UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

6335113340

CHEMISTRY **0620/02**

Paper 2 **May/June 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.

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1	
2	
3	
4	
5	
6	
7	
Total	

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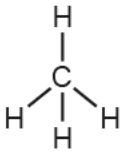
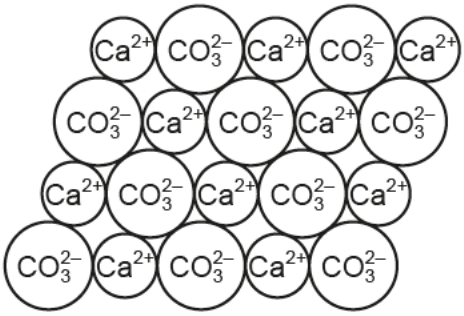
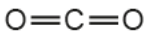
1 The diagram shows the structures of some substances containing carbon.



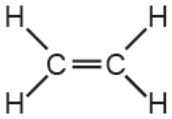
A



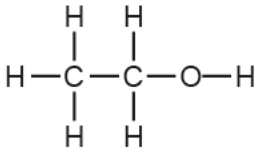
B



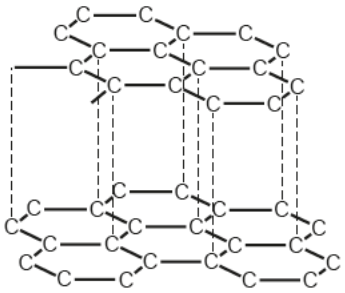
C



D



E



F

(a) Answer these questions using the letters **A, B, C, D, E** or **F**.

(i) Which one of these structures is ionic? ..... [1]

(ii) Which one of these structures represents ethanol? ..... [1]

(iii) Which one of these structures represents a gas which turns limewater milky? ..... [1]

(iv) Which one of these structures is an unsaturated hydrocarbon? ..... [1]

(b) Describe a chemical test for an unsaturated hydrocarbon.

test .....

result ..... [2]

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(c) State the chemical name of structure **B**.

.....

[1]

(d) Structure **F** has several uses. Which one of the following is a correct use of structure **F**? Tick **one** box.

for cutting metals	☐
as a lubricant	☐
for filling balloons	☐
as an insulator	☐

[1]

(e) The structures **A** to **E** are compounds. What do you understand by the term *compound*?

.....

.....

[1]

(f) State the type of bonding in structure **A**.

.....

[1]

[Total: 10]

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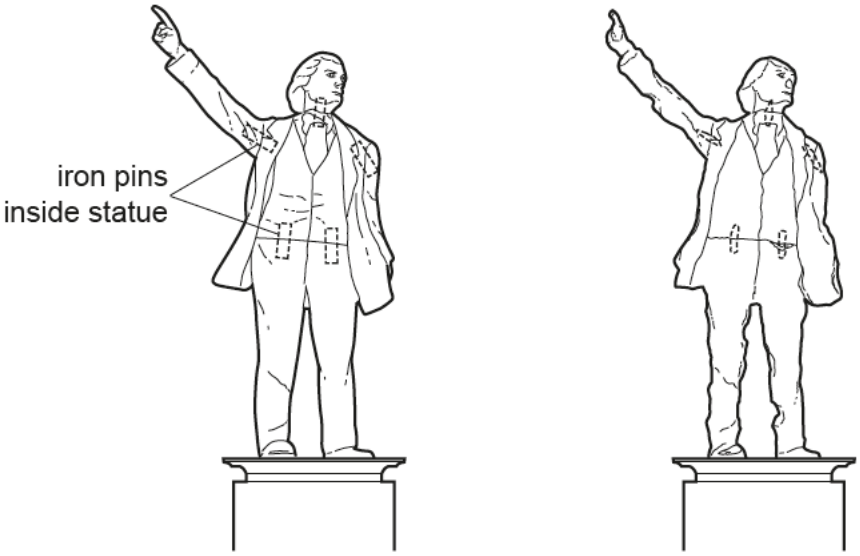
2 The diagram shows a statue in a park in an industrial town. The statue is made from limestone.



statue when first erected

the same statue after 20 years

(a) State the name of the chemical present in limestone.

