UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2339708426

CHEMISTRY **0620/02**

Paper 2 **May/June 2007**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, Candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may need to use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

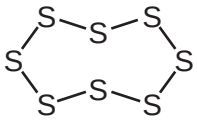
Answer **all** questions.
A copy of the periodic table is printed on page 16.

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.

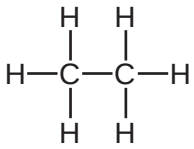
For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
Total	

This document consists of **15** printed pages and **1** blank page.

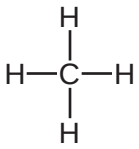
1 The structures of some elements and compounds are shown below.



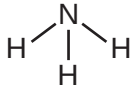
A



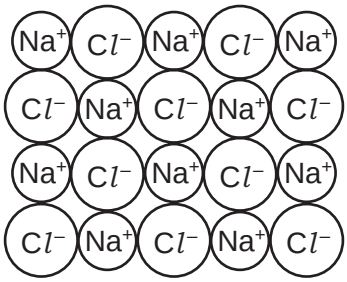
B



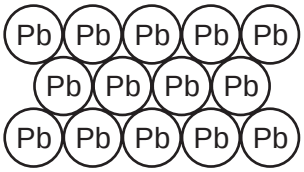
C



D



E



F

(a) Answer these questions using the letters **A** to **F**.

(i) Which structure is ethane? ..... [1]

(ii) Which structure contains ions? ..... [1]

(iii) Which structure is a gas that turns moist red litmus paper blue? ..... [1]

(iv) Which structure is sodium chloride? ..... [1]

(v) Which structure is the main constituent of natural gas? ..... [1]

(vi) Which **two** structures are organic compounds? ..... [1]

(vii) Which **two** structures are elements? ..... [1]

(b) Structure **F** is lead.

(i) What is the source of the small amount of lead present in the air?

..... [1]

(ii) State an adverse effect of lead on health.

..... [1]

(c) Structure **A** is sulphur. Explain why burning fossil fuels containing sulphur is harmful to the environment.

.....

..... [2]

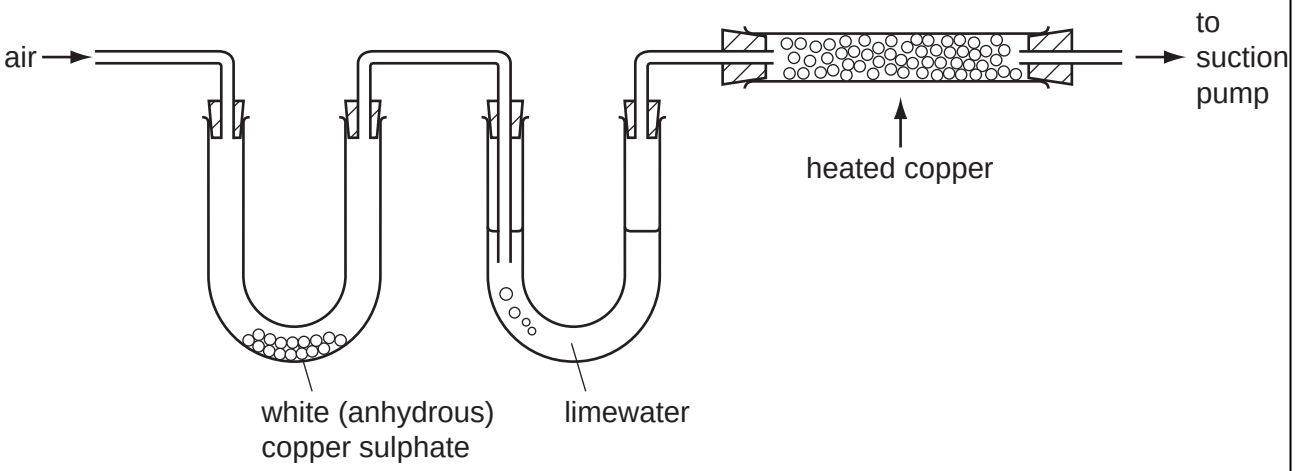
[Total: 11]

2 Clean air contains a number of different gases.

(a) State the names of the **two** gases which make up most of the air.

