UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

0269167397

CHEMISTRY **0620/02**

Paper 2 **October/November 2008**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are 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 **16** printed pages.

For Examiner's Use

1 **(a)** The table gives some information about five elements, A, B, C, D and E. Complete the table by writing either metal or non-metal in the last column.

element	properties	metal or non-metal
A	shiny solid which conducts electricity	
B	reddish brown liquid with a low boiling point	
C	a form of carbon which is black in colour and conducts electricity	
D	white solid which is an insulator and has a high melting point	
E	dull yellow solid which does not conduct heat	

[5]

(b) Describe how metallic character changes across a Period.

.....

[1]

(c) Sodium is in Group I of the Periodic Table.

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

[1]

(ii) Complete the equation to show what happens when a sodium atom forms a sodium ion.

$$Na \longrightarrow Na^{+} + \text{.....}$$

[1]

(d) Complete these sentences about the properties of the Group I elements using words from the list.

For Examiner's Use

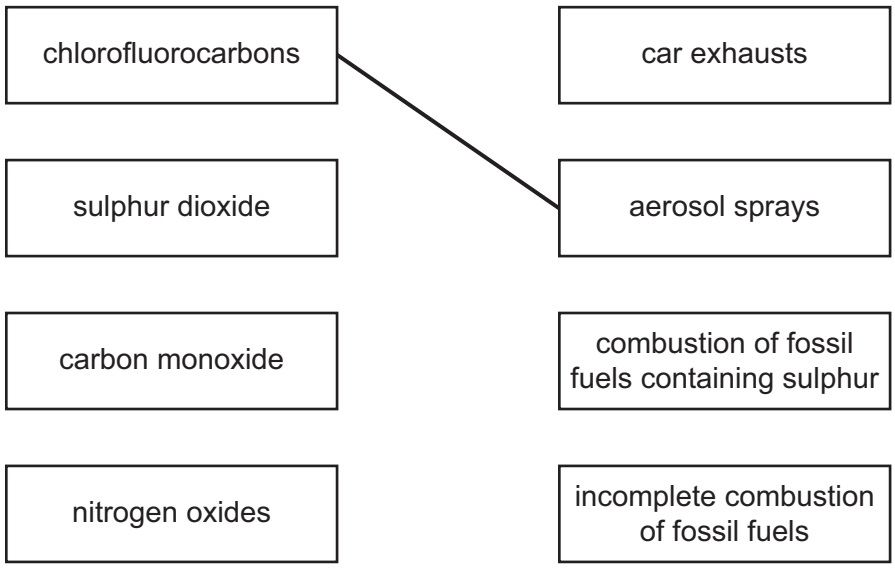
acidic	**basic**	**decrease**	**hard**
increase	**lithium**	**potassium**	**soft**

The Group I elements are relatively ..... metals which ..... in reactivity going down the Group. Sodium reacts more violently with water than ..... . The Group I metals all form ..... oxides. [4]

[Total: 12]

For Examiner's Use

2 **(a)** Match up the atmospheric pollutants on the left with their main source on the right. The first one has been done for you.



[3]

(b) One stage in the manufacture of sulphuric acid involves the oxidation of sulphur dioxide by oxygen in the air to form sulphur trioxide.

$$2SO_2 + O_2 \longrightarrow 2SO_3$$

(i) Explain how this reaction shows that sulphur dioxide is oxidized.

.....

[1]

(ii) What is the percentage of oxygen in clean air? ..... [1]

(iii) Sulphuric acid is used to make the fertiliser ammonium sulphate.

ammonia + sulphuric acid ⟶ ammonium sulphate

What type of reaction is this?

.....

[1]

(iv) Why do farmers need to use fertilisers?

.....

..... [2]

(v) Another fertiliser can be made by the reaction of ammonia with nitric acid.
State the chemical name of this fertiliser.

..... [1]

[Total: 9]

For Examiner's Use

For Examiner's Use

3 Calcium carbonate, $CaCO_3$, is the raw material used in the manufacture of lime, CaO.

(a) (i) Describe how lime is manufactured from calcium carbonate.

.....

[1]

(ii) Write a symbol equation for this reaction.