.....

[1]

(b) Use ideas about the chemistry of atmospheric pollutants to suggest how and why the statue changes over 20 years.

.....

.....

.....

.....

.....

[4]

(c) Parts of the statue are joined together with iron pins. After 30 years, the arm falls off the statue.
Suggest why the arm falls off.

.....

[1]

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(d) Iron has several isotopes.

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

.....

[1]

(ii) The table shows the number of subatomic particles in an atom of iron.

type of particle	number of particles	relative charge on the particle
electron	26	
neutron	30	
proton	26	

Complete the table to show the relative charge on each particle. [3]

(iii) State the number of nucleons in this isotope of iron.

.....

[1]

(e) Some isotopes are radioactive. State one industrial use of radioactive isotopes.

.....

[1]

(f) Iron reacts with very dilute nitric acid.

$$Fe + 2HNO_3 \longrightarrow Fe(NO_3)_2 + H_2$$

Write a word equation for this reaction.

[1]

[Total: 13]

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[Turn over

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3 The table shows the concentration of some ions present in seawater.

name of ion	formula of ion	concentration of ion in g/dm^3
bromide	Br	0.07
calcium	Ca^{2+}	0.4
chloride	Cl	19.1
magnesium	Mg^{2+}	1.2
potassium	K^+	0.3
sodium	Na^+	10.6
	SO_4^{2}	0.8

(a) Which negative ion has the highest concentration in seawater?

..... [1]

(b) State the name of the ion with the formula SO_4^{2} .

..... [1]

(c) Which two ions in the table are formed from Group I elements?

..... and ..... [1]

(d) When seawater is evaporated a number of different compounds are formed.
State the name of the compound which is present in the greatest quantity.

..... [1]

(e) State the names of two ions in the table which move to the cathode when seawater is electrolysed.

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

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(f) When concentrated seawater is electrolysed, chlorine is formed at one of the electrodes.

(i) To which Period in the Periodic Table does chlorine belong?

..... [1]

(ii) Draw the electronic structure of a chlorine molecule. Show only the outer electrons.

[2]

(g) Drinking water can be obtained by purifying seawater.
Explain why distillation rather than filtration is used to purify seawater for drinking.

.....

..... [2]

[Total: 11]

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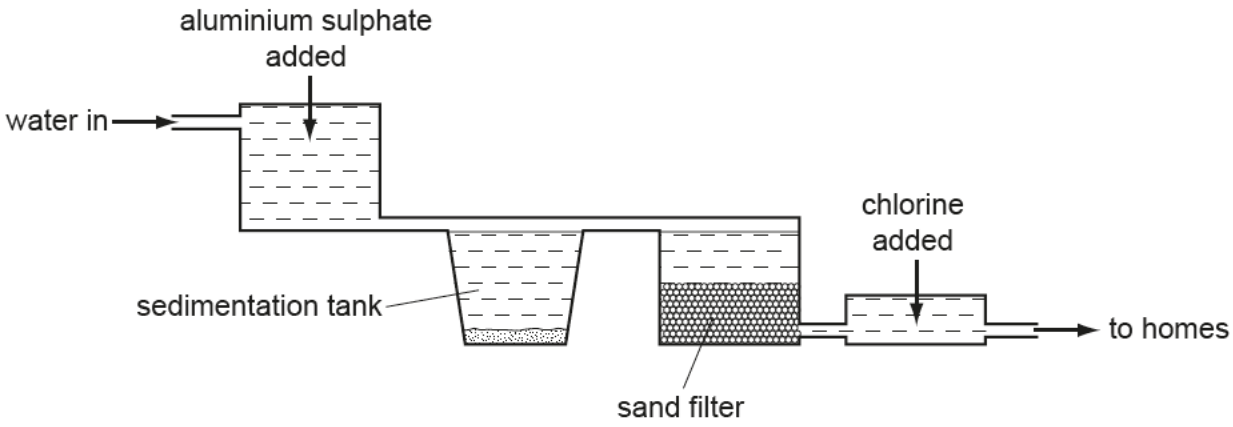
4 The diagram shows a water treatment works.



(a) State one use of water in industry.

.....

