| Centre Number | Candidate Number | Name |
|---|---|---|
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

**CHEMISTRY** **0620/02**

Paper 2 (Core)

October/November 2005

**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 on all the work you hand in.
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.

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

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

**1** The diagram shows part of the Periodic Table.

| | | | | |
|---|---|---|---|---|
| | | | | He |
| C | N | O | F | Ne |
| | | S | C*l* | Ar |
| | | | Br | Kr |

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

Write down the symbol for an element which

**(i)** has five electrons in its outer shell, ..... [1]

**(ii)** has diatomic molecules, ..... [1]

**(iii)** reacts with sodium to form sodium bromide, ..... [1]

**(iv)** is a noble gas, ..... [1]

**(v)** has a giant covalent structure, ..... [1]

**(vi)** has a lower proton number than fluorine, ..... [1]

**(vii)** is the most abundant gas in the air. ..... [1]

**(b)** Write down a use for each of the following elements.

**(i)** argon

..... [1]

**(ii)** helium

..... [1]

**(iii)** oxygen

..... [1]

**(c) (i)** Draw a diagram to show the electronic structure of argon.

[2]

**(ii)** Why is argon very unreactive?

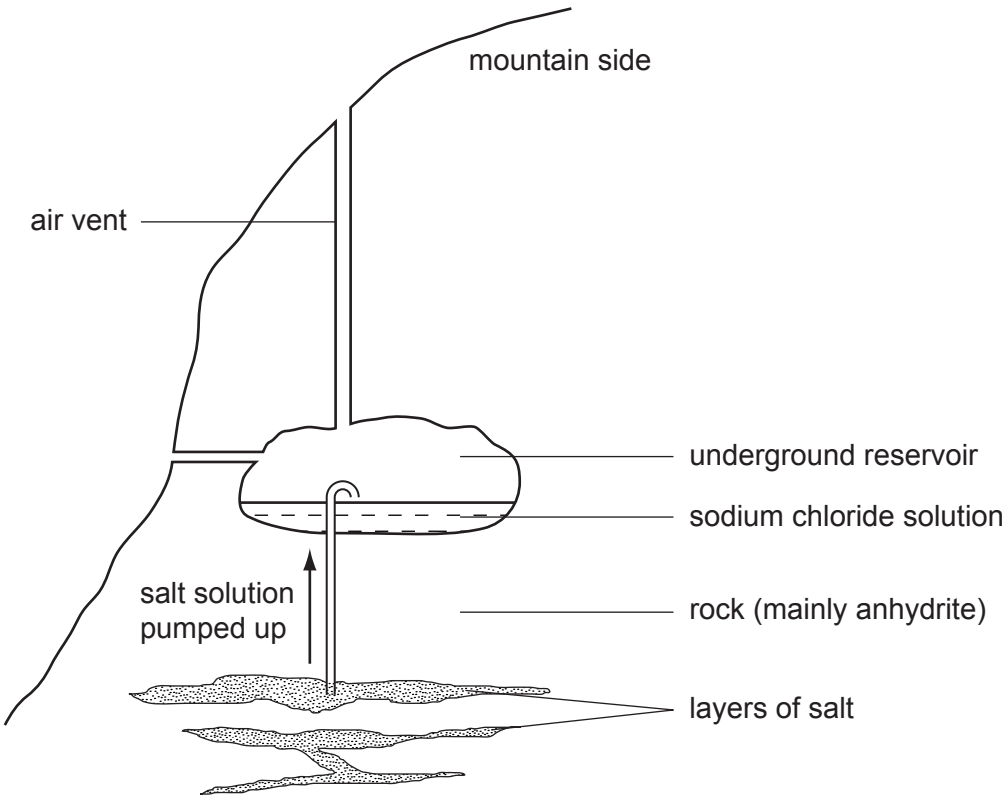
..... [1]





**[Turn over**

**2** The diagram shows the salt mines at Bex in Switzerland.




The salt is dissolved by water from underground springs and then pumped up to a reservoir where it is stored as a solution.

