

Candidate Name _____

Centre Number	Candidate Number

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

**Joint Examination for the School Certificate
and General Certificate of Education Ordinary Level**

CHEMISTRY

5070/2

PAPER 2 Theory

OCTOBER/NOVEMBER SESSION 2001

1 hour 30 minutes

Candidates answer on the question paper.

Additional materials:

Answer paper

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and on any separate answer paper used.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **three** questions.

Write your answers on the lined pages provided and/or on separate answer paper.

At the end of the examination, fasten any separate answer paper securely to the question paper.

INFORMATION FOR CANDIDATES

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	
Section A	
B7	
B8	
B9	
B10	
TOTAL	

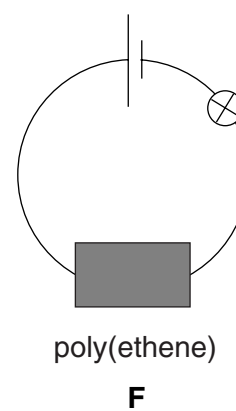
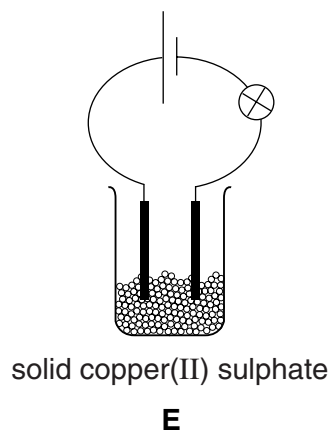
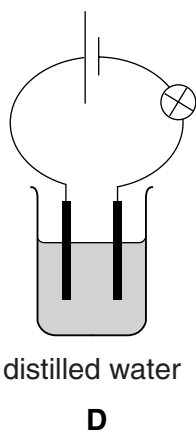
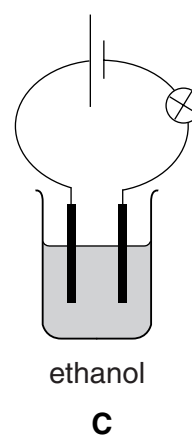
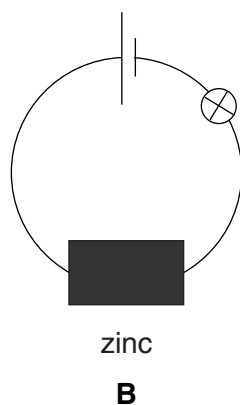
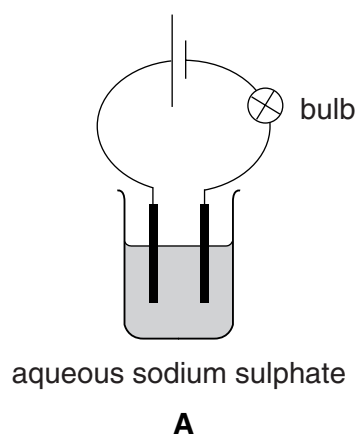
This question paper consists of 14 printed pages and 2 lined pages.

Section A

Answer **all** questions in the spaces provided.

The total mark for this section is 45.

- A1 (a)** A student tried to pass an electric current through some solids and liquids. The six experiments are represented by the diagrams below.



- (i) In which experiments will the bulb light?

.....[2]

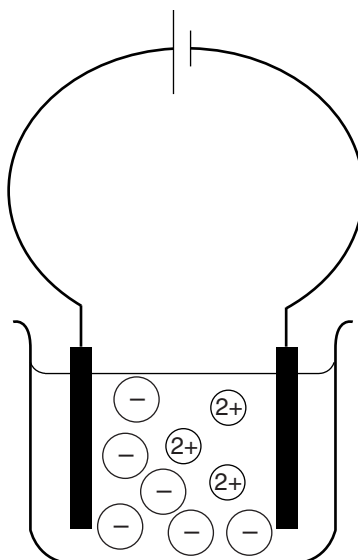
- (ii) Give the name of an electrolyte shown in the diagram.

.....[1]

- (iii) In which experiment will oxygen be produced?

.....[1]

(b) The following diagram represents the electrolysis of molten substance, **X**.



(i) Label the anode and cathode on the diagram.

