Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CHEMISTRY **0620/02**

Paper 2

May/June 2003

1 hour

Candidates answer on the Question Paper.
No Additional Materials required

READ THESE INSTRUCTIONS FIRST

Write your name, centre number and candidate number in the spaces provided at the top of this page.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
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 16.

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	
1	
2	
3	
4	
5	
6	
TOTAL	

This document consists of **16** printed pages.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate
[Turn over

1 The diagram shows part of the Periodic Table.

I	II											III	IV	V	VI	VII	0
																	He
Li													C	N	O	F	Ne
Na															S	C*l*	Ar
K							Fe			Cu	Zn					Br	Kr

(a) Answer these questions using **only** the elements shown in the diagram.

Write down the symbol for an element which

(i) is a transition metal. ____

(ii) forms an acidic oxide. ____

(iii) has six electrons in its outer shell. ____

(iv) has a giant covalent structure. ____

(v) reacts rapidly with water. ____

(vi) has a higher proton (atomic) number than iron. ____

[6]

(b) Some uses of some non-metallic elements are show below.

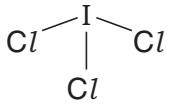
Draw lines between the boxes to link the elements to their correct uses.

The first one has been done for you.

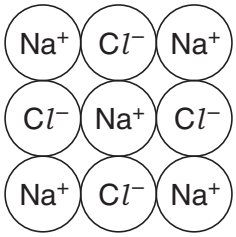
element	use
oxygen	in light bulbs
argon	in oxygen tents in hospitals
chlorine	to kill bacteria in water purification
carbon (graphite)	in balloons
helium	as a lubricant

[4]

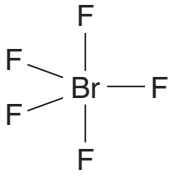
(c) The structures of some halogen compounds are shown below.



A



B



C

(i) Describe the type of bonding in compound **A**.

.....

(ii) State the simplest formula for compound **C**.

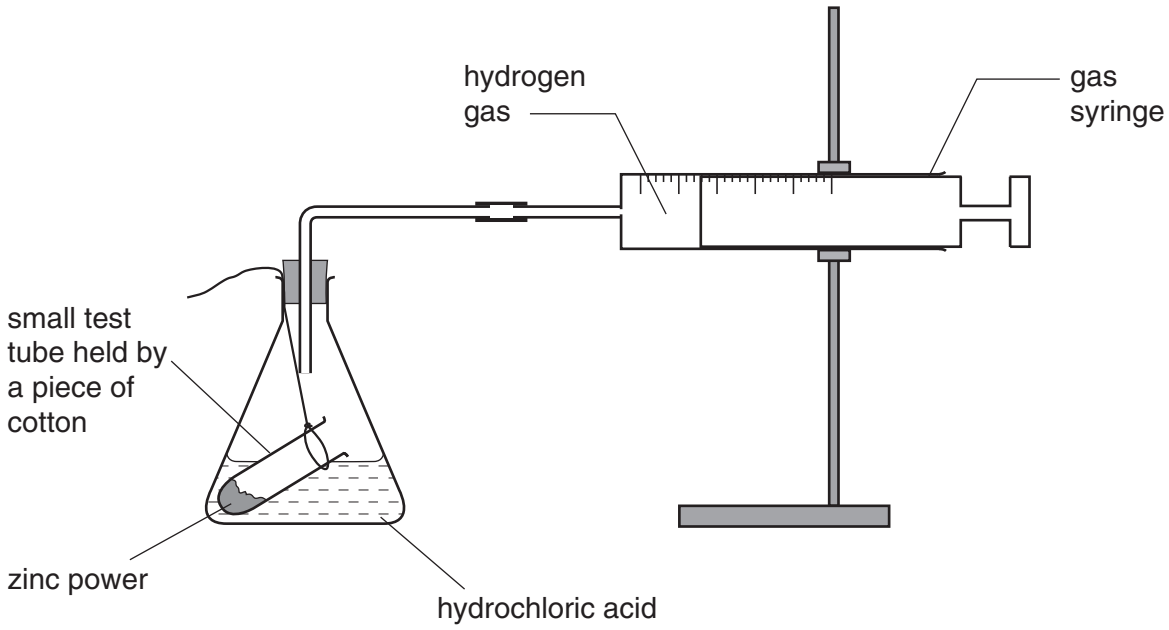
.....