[1]

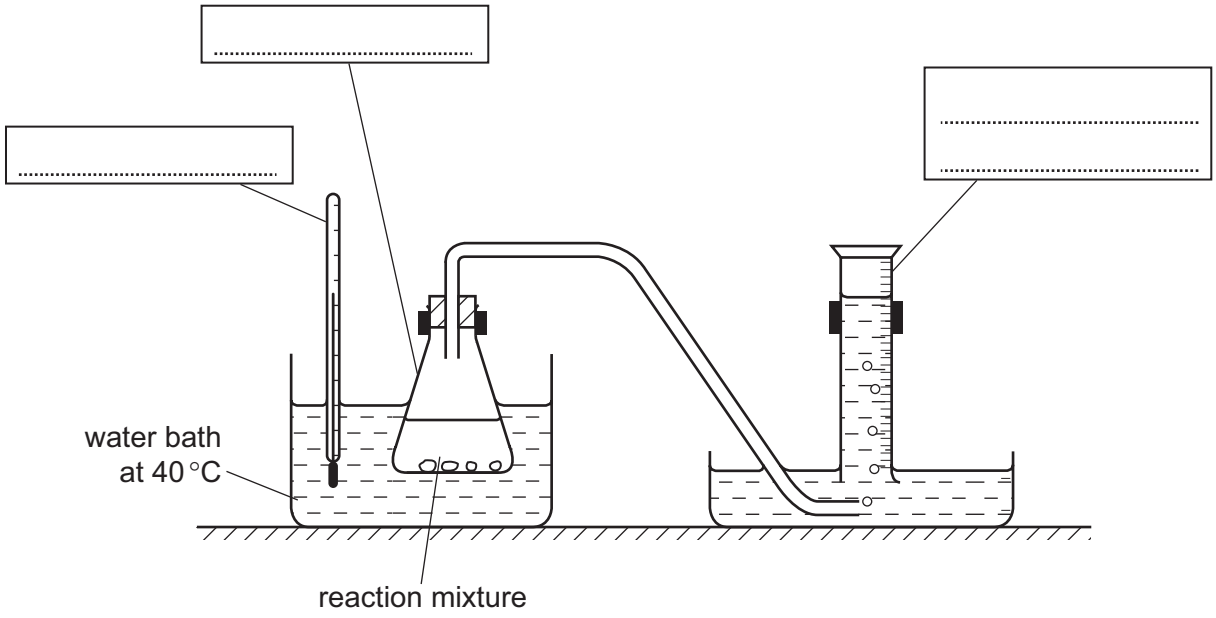
(iii) State one large scale use of lime.

.....

[1]

(b) A student investigated the speed of reaction of calcium carbonate with hydrochloric acid using the apparatus shown below.

(i) Complete the labelling of the apparatus by filling in the three boxes. [3]