(ii) Suggest the name of substance **X**.

.....

(iii) State the formula of the cation in **X**.

.....

(iv) Explain why substance **X** conducts electricity when molten, but not when solid.

.....

.....

.....

[5]

A2 The table shows the atomic structure of six particles, represented by the letters **L** to **Q**. The particles are atoms or ions. The letters are not the symbols of the elements.

<i>particle</i>	<i>electrons</i>	<i>protons</i>	<i>neutrons</i>
L	6	6	6
M	2	2	2
N	12	12	12
O	10	12	12
P	6	6	8
Q	10	13	14

Use the letters **L** to **Q** to answer the following questions.

(a) Which **two** particles are ions?

..... and[1]

(b) Which particle is an atom of a noble gas?

.....[1]

(c) Which **two** particles are an atom and an ion of the same element?

..... and[1]

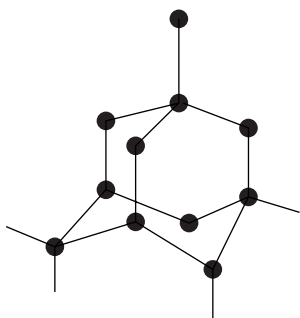
(d) Which **two** particles are isotopes of the same element?

..... and[1]

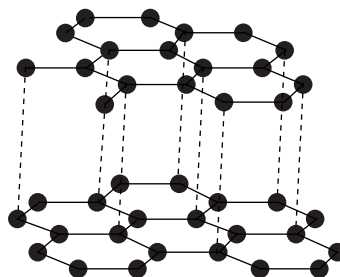
(e) Which particle has the highest atomic mass?

.....[1]

A3 Diamond and graphite are allotropes of carbon. They are both composed of macromolecules.



Diamond



Graphite

(a) Explain the meaning of the following terms.

(i) *allotropes*

.....

.....

(ii) *macromolecule*

.....

.....

[2]

(b) Graphite is used to make lubricants for engines.
Explain, in terms of its structure, why graphite can act as a lubricant.

.....

.....[2]

(c) Give **one** use of diamond which depends on its hardness.

.....[1]

A4 Potassium, atomic number 19, is an element in Group I.

(a) Describe what you **observe** when a small piece of potassium is added to water.

.....

[2]

(b) Potassium fluoride is an ionic solid with a high melting point.

(i) Draw a 'dot and cross' diagram to show the bonding in potassium fluoride.
 You only need to show the outer (valence) electrons.

(ii) Explain why the melting point of potassium fluoride is very high.

.....

 [3]

(c) Caesium, atomic number 55, is another element in Group I.
 Use your knowledge of Group I elements to complete the table of information for caesium.

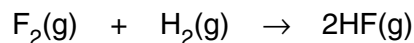
symbol	Cs
number of electrons in outer shell	
formula of caesium oxide	
names of products of the reaction between caesium and water	

[3]

(d) The reaction between caesium and water is more vigorous than the reaction between potassium and water.
 Explain why this is so.

.....
[2]

A5 The reaction below is an example of a redox reaction.



(a) (i) Identify the oxidising agent in the reaction.

.....

(ii) Explain why this is a redox reaction

.....

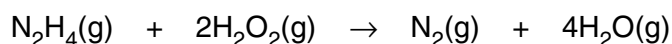
.....

[3]

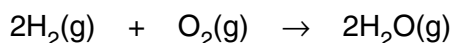
(b) Some redox reactions can be used to propel rockets.

The following equations represent redox reactions used to propel rockets.

Reaction A



Reaction B



(i) Use these equations to complete the following table.

<i>reaction</i>	<i>number of moles of reactants</i>	<i>number of moles of products</i>
A		
B		

(ii) Reactions used to propel rockets need to produce large volumes of gas. Use the information in the table to suggest why reaction **A** is more likely to be used to propel rockets.

.....

.....

[3]

(c) Explain why gas volumes measured at r.t.p. cannot be used in calculations for gases produced in rocket engines.