**(a)** Write the chemical formula for sodium chloride.

.....  [1]

**(b)** Suggest how solid sodium chloride is obtained from the sodium chloride solution.

.....  [1]

**(c)** Sodium chloride has an ionic giant structure.
Which one of the following best describes an aqueous solution of sodium chloride?
Tick one box.

a mixture of sodium ions and chlorine molecules in water ☐

a mixture of sodium and chlorine atoms in water ☐

a mixture of sodium and chloride ions in water ☐

a mixture of sodium, chloride, oxide and hydrogen ions ☐

[1]

**(d)** Describe a test for chloride ions.

test .....

result ..... [2]

**(e)** The rock surrounding the layers of salt is anhydrite.
Pure anhydrite has the chemical formula $CaSO_4$.

**(i)** State the name of the chemical found in anhydrite.

..... [1]

**(ii)** Calculate the relative formula mass of the chemical in pure anhydrite.

[1]

**(iii)** When anhydrite reacts with water, gypsum ($CaSO_4.2H_2O$) is formed.
Complete the equation for this reaction.

$CaSO_4$ + ..... ⟶ $CaSO_4.2H_2O$ [1]

**(iv)** Which one of the following describes this reaction?
Put a ring around the correct answer.

combustion fermentation hydration oxidation reduction [1]





[Turn over

**(v)** The chemical in anhydrite can be made by reacting calcium hydroxide with sulphuric acid.
Complete the balanced equation for this reaction.

$Ca(OH)_2$ + ..... → $CaSO_4$ + ..... $H_2O$ [2]

**(vi)** The spring water running through the rocks changes anhydrite into gypsum.
This reaction is exothermic.
Use this information to explain why the temperature of the mine never falls below 17 °C even in cold winters.

.....

..... [1]

**(f)** The air inside the mine contains 19% oxygen.
Which one of the following best describes the oxygen level inside the mine compared with that outside the mine?
Tick one box.

the level of oxygen inside the mine is higher ☐

the level of oxygen is the same ☐

the level of oxygen is about a quarter of that of the outside air ☐

the level of oxygen inside the mine is lower ☐

[1]

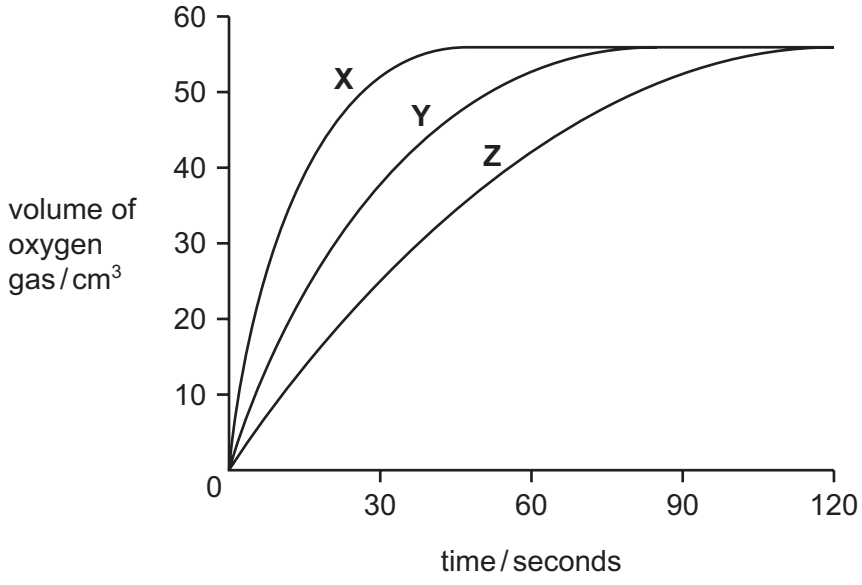
**3** Hydrogen peroxide solution, $H_2O_2$, decomposes slowly in the absence of a catalyst. Oxygen and water are formed.

$$2H_2O_2(aq) \longrightarrow 2H_2O(l) + O_2(g)$$

**(a)** Draw a diagram of the apparatus you could use to investigate the speed of this reaction.
You must label your diagram.

[3]

**(b)** Catalyst **X** was added to 50cm$^3$ of hydrogen peroxide solution at 20°C and the amount of oxygen given off was recorded over a two minute period.
The experiment was repeated with the same amounts of catalyst **Y** and catalyst **Z**.
Apart from the type of catalyst, all conditions were kept the same in the three experiments.
A graph of the results is shown below.




**(i)** What is a catalyst?

.....

[1]

**(ii)** Which catalyst, **X**, **Y** or **Z**, produced oxygen gas the fastest?
Explain your answer.

.....

..... [2]

**(iii)** Why is the final amount of oxygen gas the same in each experiment?

.....

..... [1]

**(iv)** Many transition metals and their oxides are good catalysts.
State **two** other properties of transition metals which are not shown by other metals.

.....

..... [2]

**(c)** The experiment with catalyst **Z** was repeated at 40°C.
All other conditions were kept the same.
The speed of the reaction increased.
Explain why, using ideas about particles.

.....

.....