[1]

(b) Explain how the sand filter helps purify the water.

.....

.....

[2]

(c) The aluminium ions in aluminium sulphate cause clay particles to clump together. Describe a test for aluminium ions.

test .....

result .....

.....

[3]

(d) Why is chlorine added to the water?

.....

[1]

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(e) Chlorine is in Group VII of the Periodic Table.
When chlorine reacts with a solution of potassium bromide, the solution turns a reddish – brown colour.

(i) Write a word equation for this reaction.

[2]

(ii) Explain why iodine does not react with a solution of potassium bromide.

..... [1]

(f) When chlorine reacts with sodium to form sodium chloride, energy is released.

(i) State the name given to a reaction which releases energy.

..... [1]

(ii) What type of bonding is present in sodium chloride?

..... [1]

(iii) Explain what happens in terms of electron transfer when a sodium atom reacts with a chlorine atom.

.....

..... [2]

[Total: 14]

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5 Pure dry crystals of magnesium sulphate can be made by reacting excess magnesium powder with dilute sulphuric acid.

(a) During the reaction, bubbles of a colourless gas are given off.
State the name of this gas.

.....

[1]

(b) (i) Why is excess magnesium used?

.....

[1]

(ii) How is the excess magnesium removed from the reaction mixture?

.....

[1]

(c) Describe how you can obtain pure dry crystals of magnesium sulphate from a solution of magnesium sulphate.

.....

.....

[2]

(d) (i) Describe one other reaction that makes magnesium sulphate.

.....

.....

[1]

(ii) Write a word equation for the reaction you suggested in part **(d)(i)**.

[1]

(iii) Magnesium sulphate can be used as a medicine. Explain why the chemicals used in medicines need to be as pure as possible.

.....

.....

[1]

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(e) A student repeats the experiment using excess sulphuric acid.
She obtains 24 g of magnesium sulphate from 4.8 g of magnesium.
How much magnesium sulphate can the student obtain from 1.2 g of magnesium?

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[1]

(f) A sample of 20 g of impure magnesium sulphate contains 19.5 g of magnesium sulphate.
Calculate the percentage purity of the magnesium sulphate.

[1]

[Total: 10]

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[Turn over

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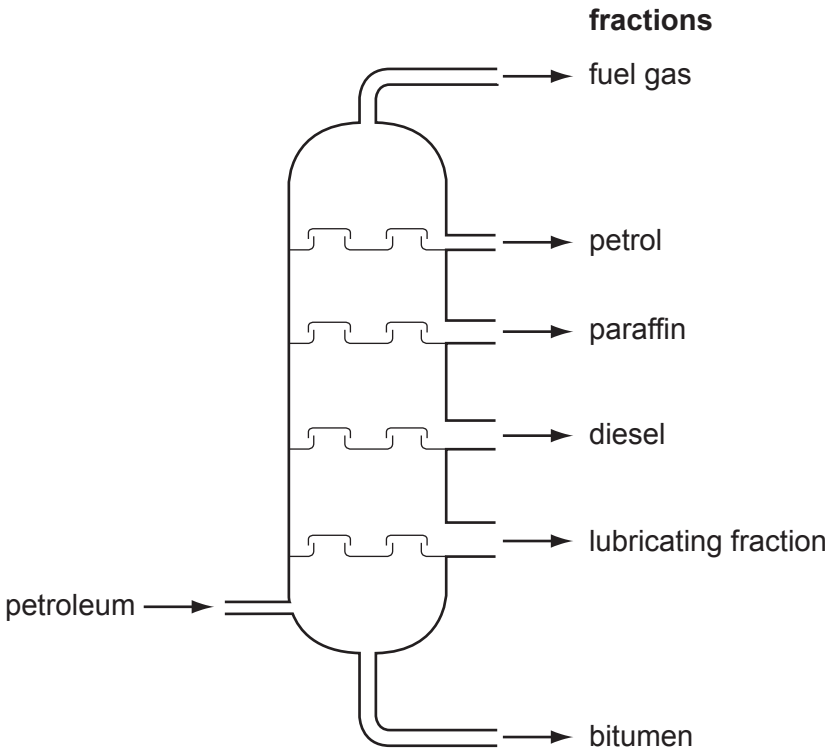
6 Petroleum is separated into useful fractions by distillation.