(iii) Explain why compound **B** does not conduct electricity when solid but does conduct when molten.

.....

.....[4]

2 A student investigates the reaction between zinc and hydrochloric acid.
The hydrochloric acid is in excess.
The student uses the apparatus shown in the diagram.



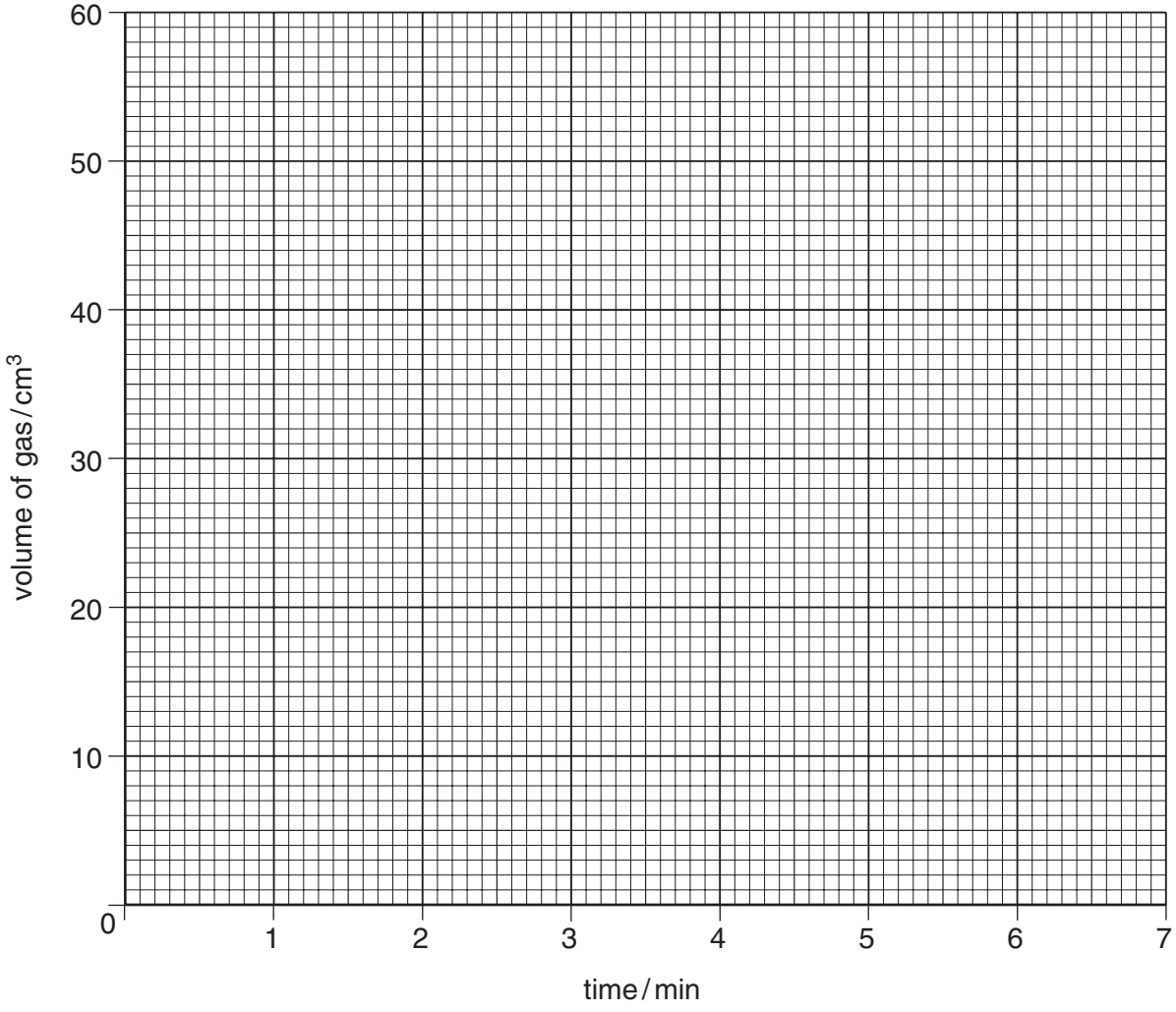
(a) What should the student do to start the reaction?