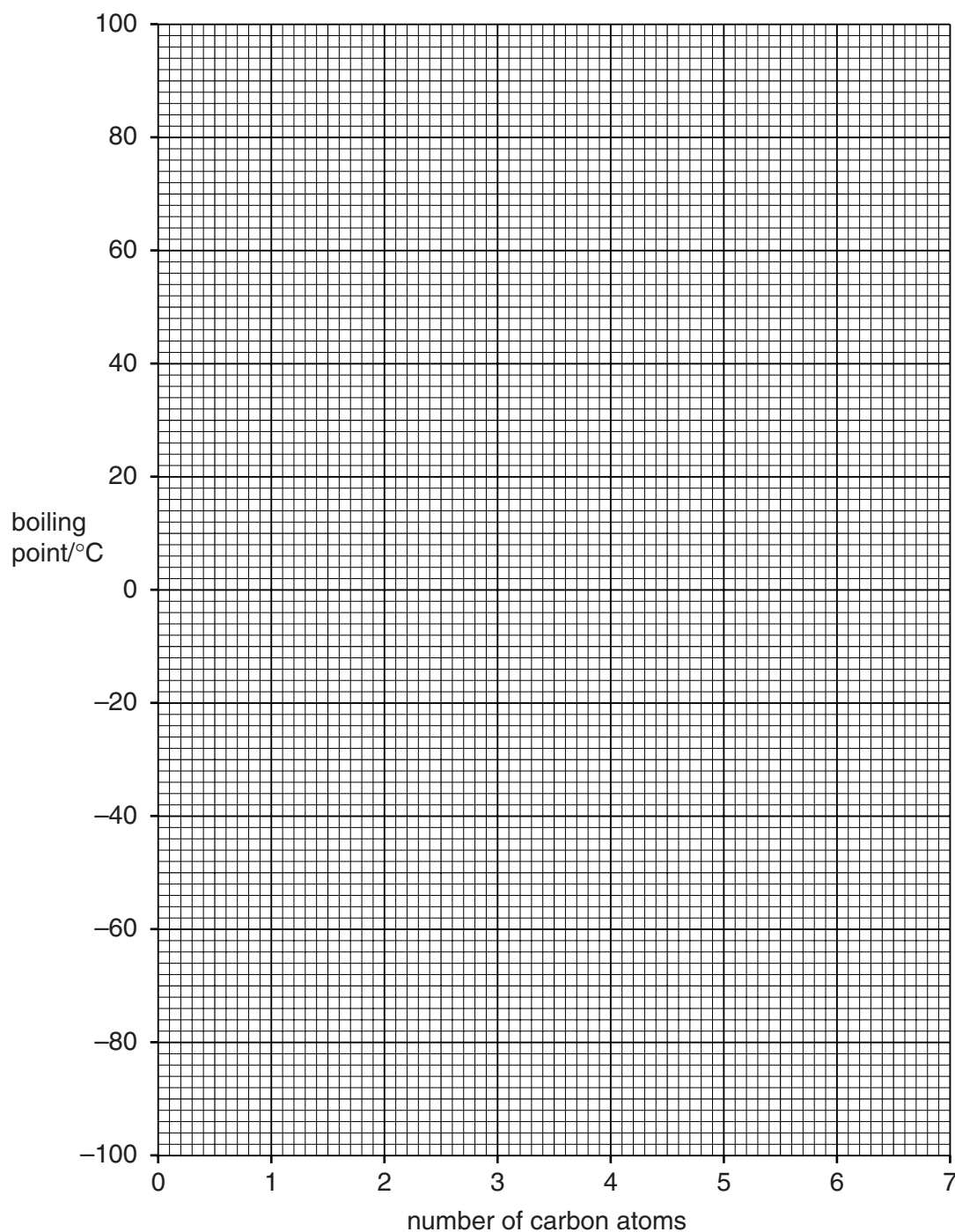
.....[1]

A6 This question is about alkanes.

(a) The table gives the boiling points of some alkanes.

<i>name</i>	<i>formula</i>	<i>boiling point / °C</i>
ethane	C_2H_6	-88
propane	C_3H_8	-42
butane	C_4H_{10}	0
pentane	C_5H_{12}	36

(i) Plot a graph of boiling points against number of carbon atoms for the alkanes in the table.



(ii) Use your graph to deduce the boiling point of hexane, C_6H_{14} .

