

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

October/November 2006

**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.

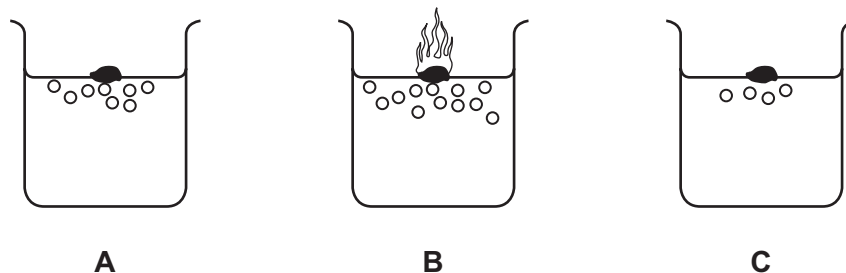
Answer **all** questions.  
The number of marks is given in brackets [ ] at the end of each question or part questions.  
A copy of the Periodic Table is printed on page 20.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
<b>Total</b>	

This document consists of **18** printed pages and **2** blank pages.



- 1 When Group I elements react with water, hydrogen gas is given off.  
The diagram shows the reaction of lithium, potassium and sodium with water.



- (a) Which **one** of these elements **A**, **B** or **C** is lithium?

..... [1]

- (b) (i) Balance the equation for the reaction of sodium with water by completing the left-hand side.



[1]

- (ii) Apart from fizzing, describe **two** things that you would **see** when sodium reacts with water.

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

- (iii) After the sodium had reacted with the water, the solution was tested with red litmus paper.

What colour did the litmus paper turn?

Give a reason for your answer.

colour .....

reason ..... [2]

- (iv) Which of the following statements about sodium are true?  
Tick **two** boxes.

It is made by reducing sodium oxide with carbon.

It reacts with chlorine to form sodium chloride.

It reacts readily with oxygen.

It only conducts electricity when molten.

[2]

- (c) Rubidium also reacts with water. How does the speed of reaction of rubidium with water compare with that of potassium with water?

..... [1]

- (d) Sodium has only one stable isotope whereas potassium has several isotopes.

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

..... [1]

- (ii) How many protons does sodium have in its nucleus?  
Use the Periodic Table to help you.

..... [1]

- (iii) How many electrons are there in an atom of potassium?

..... [1]

- (iv) Uranium has many isotopes. One of these is uranium-235 ( $^{235}\text{U}$ ).  
What is the main use of this isotope of uranium?

..... [1]

2 Copper can be extracted by heating copper carbonate with carbon.

- (a) The copper carbonate breaks down into copper oxide and releases a gas. Complete the equation for this reaction.



- (b) The copper oxide then reacts with the carbon.



- (i) Complete the following sentences using words from the list.

**endothermic**      **exothermic**      **halogen**      **metal**  
**neutralised**      **oxidised**      **reduced**

In this reaction copper oxide is ..... to copper.

The copper obtained is a pinkish-brown .....

The reaction is ..... because heat is absorbed. [3]

- (ii) State the name of the substance which is oxidised during this reaction.

..... [1]

- (iii) How would you test for the carbon dioxide given off in this reaction?

test .....

result ..... [2]

- (c) Describe a test for aqueous copper ions and state the result.

.....  
.....  
..... [3]

(d) Carbon is in Group IV of the Periodic Table.

(i) Draw a diagram to show how the electrons are arranged in an atom of carbon.

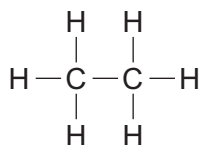
(ii) To which Period in the Periodic Table does carbon belong?

[1]

..... [1]

(e) Organic compounds contain carbon and hydrogen.

(i) To which homologous series does the organic compound **A** belong?



