Centre Number	Candidate Number	Name

## 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.

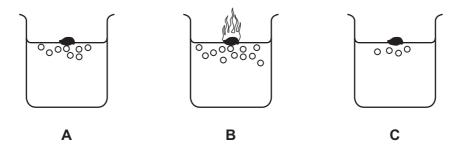
The number of marks is given in brackets [ ] at the end of each question or part questions. A copy of the Periodic Table is printed on page 20.

For Examiner's Use			
1			
2			
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Total			

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



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



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

.....Na + .....
$$H_2O$$
  $\longrightarrow$  2NaOH +  $H_2$  [1]

(ii)	Apart from with water.	fizzing,	describe	two	things	that	you	would	see	when	sodium	reacts
												[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 <b>two</b> 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]
	bidium also reacts with water. How does the speed of reaction of rubidium with the ter compare with that of potassium with water?
••••	[1]
(d) Ca	dium has anly one stable isotone whorese notaceium has soveral isotones
(d) Sc (i)	dium has only one stable isotope whereas potassium has several isotopes.  What do you understand by the term <i>isotopes</i> ?
(1)	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 ( <sup>235</sup> 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.

 $CuCO_3 \longrightarrow CuO + \dots$  [1]

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

 $2CuO + C \xrightarrow{\text{heat}} 2Cu + CO_2$ 

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

		endotnermic	exotnermic	naiogen	metai	
		neutralised	0	xidised	reduced	
		In this reaction copper	r oxide is	to copper.		
		The copper obtained i	s a pinkish-brown			
		The reaction is	because	heat is absorbed.		[3]
	(ii)	State the name of the	substance which	is oxidised during t	his reaction.	
						[1]
(	(iii)	How would you test for	or the carbon diox	ide given off in this	reaction?	
		test				
		result				[2]
(c)	Des	scribe a test for aqueou	ıs copper ions and	d state the result.		
						[0]

- (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]
- (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.

$$\begin{array}{c} \text{CH}_{3} \text{ CH}_{3} \\ \text{C} \\ \text{C} - \text{H} \\ \text{CH}_{2} \\ \text{HO} - \text{CH}_{2} - \text{CH} \\ \text{C} \\ \text{CH}_{3} \text{ CH}_{2} \end{array}$$

(a) Put a ring around the alcohol functional group in this formula.

[1]

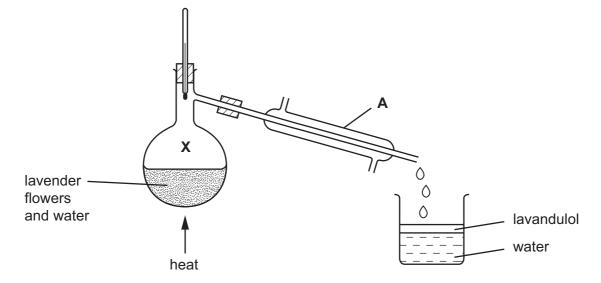
**(b)** Is lavandulol a saturated or unsaturated compound? Give a reason for your answer.

[11

(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 <b>A</b> .	
			[1]
	(ii)	What is the temperature of the water at point <b>X</b> in the diagram?	
			[1]
	(iii)	The lavandulol and water are collected in the beaker. What information in the diagram shows that lavandulol is less dense than water?	
			[1]
(e)	A s	vender flowers contain a variety of different pigments (colourings). tudent separated these pigments using paper chromatography. e results are shown in the diagram below.	
		chromatography paper  chromatography paper	
	(i)	Put an <b>X</b> on this diagram to show where the mixture of pigments was placed at start of the experiment.	the [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

(iv)	During chromatography, the solvent evaporates and ther chromatography jar. What do you understand by the term diffusion?	diffuses throughout	the
			[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?		[1]
	Tick <b>two</b> boxes.		
	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 atoms to others		
	It is formed by the catalytic addition of steam to ethene.		
			[1]

4	Thi	s 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	CaO	
calcium oxide	O = 1	CaO	
sodium chloride	Na = 1 C <i>l</i> = 1		table salt
	Ca = 1		
calcium carbonate	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	<b>A</b>
magnesium	
iron	
copper	less reactive

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

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**(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		
magnasium	Gives off a few bubbles of gas with hot water.		
magnesium	Dissolves very slowly.		
aalaium	Gives off bubbles steadily with cold water.		
calcium	Dissolves slowly.		
strontium			

[2]

[1]

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

[1]

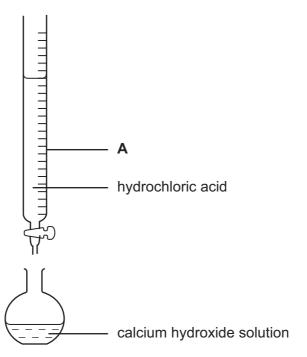
- (d) A solution of calcium hydroxide is alkaline.
  - (i) Complete and balance the equation for the reaction of calcium hydroxide with hydrochloric acid.

$$Ca(OH)_2 + 2HCl \longrightarrow CaCl_2 + \dots$$

(ii) What type of chemical reaction is this?