.....[1]

(b) The student reads the volume of gas in the syringe every minute.
The results are shown in the table.

time in minutes	0	1	2	3	4	5	6	7
volume of gas in cm^3	0	23	35	45	50	53	55	55

(i) Plot the results on the grid on page 5.



(ii) Draw the best curve through the points.

(iii) Explain why the volume of gas stays the same after six minutes.

.....

.....[5]

(c) The student does the experiment again.
The only difference is that the student uses warm, rather than cold, hydrochloric acid.
On the grid, draw the shape of the graph you would expect for the experiment with the warm hydrochloric acid.

[2]

.

(d) **(i)** Balance the equation for the reaction between zinc and hydrochloric acid.

$$Zn + \ldots HCl \rightarrow ZnCl_2 + H_2$$

(ii) Name the compound which has the formula $ZnCl_2$.

.....

(iii) Calculate the relative formula mass of $ZnCl_2$.

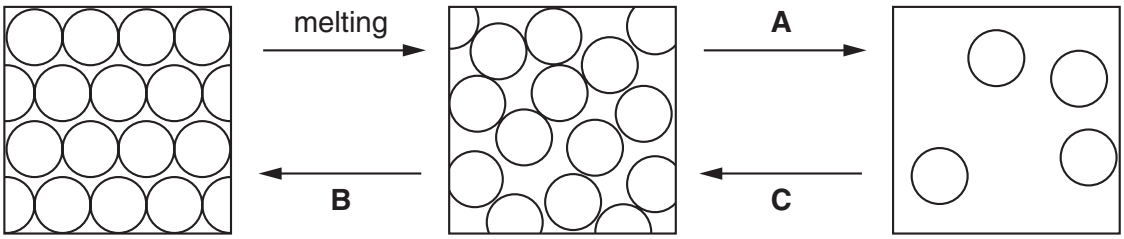
[3]

(e) Zinc is an element.
State the meaning of the term *element*.

.....

.....[1]

3 The states of matter are solid, liquid and gas.
The diagram below shows how the molecules are arranged in these three states.



(a) State the name given to the change of state labelled

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

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

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

[3]

(b) Which one of the following best describes the movement of molecules in the liquid state?

Tick **one** box.

The molecules are not moving from place to place. ☐

The molecules are sliding over each other. ☐

The molecules are moving freely. ☐

[1]

(c) Which of the changes **A**, **B** or **C**, is endothermic?
Explain your answer.

.....

.....[2]

[Turn over

(d) Choose from the following list of substances to answer the questions below.

bromine
chlorine
iron
mercury
sodium chloride
sulphur

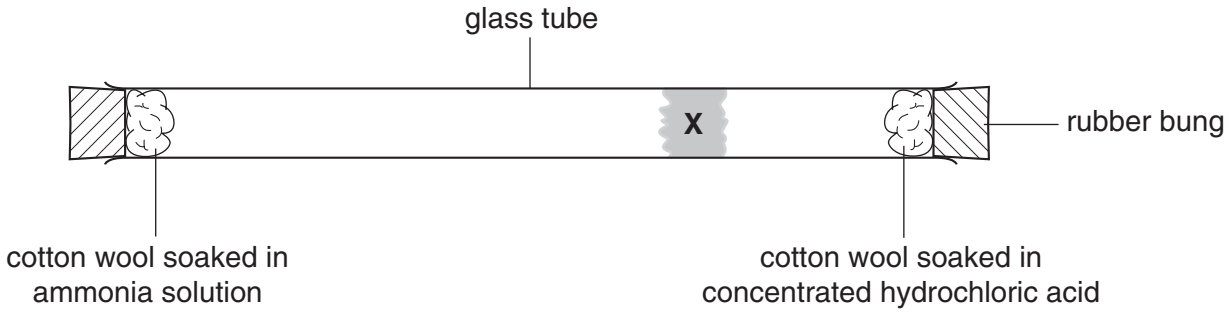
Name a substance which is

(i) a gas at room temperature. .....

(ii) a non-metallic liquid at room temperature. .....

(iii) a compound which is a solid at room temperature. .....
[3]

(e) A student set up the apparatus shown in the diagram below.



The white solid is formed because the molecules of hydrogen chloride gas and ammonia gas move at random throughout the tube and eventually react with each other.