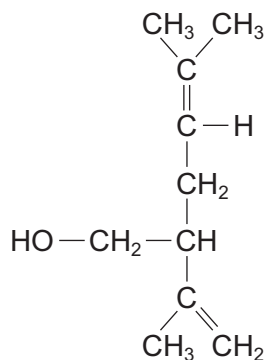
compound **A**

..... [1]

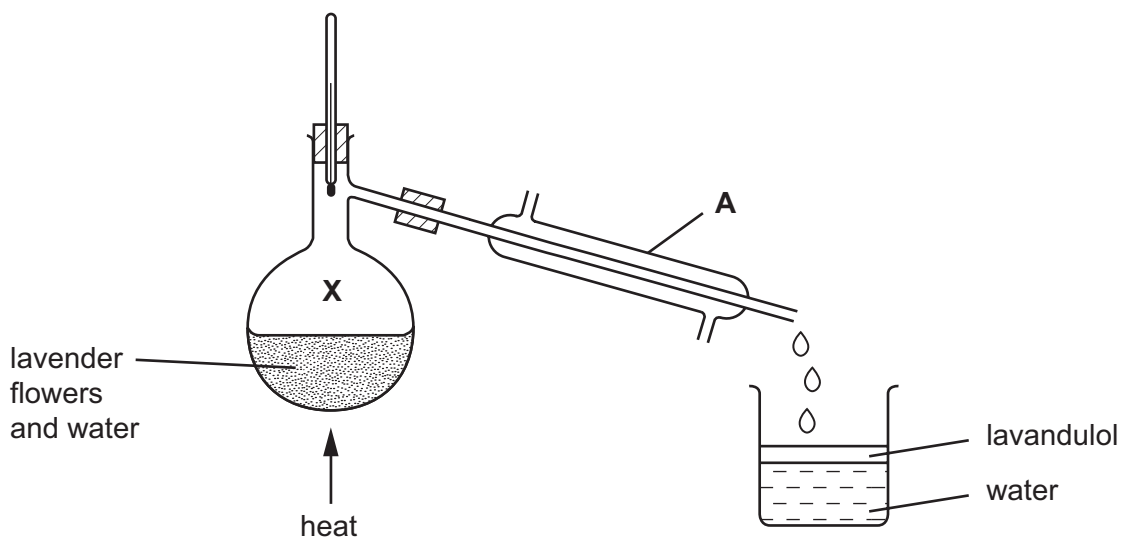
(ii) State the name of compound **A**.

..... [1]

- 3 Lavandulol is found in lavender plants. The formula of lavandulol is shown below.



- (a) Put a ring around the alcohol functional group in this formula. [1]
- (b) Is lavandulol a saturated or unsaturated compound?  
Give a reason for your answer.  
..... [1]  
.....
- (c) State the names of the **two** products formed when lavandulol is burnt in excess oxygen.  
..... and ..... [2]
- (d) Lavandulol can be extracted from lavender flowers by distillation using the apparatus shown below. The lavandulol is carried off in small droplets with the steam.



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

..... [1]

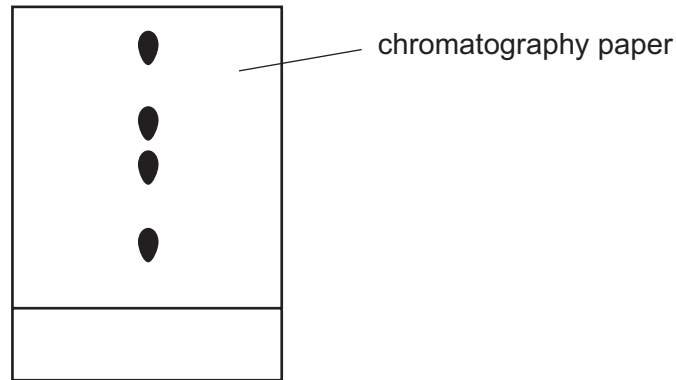
- (ii) What is the temperature of the water at point **X** in the diagram?

..... [1]

- (iii) The lavender oil and water are collected in the beaker.  
What information in the diagram shows that lavender oil is less dense than water?

..... [1]

- (e) Lavender flowers contain a variety of different pigments (colourings).  
A student separated these pigments using paper chromatography.  
The results are shown in the diagram below.



- (i) Put an **X** on this diagram to show where the mixture of pigments was placed at the start of the experiment. [1]

- (ii) How many different pigments have been separated?

..... [1]

- (iii) Draw a diagram to show how the chromatography apparatus was set up.  
On your diagram label

- the solvent
- the origin line

[1]

- (iv) During chromatography, the solvent evaporates and then diffuses throughout the chromatography jar.

What do you understand by the term *diffusion*?