.....[3]

(b) A hydrocarbon has the formula C_8H_{16} .
Explain why this is not an alkane.

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

(c) In some parts of the world, butane is used as a fuel for room heaters. If these are faulty, incomplete combustion occurs and carbon monoxide is produced.

(i) What causes incomplete combustion?

.....

(ii) Construct an equation to show that incomplete combustion of butane produces carbon monoxide and water only.

.....

(iii) State why carbon monoxide is hazardous.

.....

.....

[3]

(d) Combustion of petrol in a car engine also produces pollutants.
Name **two** pollutants, other than carbon monoxide, which are produced in car engines.

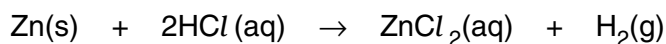
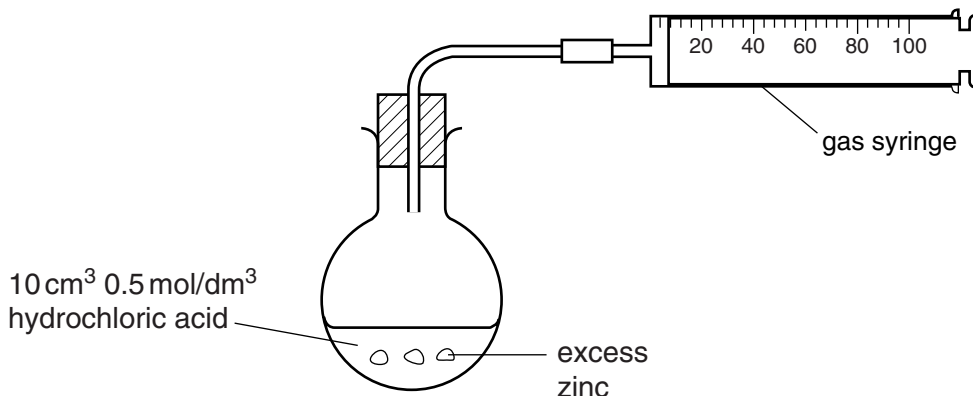
..... and[2]

Section B

Answer **three** questions from this section.

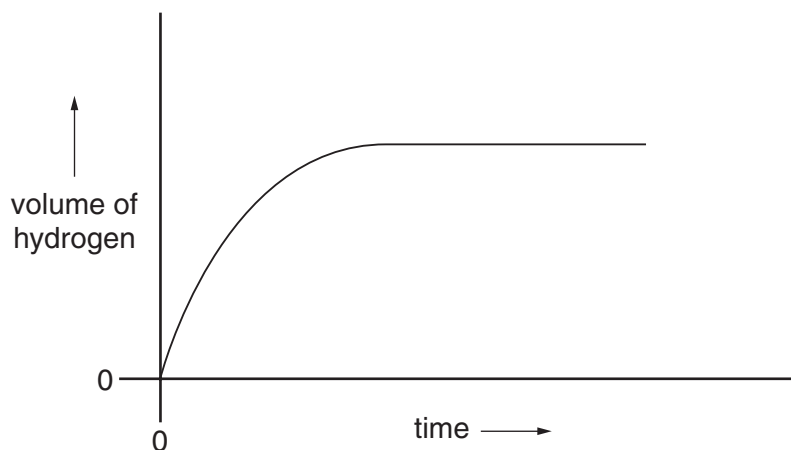
Write your answers on the lined pages that follow.

- B7** An **excess** of zinc was added to 10 cm^3 of 0.5 mol/dm^3 hydrochloric acid, using the apparatus below.



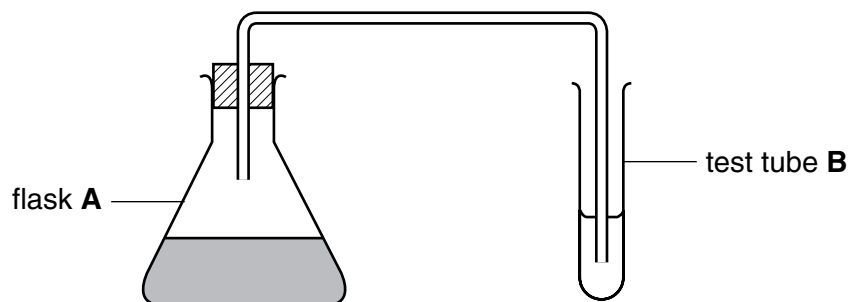
- (a) Calculate the maximum volume of hydrogen which could be produced in the reaction at r.t.p. [3]

This graph shows how the volume of hydrogen changed during the reaction.