..... [2]

**(d)** Some enzymes also catalyse the decomposition of hydrogen peroxide.

**(i)** State one difference between an enzyme and an inorganic catalyst such as a transition metal.

..... [1]

**(ii)** Enzymes are also responsible for fermentation reactions.
Which one of the following equations **A**, **B**, **C** or **D** describes fermentation?

**A** $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$

**B** $C_2H_4 + H_2O \longrightarrow C_2H_5OH$

**C** $C_6H_{12}O_6 \longrightarrow 6C + 6H_2O$

**D** $C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$

..... [1]

**4** The list shows some oxides.

calcium oxide
magnesium oxide
nitrogen dioxide
sodium oxide
sulphur dioxide

**(a)** From this list choose **two** oxides which are basic.
Give a reason for your answer.

.....

..... [2]

**(b)** **(i)** Which **two** oxides from this list contribute to acid rain?

..... [2]

**(ii)** How do each of these oxides get into the atmosphere?

name of oxide .....

source of oxide ..... [1]

name of oxide .....

source of oxide ..... [1]

**(c)** Calcium oxide is manufactured from calcium carbonate.

**(i)** Complete the word equation for this reaction.

calcium carbonate ⟶ calcium oxide + ..... [1]

**(ii)** What condition is needed for this reaction to take place?

..... [1]

**(d) (i)** Explain why calcium oxide and sodium oxide cannot be reduced by heating with carbon.

.....

[1]

**(ii)** Copper(II) oxide can be reduced by heating with carbon.
Complete the equation for this reaction.

..... CuO + C ⟶ 2Cu + ..... [2]

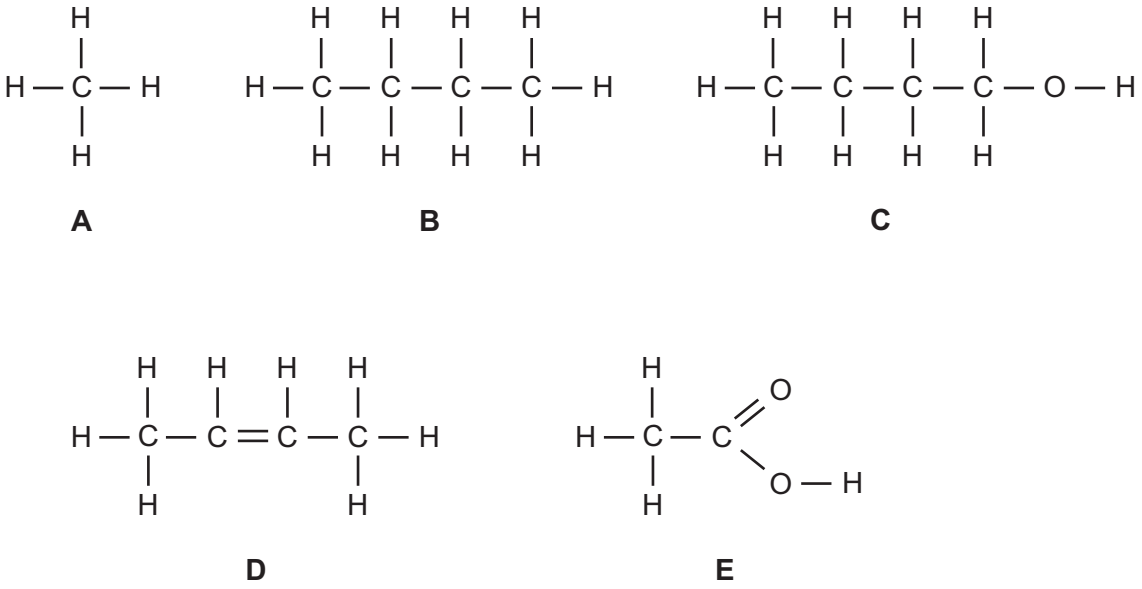
**(iii)** What do you understand by the term *reduction*?

.....

.....

[1]

**5** The structures of some organic compounds are shown below.



**A** **B** **C**



**D** **E**

**(a)** Name compound **A**.

.....

[1]

**(b)** Which **two** of the compounds **A** to **E** belong to the same homologous series?

.....

[1]

**(c)** **(i)** Which one of the compounds **A** to **E** has the same functional group as ethanol?

.....

[1]

**(ii)** Draw the structure of ethanol, showing all atoms and bonds.

[2]

**(iii)** Describe how ethanol is made in industry from ethene.

.....

.....