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

- (v) Ethanol can be used as a solvent in chromatography.  
Draw the formula for ethanol showing all atoms and bonds.

- (vi) Which of the following statements about ethanol are true?  
Tick **two** boxes.

[1]

It is a carboxylic acid.

It is a product of the fermentation of glucose.

It is an unsaturated compound.

It is formed by the catalytic addition of steam to ethene.

[1]



4 This question is about compounds.

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

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

(b) Complete the table below to show the formulae and uses of some compounds.

compound	relative number of atoms present	formula	use
calcium oxide	Ca = 1 O = 1	CaO	
sodium chloride	Na = 1 Cl = 1		table salt
calcium carbonate	Ca = 1 C = 1 O = 3		
		NH <sub>4</sub> NO <sub>3</sub>	in fertilizers

[6]

(c) Calculate the relative formula mass of NH<sub>4</sub>NO<sub>3</sub>.

[1]

- 5 The list shows part of the reactivity series.

strontium	more reactive
calcium	
magnesium	↑
iron	
copper	less reactive

- (a) Calcium is manufactured by the electrolysis of molten calcium chloride. Suggest why calcium is extracted by electrolysis.

..... [1]

- (b) Equal sized pieces of magnesium, strontium and calcium are placed in water. Some observations about these reactions are shown in the table. Complete the box for strontium.

metal	observations
magnesium	Gives off a few bubbles of gas with hot water. Dissolves very slowly.
calcium	Gives off bubbles steadily with cold water. Dissolves slowly.
strontium	

[2]

- (c) When water is added to calcium carbide, acetylene and calcium hydroxide are formed. State a use for acetylene.

..... [1]

- (d) A solution of calcium hydroxide is alkaline.

- (i) Complete and balance the equation for the reaction of calcium hydroxide with hydrochloric acid.

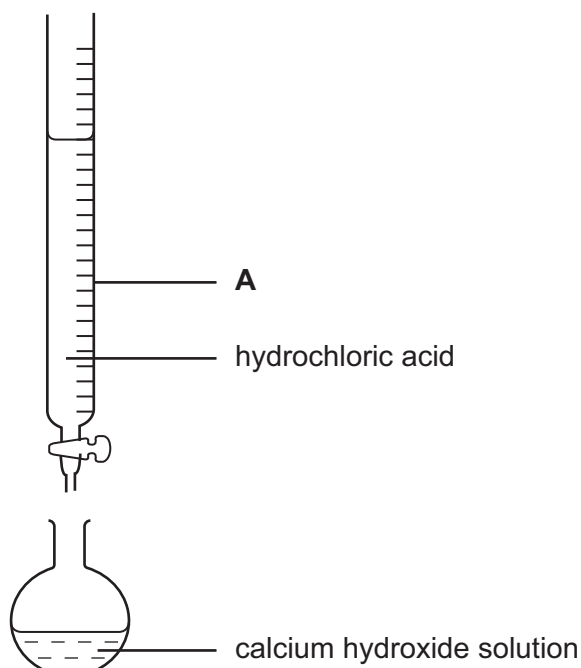


[1]

- (ii) What type of chemical reaction is this?

..... [1]

- (e) A student used the apparatus shown below to calculate the concentration of a solution of calcium hydroxide.



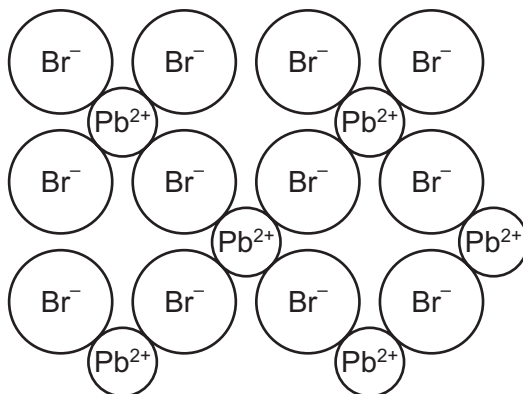
- (i) State the name of the piece of apparatus labelled **A**.

..... [1]

- (ii) Describe how the pH of the solution in the flask changes as the hydrochloric acid is added.

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

- 6 The diagram shows the structure of lead bromide.



- (a) What is the simplest formula for lead bromide?