..... [2]

(b) A sample of air is drawn through the apparatus shown below.



(i) When the air is drawn through the apparatus, the lime water turns milky. Which gas turns lime water milky?

..... [1]

(ii) The white (anhydrous) copper sulphate turns blue. State the name of the substance which turns white copper sulphate blue.

..... [1]

(iii) Oxygen is removed from the air by passing it over heated copper.
Complete the equation for this reaction.

$$2Cu + \text{.....} \rightarrow \text{.....} CuO$$ [2]

(c) Pure air contains about 1% argon.

(i) In which Period of the Periodic Table is argon?

..... [1]

(ii) State the **name** of the Group of elements to which argon belongs.

..... [1]

(iii) Draw the electronic structure of argon.

[1]

(iv) Why is argon used in lamps?

..... [1]

(v) An isotope of argon has a mass number of 40.
Calculate the number of neutrons in this isotope of argon.

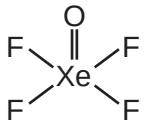
..... [1]

(d) A small amount of xenon is present in the air.
A few compounds of xenon have been made in recent years.

Calculate the relative molecular mass of xenon difluoride, XeF_2.

[1]

(e) The structure of another compound of xenon is shown below.



(i) Write the simplest formula for this compound of xenon.

..... [1]

(ii) Describe the type of bonding in this compound.

..... [1]

[Total: 14]

3 Hydrogen is a fuel which can be obtained from water by electrolysis.
Petrol is a fuel obtained by the fractional distillation of petroleum.

(a) (i) Complete the equation for the burning of hydrogen.

..... $H_2 + O_2 \rightarrow$ ..... H_2O [1]

(ii) Suggest why hydrogen is a renewable source of energy.

..... [1]

(iii) When hydrogen is burnt, heat is given off. State the name of the type of reaction which gives off heat.

..... [1]

(b) Petrol is a mixture of alkanes.
One of the alkanes in petrol is octane, C_8H_{18}.

What products are formed when octane is completely burnt in air?

..... [2]

(c) Petrol is only one of the fractions obtained from the fractional distillation of petroleum.
State the name of two **other** fractions obtained from the distillation of petroleum. Give a use for each of these fractions.

fraction .....

use .....

fraction .....

use ..... [4]

[Turn over

(d) More petrol can be made by cracking less useful petroleum fractions.

(i) What do you understand by the term *cracking*?

..... [1]

(ii) State **two** conditions needed for cracking.

..... [2]

(iii) Alkenes can be formed by cracking. The simplest alkene is ethene.
Draw a diagram to show the structure of ethene.
Show all atoms and bonds.

[1]

[Total: 13]

4 Catalysts are often used in industry.

(a) (i) What do you understand by the term *catalyst*?

.....

[1]

(ii) Which type of metals often act as catalysts?