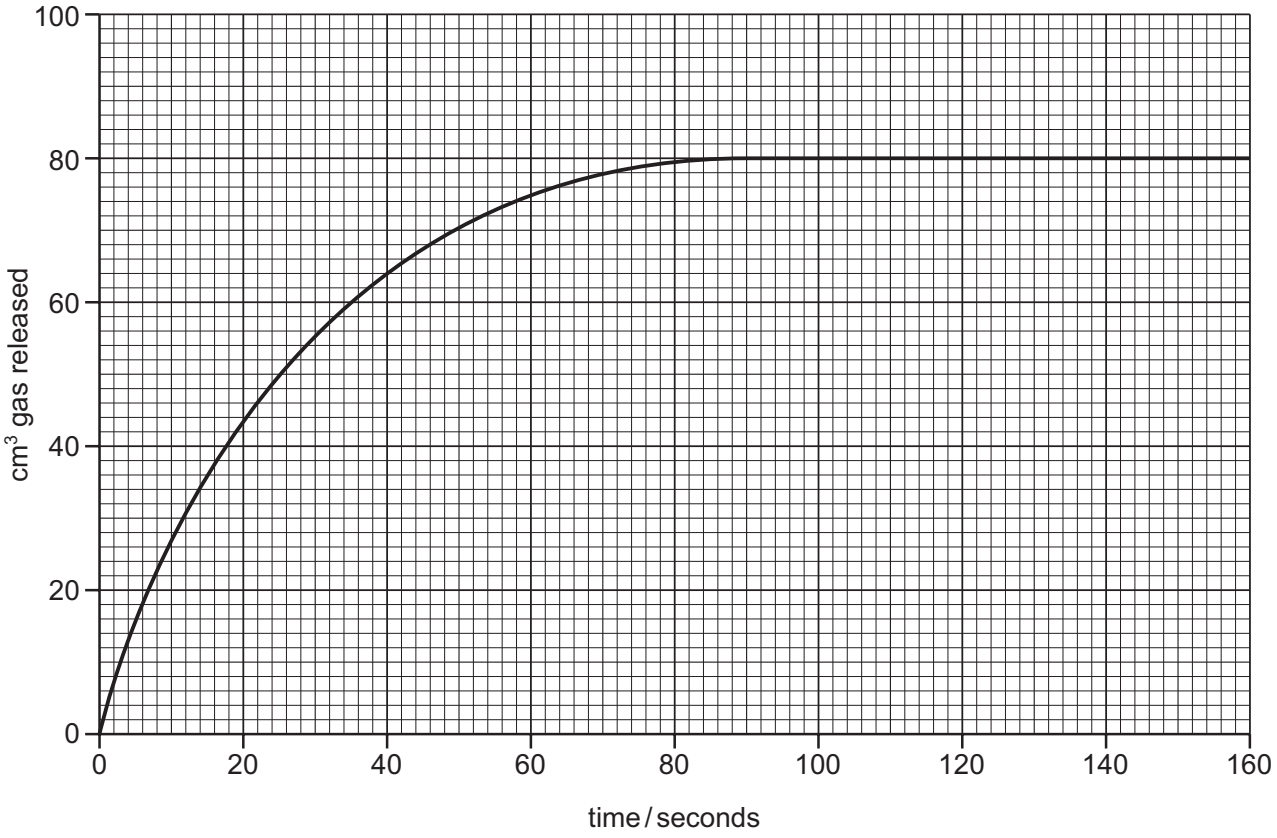
(ii) The equation for the reaction is

$$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$$

Write the word equation for this reaction.

[2]

(iii) The student carried out the reaction at 40°C using large pieces of calcium carbonate. The results of the experiment are shown below.



At what time did the reaction stop?

..... [1]

(iv) The student repeated the experiment using the same mass of powdered calcium carbonate. All other conditions were kept the same. On the grid above, sketch the graph for the reaction with calcium carbonate powder. [2]

(v) How does the speed of reaction change when

the concentration of hydrochloric acid is decreased, ...

the temperature is increased? ..... [2]

[Total: 13]

For Examiner's Use

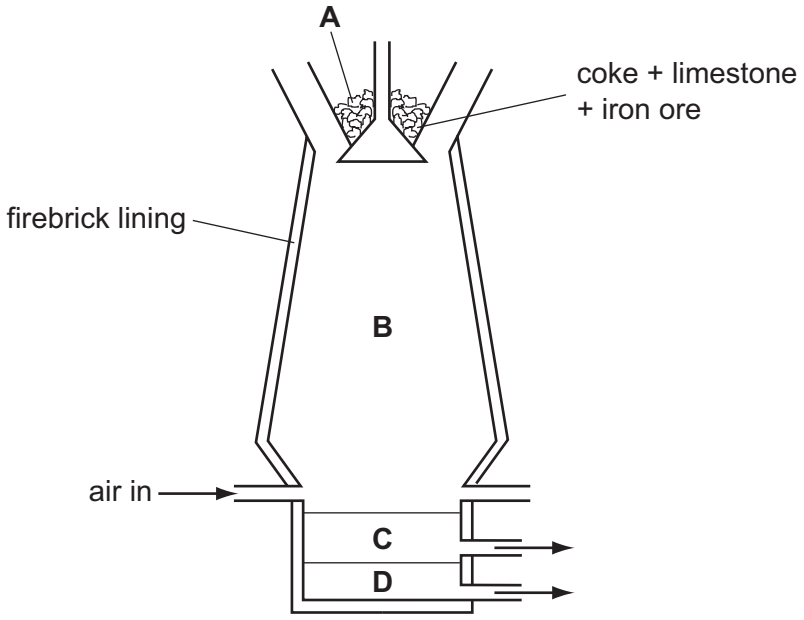
4 Iron is extracted from its ore in a blast furnace.