..... [1]

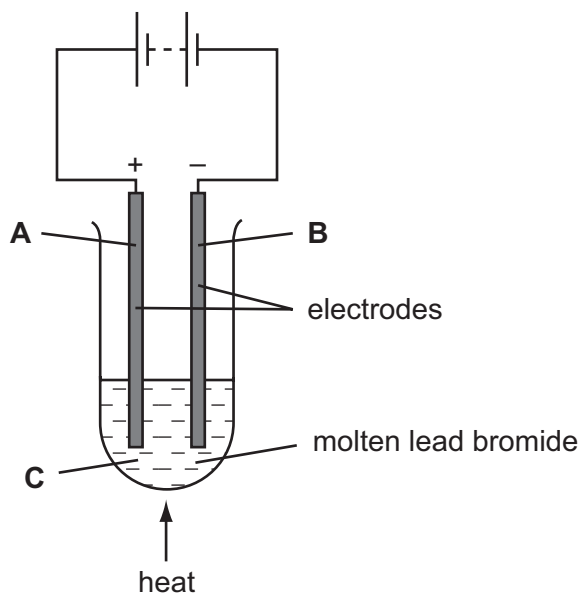
- (b) What type of structure and bonding is present in lead bromide?

Choose **two** words from the following:

atomic      covalent      giant      ionic      metallic      molecular

..... [2]

- (c) Lead bromide is electrolysed using the apparatus shown below.



- (i) Which letter, **A**, **B** or **C** represents the cathode?

..... [1]

(ii) State the name of a metal which can be used for the electrodes.

..... [1]

(iii) Why does lead bromide have to be molten for electrolysis to occur?

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

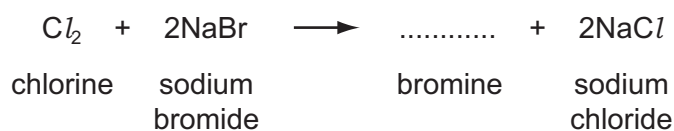
(iv) State the name of the products formed during this electrolysis;

at the anode, .....

at the cathode. .... [2]

(d) A student bubbled chlorine gas through an aqueous solution of sodium bromide.

(i) Complete the equation for this reaction.



[1]

(ii) What colour is the solution at the end of the reaction?

..... [1]

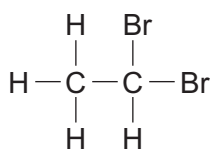
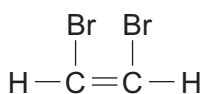
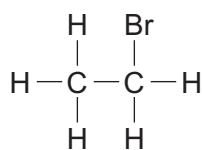
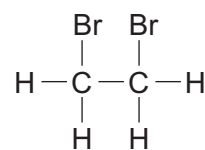
(iii) An aqueous solution of iodine does not react with a solution of sodium bromide. Explain why there is no reaction.

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

- (e) Bromine becomes decolourised when it reacts with ethene.
- (i) Draw the structure of ethene showing all atoms and bonds.

[1]

- (ii) Which **one** of the following, **A**, **B**, **C** or **D**, shows the correct structure of the product formed when bromine reacts with ethene?

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

answer .....

[1]

7 The table gives some information about the properties of some metals.

metal	melting point /°C	colour of chloride
<b>A</b>	1890	pink
<b>B</b>	98	white
<b>C</b>	63	white
<b>D</b>	1535	brownish-black

(a) Which **two** of the metals **A** to **D** are transition metals?

Give a reason for your answer.

metals .....

reason ..... [2]