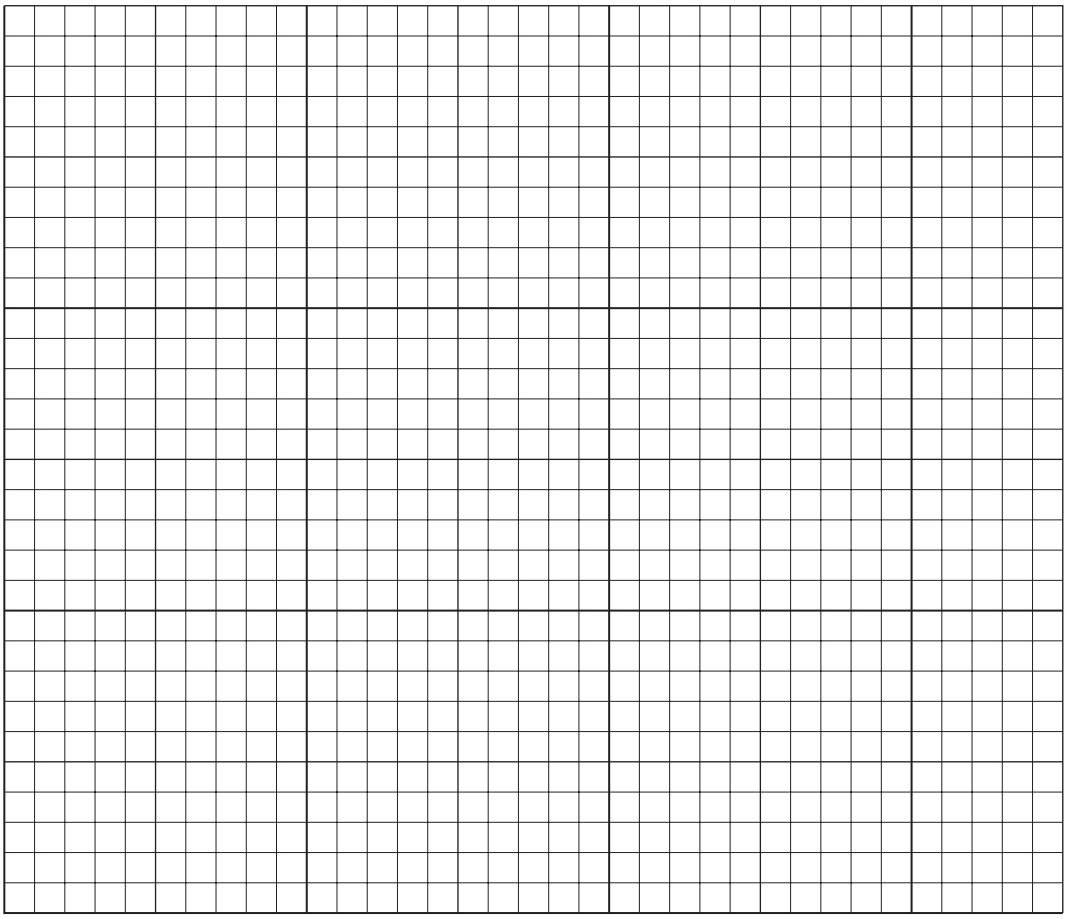
.....

[1]

(b) A student measured the volume of hydrogen gas produced when a few large pieces of zinc reacted with hydrochloric acid of concentration 2.0 mol / dm^3. The hydrochloric acid was in excess.
The results are given in the table.

time / minutes	0	10	20	30	40	50	60
volume of hydrogen / cm^3	0	27	54	81	100	110	110

(i) Plot a graph of volume of hydrogen against time on the axes below. Label the axes.



[4]

(ii) Copper ions catalyse the reaction between zinc and hydrochloric acid.
On the axes above, sketch the line you would expect for the catalysed reaction. Label this line **C**. [2]

(iii) Explain why no more hydrogen is given off after 50 minutes.

..... [1]

(c) What would happen to the speed of the reaction if

(i) small pieces of zinc were used instead of large pieces,

..... [1]

(ii) the concentration of hydrochloric acid was $1.0\,\text{mol}/\text{dm}^3$?

..... [1]

(d) The equation for this reaction is

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

(i) State the name of the salt formed in this reaction.

..... [1]

(ii) Describe a test for hydrogen.

test .....

result ..... [2]

[Total: 14]

5 Some sunglasses are made from glass which darkens in bright sunlight. The glass contains tiny crystals of silver chloride and copper(I) chloride.

(a) In bright sunlight, in the presence of copper(I) chloride, the silver chloride breaks down to solid silver which darkens the glass.

$$Ag^{+}(s) + e^{-} \rightarrow Ag(s)$$

State the name of the particle with the symbol e^{-}.

.....

[1]

(b) Silver is a metal. State **two** physical properties which are characteristic of all metals.

.....

.....

[2]

(c) In bright sunlight, the copper(I) chloride in the sunglasses is converted to copper(II) chloride.
What do the roman numerals (I) and (II) show in these copper compounds?
Tick one box.

the number of atoms of copper in the copper compounds	☐
the number of neutrons in the copper compounds	☐
whether the copper is in the solid, liquid or gaseous state	☐
the oxidation state of the copper in the copper compounds	☐

[1]

(d) Describe a test for aqueous copper(II) ions.

test .....

result .....