(a) State the name of the ore from which iron is extracted.

.....

[1]

(b) The diagram shows a blast furnace.



(i) Which **one** of the raw materials is added to the blast furnace to help remove the impurities from the iron ore?

.....

[1]

(ii) The impurities are removed as a slag. Which letter on the diagram shows the slag?

.....

[1]

(c) Carbon monoxide is formed in the blast furnace by reaction of coke with oxygen.

(i) Complete the equation for this reaction.

..... C + ... → ..... CO

[2]

(ii) State the adverse affect of carbon monoxide on human health.

.....

[1]

For Examiner's Use

(d) In the hottest regions of the blast furnace the following reaction takes place.

$$Fe_2O_3 + 3C \longrightarrow 2Fe + 3CO$$

Which two of these sentences correctly describe this reaction?
Tick **two** boxes.

The iron oxide gets reduced. ☐

The reaction is a thermal decomposition. ☐

The carbon gets oxidised. ☐

The carbon gets reduced. ☐

Carbon neutralises the iron oxide. ☐ [1]

(e) Aluminium cannot be extracted from aluminium oxide in a blast furnace.

Explain why aluminium cannot be extracted in this way.

.....

..... [2]

(f) **(i)** State the name of the method used to extract aluminium from its oxide ore.

..... [1]

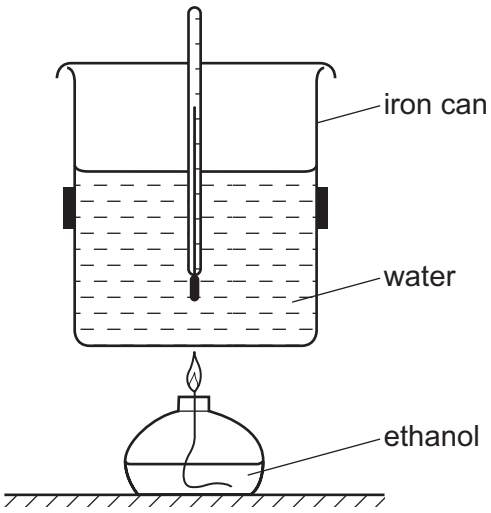
(ii) State one use of aluminium.

..... [1]

[Total: 11]

For Examiner's Use

5 The apparatus shown below can be used to measure the energy released when a liquid fuel is burnt. The amount of energy released is calculated from the increase in temperature of a known amount of water.



(a) (i) Explain how this experiment shows that the burning of ethanol is an exothermic reaction.

.....

[1]

(ii) Complete the word equation for the complete combustion of ethanol.

ethanol + oxygen → ..... + ... [2]

(b) Ethanol is a fuel containing carbon.
State the names of two other commonly used fuels containing carbon.

..... and ..... [2]

(c) Give the formula of the functional group present in ethanol.

.....

[1]

(d) The can contains water. Describe a chemical test for water.

test .....

result ..... [2]

For Examiner's Use

(e) The iron can used in this experiment rusts easily.

(i) Describe a method which can be used to prevent iron from rusting.

.....

[1]

(ii) Rust contains hydrated iron(III) oxide.
What do you understand by the term *hydrated*?

.....

[1]

(iii) Iron is a transition metal.
State **two** properties which are typical of transition metals.

.....

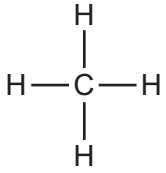
.....

[2]

[Total: 12]

For Examiner's Use

6 The compound shown below is the first member of the alkane homologous series.



(a) State **two** characteristics of a homologous series.

.....