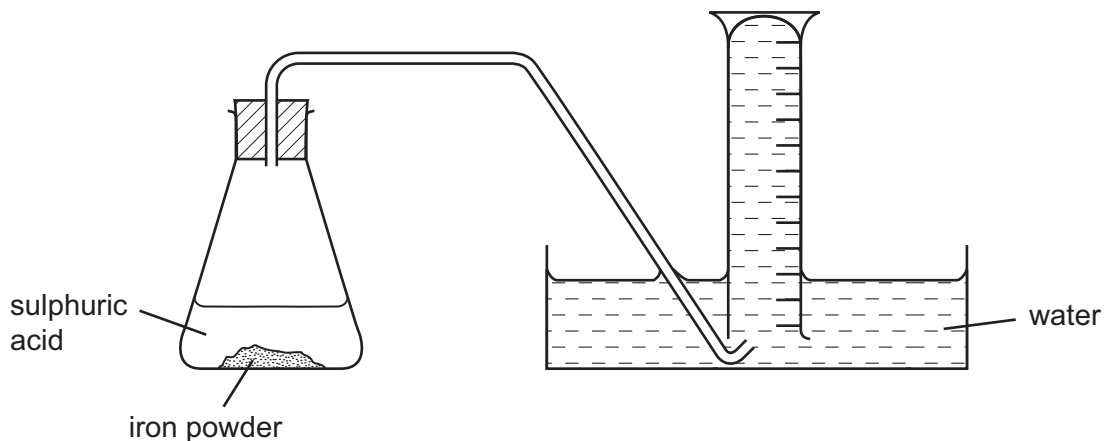
(b) When iron powder reacts with warm sulphuric acid, hydrogen is given off.



State the name of the salt made in this reaction.

..... [1]

- (c) A student used the apparatus shown below for investigating the speed of the reaction between iron and sulphuric acid.



Describe how this apparatus can be used to investigate the speed of this reaction.

.....

.....

.....

..... [3]

- (d) The student repeated the experiment with different concentrations of sulphuric acid. In each experiment the mass of iron powder was the same and the temperature was kept at 30°C. The results are shown in the table.

concentration of sulphuric acid / moles per dm <sup>3</sup>	speed of reaction / cm <sup>3</sup> hydrogen per second
0.4	4.2
0.8	8.5
1.6	17.0

- (i) Use the information in the table to help you work out how the speed of the reaction is affected by the concentration of sulphuric acid.

.....

.....

..... [2]

- (ii) What will happen to the speed of the reaction if lumps of iron are used instead of iron powder?

..... [1]



- (iii) What will happen to the speed of the reaction if it is carried out at 20°C rather than at 30°C?

..... [1]



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**DATA SHEET**  
**The Periodic Table of the Elements**

		Group															
I	II	III	IV	V	VI	VII	O										
		1 <b>H</b> Hydrogen 1										4 <b>He</b> Helium 2					
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4											20 <b>Ne</b> Neon 10					
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12											35.5 <b>Ar</b> Argon 18					
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	45 <b>Sc</b> Scandium 21	48 <b>Ti</b> Titanium 22	51 <b>V</b> Vanadium 23	52 <b>Cr</b> Chromium 24	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	59 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	89 <b>Y</b> Yttrium 39	91 <b>Zr</b> Zirconium 40	93 <b>Nb</b> Niobium 41	96 <b>Mo</b> Molybdenum 42	101 <b>Ru</b> Ruthenium 44	103 <b>Rh</b> Rhodium 45	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	112 <b>Cd</b> Cadmium 48	115 <b>In</b> Indium 49	119 <b>Sn</b> Tin 50	122 <b>Sb</b> Antimony 51	128 <b>Te</b> Tellurium 52	127 <b>I</b> Iodine 53	131 <b>Xe</b> Xenon 54	
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	139 <b>La</b> Lanthanum 57	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum 73	184 <b>W</b> Tungsten 74	190 <b>Os</b> Osmium 76	192 <b>Ir</b> Iridium 77	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold 79	201 <b>Hg</b> Mercury 80	204 <b>Tl</b> Thallium 81	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth 83	85 <b>At</b> Astatine 85	86 <b>Rn</b> Radon 86		
226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89																

\*58-71 Lanthanoid series  
90-103 Actinoid series

**Key**

a	<b>X</b>
a = relative atomic mass	
X = atomic symbol	
b = proton (atomic) number	

140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71
232 <b>Th</b> Thorium 90	238 <b>Pa</b> Protactinium 91	238 <b>U</b> Uranium 92	94 <b>Pu</b> Plutonium 94	95 <b>Am</b> Americium 95	96 <b>Cm</b> Curium 96	98 <b>Cf</b> Californium 98	99 <b>Es</b> Einsteinium 99	100 <b>Fm</b> Fermium 100	101 <b>Md</b> Mendelevium 101	102 <b>No</b> Nobelium 102	103 <b>Lr</b> Lawrencium 103

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).