.....

[3]

(e) Give a common use of copper.

.....

[1]

[Total: 8]

6 The halogens are a group of elements showing trends in colour, state and reaction with other halide ions.

(a) Complete the word equation for the reaction of chlorine with aqueous potassium bromide.

chlorine + potassium bromide → .....+ ..... [2]

(b) Explain why an aqueous solution of iodine does not react with potassium chloride.

..... [1]

(c) The table shows the properties of some halogens.

halogen	state at room temperature	colour	boiling point / °C	density of solid / g cm^{-3}
fluorine	gas	yellow		1.51
chlorine		green	−35	1.56
bromine	liquid	red-brown	59	
iodine	solid		184	4.93

(i) Complete the missing spaces in the table. [2]

(ii) Suggest values for

the boiling point of fluorine, ...

the density of bromine. ..... [2]

(d) How many electrons does an atom of fluorine have

(i) in total, ...

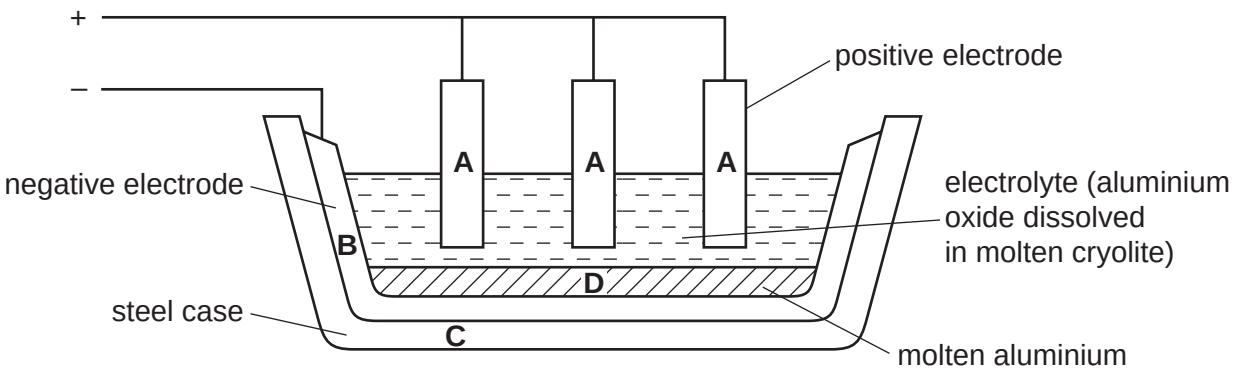
(ii) in its outer shell? ..... [2]

(e) State a use for chlorine.

..... [1]

[Total: 10]

7 Aluminium is extracted by the electrolysis of aluminium oxide dissolved in cryolite.



(a) What information in the diagram shows that aluminium is more dense than the electrolyte?

.....

[1]

(b) What form of carbon is used for the electrodes in this electrolysis?

.....

[1]

(c) Which letter in the diagram, **A**, **B**, **C** or **D**, represents the anode?

.....

[1]

(d) Suggest why electrolysis is used to extract aluminium rather than reduction using carbon.

.....

[1]

(e) Oxygen gas is released at the anode.

(i) Where does this oxygen come from?

.....

[1]

(ii) The oxygen reacts with the carbon anode to form carbon dioxide.
What is the formula of carbon dioxide?

.....

[1]

(iii) Why does the anode decrease in size during electrolysis?

.....

[1]

[Turn over

(f) Each electrolysis cell makes 212 kg of aluminium per day from 400 kg of aluminium oxide.
Calculate how much aluminium can be made from 1 tonne (1000 kg) of aluminium oxide.

[1]

(g) Complete the following sentences about the electrolysis of aluminium oxide using words from the following list.

atoms **gaseous** **molten** **solid** **ions** **molecules**

Aluminium oxide conducts electricity when it is ..... because it contains ..... which are free to move. [2]

[Total: 10]

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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 = 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.).