..... [2]

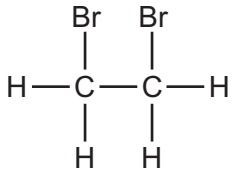
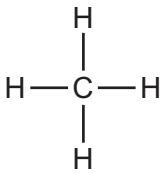
(b) Name and draw the structure of the next member of the alkane homologous series.

name .....

structure

[2]

(c) Complete the table to show the structure and uses of some organic compounds.

name of compound	molecular formula	structure (showing all atoms and bonds)	use
ethene	C_2H_4		
ethanoic acid	$C_2H_4O_2$		making esters
dibromoethane			
	CH_4		

[6]

(d) Calculate the relative molecular mass of dibromoethane.

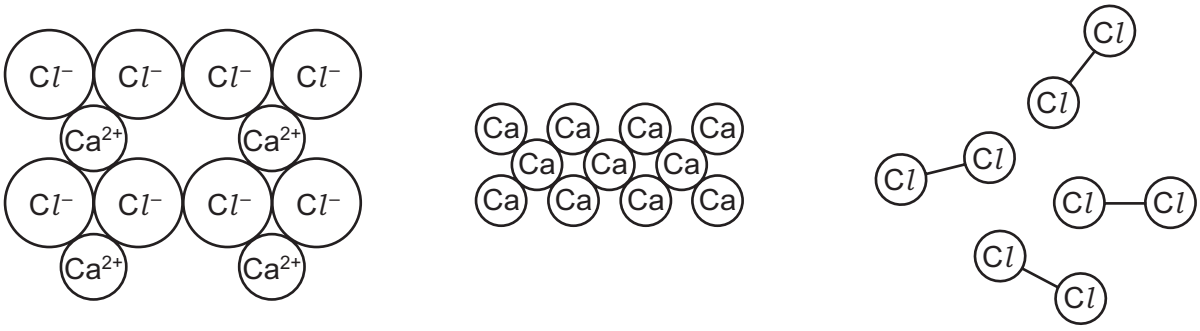
For Examiner's Use

[1]

[Total: 11]

7 The diagram shows the structures of calcium chloride, calcium and chlorine.

For Examiner's Use



calcium chloride calcium chlorine

(a) Use ideas about structure and bonding to explain the following:

(i) Calcium chloride conducts electricity when molten but not when solid.

.....

.....

..... [2]

(ii) At room temperature, calcium is a solid but chlorine is a gas.

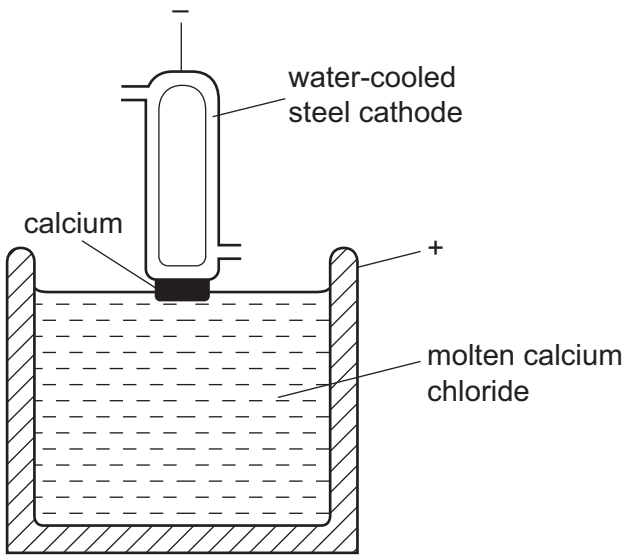
.....

.....

..... [2]

For Examiner's Use

(b) Calcium is manufactured by the electrolysis of molten calcium chloride.



(i) State the products formed

at the anode, ...

at the cathode. ..... [2]

(ii) Suggest a non-metal that can be used as an anode in this electrolysis.

..... [1]

(iii) A stream of inert gas is blown over the calcium as it is removed from the molten calcium chloride.
Suggest why a stream of inert gas is blown over the hot calcium.

..... [1]

(iv) State the name of a gas which is inert.

..... [1]

(c) Aqueous sodium hydroxide or aqueous ammonia can be used to test for calcium ions in solution.
Describe the results of these tests

with aqueous sodium hydroxide, ...

..... [2]

with aqueous ammonia. .....

..... [1]

[Total: 12]

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.).