[1

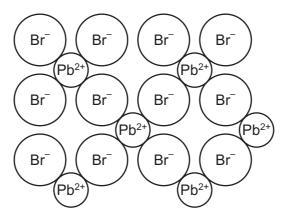
**(e)** A student used the apparatus shown below to calculate the concentration of a solution of calcium hydroxide.



(i)	State the name of the piece of apparatus labelled <b>A</b> .
	[1]
(ii)	Describe how the pH of the solution in the flask changes as the hydrochloric acid is added.
	[2]

[2]

6 The diagram shows the structure of lead bromide.



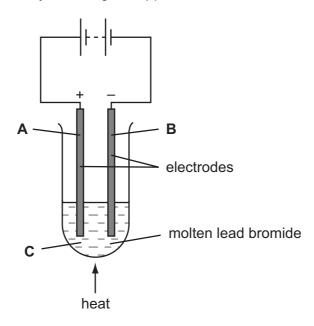
	14/1 ( '				
(a)	vvnat is	the simple	est formula	tor lead	bromide?

Г1	n
ין	J

**(b)** What type of structure and bonding is present in lead bromide? Choose **two** words from the following:

atomic	covalent	giant	ionic	metallic	molecular

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



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

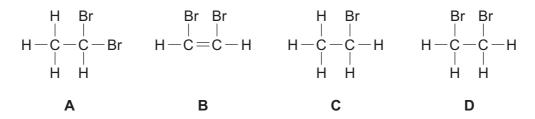
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(ii)	State the name of a metal which can be used for the electrodes.	
		[1]
(iii)	Why does lead bromide have to be molten for electrolysis to occur?	
		[1]
(iv)	State the name of the products formed during this electrolysis;	
	at the anode,	
	at the cathode.	[2]
( <b>d</b> ) A s	tudent bubbled chlorine gas through an aqueous solution of sodium bromide.	
(i)	Complete the equation for this reaction.	
	$Cl_2$ + 2NaBr $\longrightarrow$ + 2NaC $l$	
	chlorine sodium bromine sodium bromide chloride	
(ii)	What colour is the solution at the end of the reaction?	[1]
		[1]
(iii)	An aqueous solution of iodine does not react with a solution of sodium bromi	de.
()	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?



answer [1]

]

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

metal	melting point /°C	colour of chloride
Α	1890	pink
В	98	white
С	63	white
D	1535	brownish-black

(a)	Which <b>two</b> of the metals <b>A</b> to <b>D</b> are transition metals?	
	Give a reason for your answer.	

metals	
reason	[2]

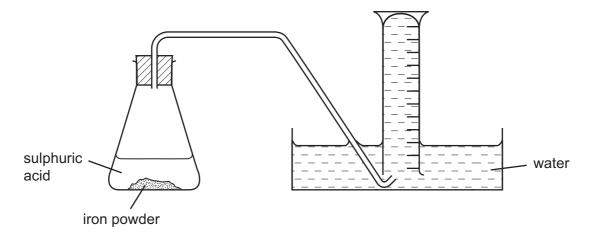
(b) When iron powder reacts with warm sulphuric acid, hydrogen is given off.

Fe + 
$$H_2SO_4$$
  $\longrightarrow$  FeSO<sub>4</sub> +  $H_2$ 

State the name of the salt made in this reaction.

	- 4
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	Γ.
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**(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 /cm³ 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 that 30°C?	nan
		[1]

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DATA SHEET
The Periodic Table of the Elements

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20

175 <b>Lu</b>	Lutetium 71	<b>Lr</b> Lawrencium 103
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167 <b>Er</b>		Fm Fermium 100
165 <b>Ho</b>		<b>Es</b> Einsteinium 99
162 <b>Dy</b>	Dysprosium 66	Cf Californium 98
159 <b>Tb</b>	lerblum 65	<b>BK</b> Berkelium 97
157 <b>Gd</b>	Gadolinium 64	<b>Cm</b> Curium 96
152 <b>Eu</b>	63	<b>Am</b> Americium 95
<b>Sm</b>	samarium 62	<b>Pu</b> Plutonium 94
Pm	Prometnium 61	Np Neptunium 93
4 <b>Z</b>	Neodymium 60	238 <b>U</b> Uranium 92
141 <b>Pr</b>	Praseodymium 59	<b>Pa</b> Protactinium 91
<b>Ge</b> 140	cenum 58	232 <b>Th</b> Thorium 90

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

b = proton (atomic) number

a = relative atomic massX = atomic symbol

Key