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

.....

..... [1]

(ii) Which fraction has the lowest boiling point?

..... [1]

(iii) Describe how distillation is used to separate these fractions.

.....

.....

..... [2]

(iv) State a use for

the paraffin fraction, ...

the bitumen fraction. ..... [2]

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(b) Ethene can be made by cracking certain hydrocarbon fractions.

(i) Explain what is meant by the term *cracking*.

.....

..... [1]

(ii) Complete the equation for the cracking of tetradecane, $C_{14}H_{30}$.

$$C_{14}H_{30} \longrightarrow \text{.....} + C_2H_4 \quad [1]$$

(c) Ethanol is formed when steam reacts with ethene at high pressure and temperature. A catalyst of phosphoric acid is used.

$$\text{ethene} + \text{steam} \rightleftharpoons \text{ethanol}$$

(i) What is the function of the catalyst?

..... [1]

(ii) What is the meaning of the symbol $\rightleftharpoons$?

..... [1]

(iii) Ethanol is also formed when yeast grows in sugar solution.
What is this process called?
Put a ring around the correct answer.

addition **combustion** **fermentation** **neutralisation** [1]

(iv) Phosphoric acid is a typical acid. State what you would observe when a solution of phosphoric acid is added to

blue litmus, ...

a solution of sodium carbonate. ..... [2]

[Total: 13]

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7 A student placed a crystal of copper(II) sulphate in a beaker of water.
After one hour the crystal had completely disappeared and a dense blue colour was observed in the water at the bottom of the beaker. After 48 hours the blue colour had spread throughout the water.

(a) Use the kinetic particle theory to explain these observations.

.....

.....

.....

..... [2]

(b) Describe the arrangement and motion of the particles in the copper(II) sulphate crystal.

arrangement .....

motion ..... [2]

(c) Copper ions can be separated from other metal ions by paper chromatography. Draw a labelled diagram of the apparatus for paper chromatography.

In your diagram include

- the solvent,
- the spot where the solution containing copper ions is placed.

[2]

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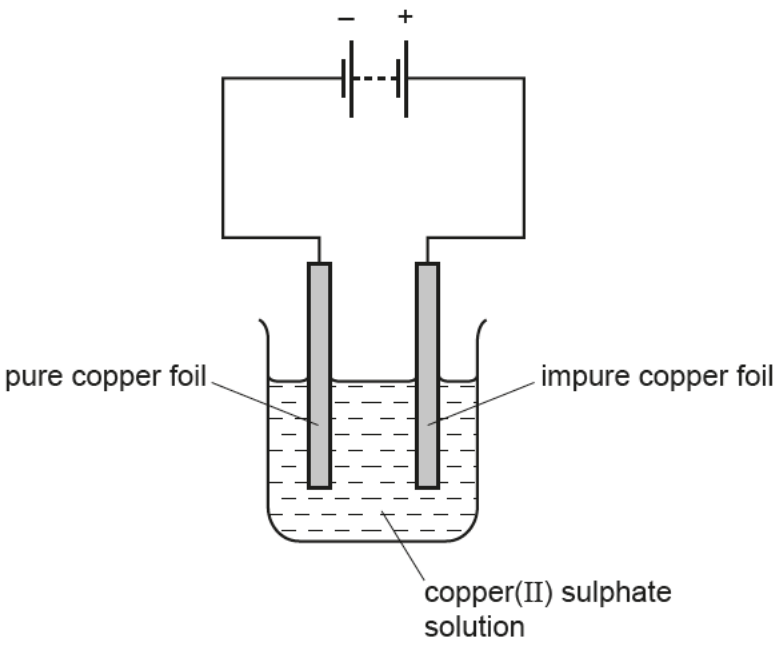
(d) Copper can be purified by electrolysis.



(i) Choose a word from the list below which describes the pure copper foil.
Put a ring around the correct answer.

anion **anode** **cathode** **cation** **electrolyte** [1]

(ii) Describe what happens during this electrolysis to

the pure copper foil, ...

the impure copper foil. ..... [2]

[Total: 9]

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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.).