(i) State the name given to this random movement of molecules.

.....

(ii) State the name of the white solid formed at **X**.

.....

(iii) Suggest why the white solid is formed towards one end of the tube and not in the middle.

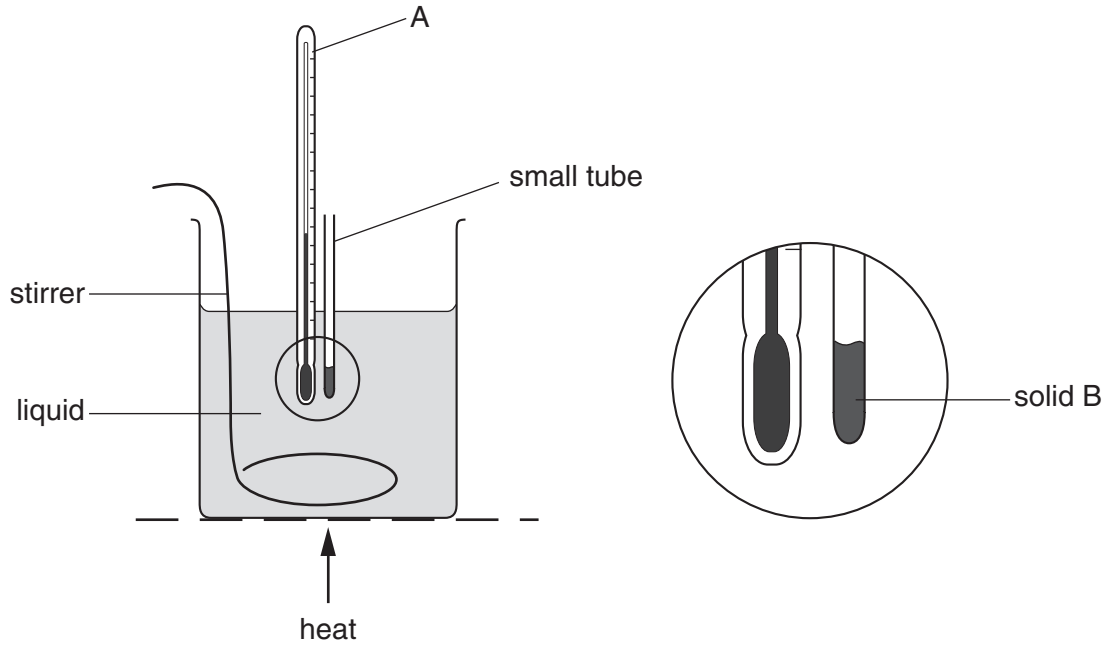
.....

.....[3]

(f) What type of chemical reaction takes place when ammonia reacts with hydrochloric acid?

.....[1]

(g) The diagram below shows a simple apparatus that can be used for measuring the melting point of a solid.
The liquid in the beaker is heated slowly and the temperature at which the solid B melts is recorded.



(i) State the name of the piece of apparatus labelled **A**.

.....

(ii) Solid **B** melted at 155°C.
Why would water **not** be a suitable liquid to put in the beaker when using this apparatus to find the melting point of solid **B**?

.....

.....

(iii) Suggest why the liquid needs to be kept stirred.

.....

.....[3]

4 Catalytic cracking is carried out by oil companies to produce high grade petrol.
The process is carried out using an aluminium oxide catalyst.
The reaction is a type of thermal decomposition.

(a) Explain the meaning of

(i) *thermal decomposition.*

.....

.....

(ii) *catalyst.*

.....

.....[2]

(b) A typical 'cracking' reaction is

$$C_{10}H_{22} \rightarrow C_8H_{18} + C_2H_4$$

State the name of the unsaturated compound in this equation.

.....[1]

(c) The table shows some of the products obtained by cracking 100g of different 'fractions' under the same conditions.

	products obtained / g per 100g of 'fraction' cracked			
'fraction' cracked	hydrogen	methane	ethene	petrol
ethane	10	5	75	2
paraffin	1	15	30	23
diesel	0	6	20	17

(i) Which 'fraction' is the best source of fuel for cars?

.....

(ii) Calculate the amount of paraffin 'fraction' needed to make 600g of methane.