[2]





[Turn over

**(d) (i)** Which one of the compounds **A** to **E** is an unsaturated hydrocarbon?

..... [1]

**(ii)** Describe a chemical test for an unsaturated hydrocarbon.

test .....

result ..... [2]

**(e)** Compound **E** is acidic.

**(i)** State the name of compound **E**.

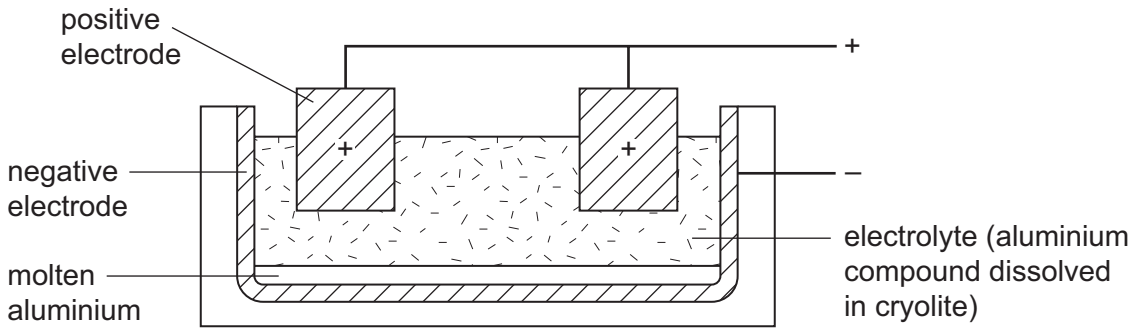
..... [1]

**(ii)** Describe a test to show that compound **E** is acidic.

test .....

result ..... [2]

**6** The diagram shows an electrolysis cell used to extract aluminium.




**(a)** What compound of aluminium is used for the electrolyte?

.....

[1]

**(b)** The electrolyte must be molten for the electrolysis to work.
Explain why.

.....

[1]

**(c)** **(i)** State the name of the substance used for the electrodes.

.....

[1]

**(ii)** To which electrode do the aluminium ions move during electrolysis?
Explain your answer.

.....

.....

[2]

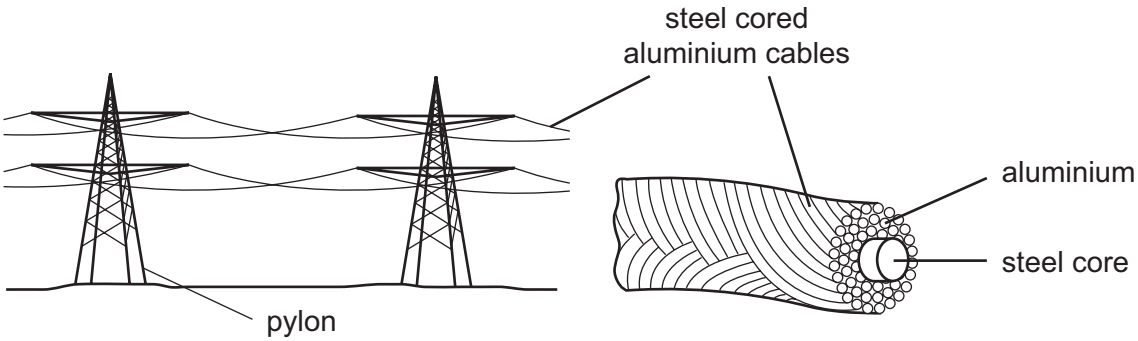
**(d)** Complete the following sentences about the molten electrolyte using words from the list below.

| | | | |
|---|---|---|---|
| bauxite | chemical | cryolite | decreased |
| electrical | haematite | increased | light |

The melting point of the electrolyte is ..... by adding ..... . This means that less ..... energy is needed to melt the electrolyte.

[3]

**(e)** Aluminium is used in overhead power cables.




The table shows some properties of three metals which could be used for the power cables.

| metal | relative electrical conductivity | density / grams per $cm^3$ | price / £ per kg | relative strength |
|---|---|---|---|---|
| aluminium | 0.4 | 2.70 | 18 | 9 |
| copper | 0.7 | 8.92 | 15 | 30 |
| steel | 0.1 | 7.86 | 2.7 | 50 |

**(i)** Suggest why aluminium is used for overhead power cables rather than copper.

.....

[1]

**(ii)** Suggest why steel is not used alone for overhead power cables.

.....

[1]

**(iii)** Why is steel used as a core for overhead power cables?

.....

[1]

**(iv)** Electrical insulators are used in parts of the pylons which carry the electrical cables.
Which one of the following is an electrical insulator?
Put a ring around the correct answer.

aluminium ceramic graphite zinc [1]

**(f)** Aluminium has many uses.

**(i)** Why is aluminium used for aircraft bodies?

.....[1]

**(ii)** Describe a test for aluminium ions.

test .....

result .....

.....[3]

# 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.).