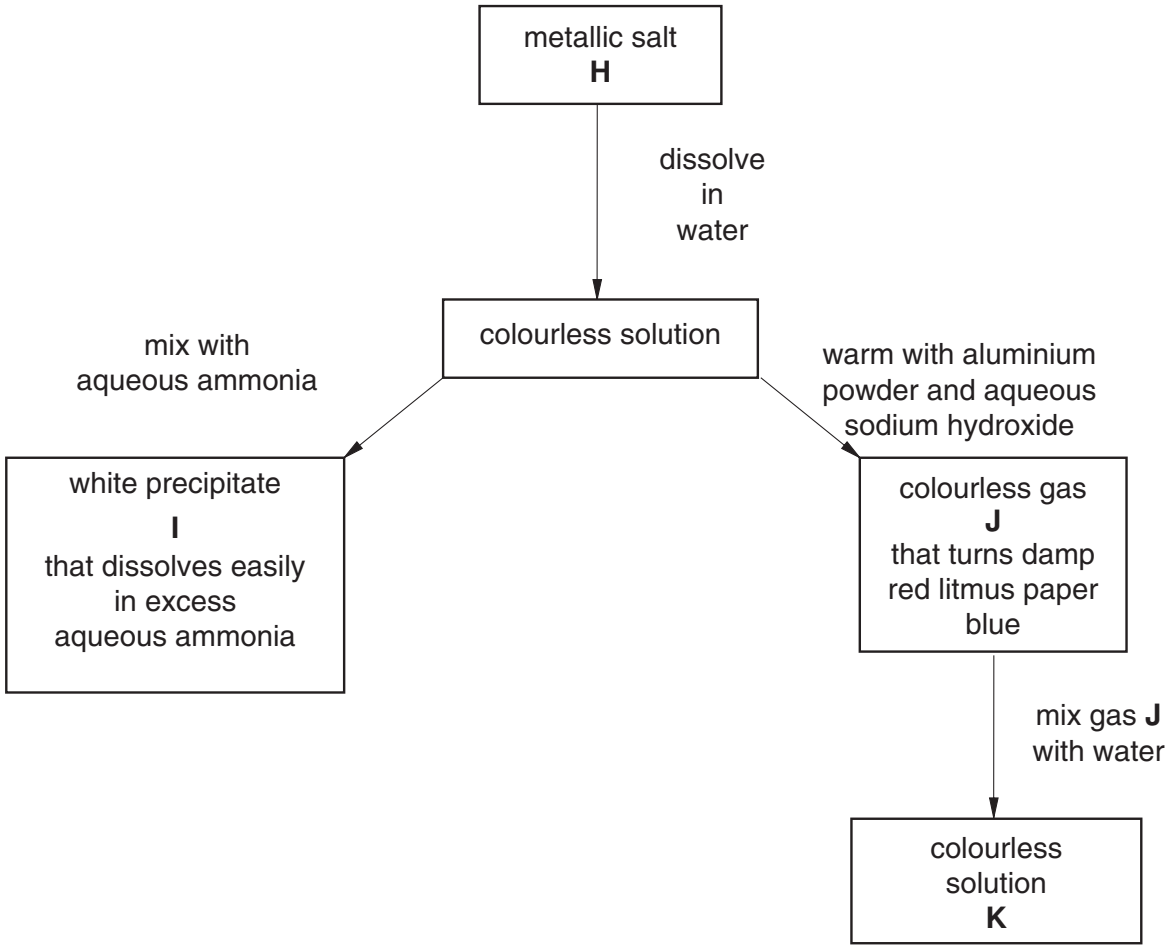


Fig. 11.1

(a) Name substances **H**, **I**, **J** and **K**. [5]

(b) Give the chemical formula for **one** of **H**, **I**, **J** or **K**. [1]

(c) Write the equation for any **one** of the reactions shown in Fig. 11.1. [2]

(d) Give **two** uses of the metal in the metallic salt **H**. [2]

For Examiner's Use

For Examiner's Use

For Examiner's Use

For Examiner's Use

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	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.).