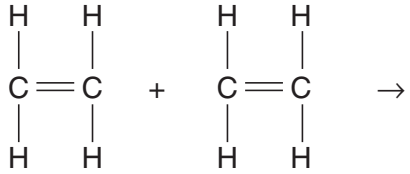
(iii) Complete the equation for the cracking of ethane to produce hydrogen and ethene.

$$C_2H_6 \rightarrow \text{.....} + \text{.....}$$

[4]

(d) Ethene can be polymerised to form poly(ethene).

(i) Complete the equation below to show the structure of **two** units in the poly(ethene) molecule.



(ii) State the name given to this type of polymerisarion.

.....[2]

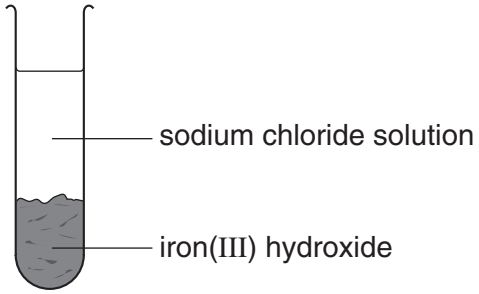
5 A precipitate may be formed when two aqueous solutions are mixed. The colour of these precipitates may be used to identify particular aqueous ions.

(a) Complete the following table.

ion under test	solution to be added to test for the ion	colour of precipitate
iron(II)		
iodide		
chloride		
sulphate		

[8]

(b) When a solution of iron(III) chloride is added to a solution of sodium hydroxide, a precipitate of iron(III) hydroxide is formed and sodium chloride remains in solution.



Explain how you would obtain a pure dry sample of sodium chloride from this mixture. You may use diagrams to help with your explanation.

[3]

(c) Sodium chloride and iron(III) hydroxide are both compounds.
Explain the meaning of the term *compound*.

.....

..... [2]

(d) Molten sodium chloride can be electrolysed using graphite electrodes.

Predict the products of this electrolysis

(i) at the anode .....

(ii) at the cathode .....
[2]

6 This question is about different metals.

The list below shows part of the metal reactivity series .

potassium	more reactive
magnesium	
aluminium	
zinc	
iron	
copper	less reactive

(a) From this list, choose a metal which is extracted using electrolysis.

.....[1]

(b) Two thousand years ago, people were able to extract iron and copper from their ores. They were not able to extract aluminium.

Suggest why they were not able to extract aluminium from its ore.

.....

.....[1]

(c) Uranium is between magnesium and zinc in the reactivity series.

Equal sized strips of magnesium, uranium and zinc were placed in hydrochloric acid. The hydrochloric acid was the same concentration.
The results are shown in the table.

(i) Complete the result for uranium and hydrochloric acid.

metal	*observations on adding to hydrochloric acid*
magnesium	many bubbles of gas produced very rapidly and magnesium dissolves quickly
uranium	
zinc	a few bubbles produced at a steady rate and zinc dissolves slowly

(ii) Uranium has several isotopes which are radioactive.
One of these isotopes is uranium – 235 (^{235}U).

What do you understand by the term *isotopes*?

.....

.....

(iii) State **one** use of uranium –235.

.....[3]

[Turn over

(d) Metals high in the reactivity series react readily with oxygen.
Name the compound formed when magnesium reacts with oxygen.

.....[1]

(e) Copper is alloyed with tin to make bronze.

(i) State what is meant by the term *alloy*.

.....

.....

(ii) Suggest why metals are often used in the form of alloys.

.....

.....

.....[2]

(f) Zinc can be extracted by heating zinc oxide with carbon.

$$ZnO + C \rightarrow Zn + CO$$

Explain why carbon is a reducing agent (reductant) in this reaction.

.....

.....

.....[1]

(g) Iron is used as a catalyst in the Haber Process for making ammonia.

$$3H_2 + N_2 \rightleftharpoons 2NH_3$$

(i) What does the sign $\rightleftharpoons$ mean?

.....

(ii) What is the approximate percentage of nitrogen in the air?

.....[2]

(h) Magnesium is in group II of the Periodic Table.

(i) Draw a diagram to show the electronic structure of magnesium.

(ii) Explain what happens to the magnesium atom when it reacts and forms a magnesium ion.

.....[3]

[Turn over

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
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.).