- (b) (i) Describe how the rate of reaction changes as the reaction progresses. [2]
 (ii) Suggest a reason for this change.
- (c) The experiment was repeated using dilute sulphuric acid of the same concentration. Write a balanced equation for the reaction between zinc and sulphuric acid. Suggest how both the rate of reaction and the total volume of hydrogen obtained would differ from the reaction between zinc and hydrochloric acid. Explain your reasoning. [5]
- [10 marks]

B8 The following apparatus can be used to produce ethanol from sugar.



- (a) Describe how this apparatus can be used to produce ethanol.
Your answer should include the names of the substances added to flask **A**, the optimum (or best) conditions for the reaction and a word equation for the reaction. [3]
- (b) Suggest what could be added to test-tube **B** to identify the gas produced. [1]
- (c) Ethanol can be used as a fuel.
The enthalpy change of combustion for 1 mole of ethanol is -1367 kJ.
Write an equation for the complete combustion of ethanol.
Calculate the total energy released by the complete combustion of 23 g of ethanol. [3]
- (d) Ethanol can be manufactured by the catalytic addition of water vapour to ethene.

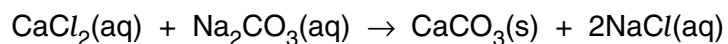
The structure of a water molecule is shown below.



Draw the structures of ethene and ethanol.
Explain why ethene undergoes addition reactions. [3]

[10 marks]

- B9 (a)** Brine is an impure solution of sodium chloride. The main impurity in brine is calcium chloride. It is removed by reacting the brine with sodium carbonate.



- (i) State the name for this type of reaction.
 - (ii) Construct an ionic equation for the reaction between calcium ions and carbonate ions to produce calcium carbonate.
 - (iii) Suggest how the calcium carbonate is removed from the mixture.
- [3]

- (b)** Chlorine is manufactured by the electrolysis of concentrated sodium chloride.

- (i) Write equations for both of the electrode reactions.
 - (ii) Calculate the maximum volume of chlorine, at r.t.p., which can be obtained from 175.5 kg sodium chloride.
- [5]

- (c)** Chlorine reacts with methane to produce chloromethane, CH_3Cl .
Draw a 'dot and cross' diagram to show the bonding in chloromethane.
You only need to show outer (valence) electrons.
- [2]

[10 marks]

B10 (a) You are provided with the following substances.

magnesium metal
 copper metal
 aqueous chlorine
 aqueous iodine
 aqueous copper(II) sulphate
 aqueous magnesium nitrate
 aqueous potassium chloride
 aqueous potassium iodide.

Use substances from the list to show that,

- (i) iodine is less reactive than chlorine,
 (ii) copper is less reactive than magnesium.

Your answer should include details of your observations and the equations for the reactions which occur. [7]

(b) The table shows information about three metals, **X**, **Y** and **Z**.

<i>metal</i>	<i>method of extraction of metal</i>
X	found uncombined
Y	electrolysis of molten oxide
Z	heating oxide with carbon

- (i) Place the three metals in order of increasing reactivity.
 (ii) Suggest the identity of the three metals **X**, **Y** and **Z**. [3]

[10 marks]

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DATA SHEET
The Periodic Table of the Elements

		Group																																																			
I	II	III	IV	V	VI	VII	0																																														
7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1	11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10						4 He Helium 2																																							
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	36 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	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	127 I Iodine 53	128 Te Tellurium 52	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	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	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86																																					
87 Fr Francium	88 Ra Radium	89 Ac Actinium																																																			
*58-71 Lanthanoid series																																																					
†90-103 Actinoid series																																																					
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a	X	b																																																			
<p>Key</p> <p>a = relative atomic mass X = atomic symbol b = proton (atomic) number</p>																																																					
<p>The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).</p>																																																					