

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
TWENTY FIRST CENTURY SCIENCE  
CHEMISTRY A**

**A322/01**

Unit 2: Modules C4 C5 C6 (Foundation Tier)

Candidates answer on the Question Paper  
A calculator may be used for this paper

**OCR Supplied Materials:**  
None

**Other Materials Required:**

- Pencil
- Ruler (cm/mm)

**Wednesday 27 January 2010  
Afternoon**

**Duration: 40 minutes**



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- The Periodic Table is printed on the back page.
- This document consists of **16** pages. Any blank pages are indicated.



(c) The diagram shows some of the elements in the Periodic Table.

2				C				
3		Mg						
4	K	Ca	transition elements		Ga			
5								

(i) Which element has properties that are **most similar** to calcium?

Put a ring around the correct answer.

**carbon**

**gallium**

**magnesium**

**potassium**

[1]

(ii) Which element is a non-metal?

Put a ring around the correct answer.

**carbon**

**gallium**

**magnesium**

**potassium**

[1]

[Total: 4]

2 Liz makes some notes about the properties of some elements in Group 1.

Group 1	
lithium Li	<p><u>Lithium</u> Atomic number: 3 Melting point: 181°C Density: 0.53 g/cm<sup>3</sup></p>
sodium Na	
potassium K	
rubidium Rb	<p><u>Sodium</u> Atomic number: 11 Melting point: 98°C Density: 0.97 g/cm<sup>3</sup></p>
	<p><u>Rubidium</u> Atomic number: 37 Melting point: 39°C Density: 1.53 g/cm<sup>3</sup></p>

(a) Explain how Liz could use her notes to predict the properties of potassium.

.....

.....

..... [2]

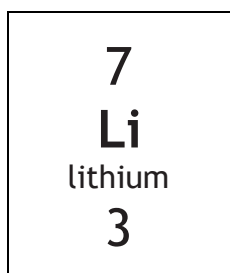
(b) Describe **two** patterns in the properties of Group 1 elements shown by the information.

.....

.....

..... [2]

(c) This is the information for lithium on the Periodic Table.



Complete the sentences about the structure of a lithium atom.

Choose words from this list.

**electrons**      **elements**      **ions**      **molecules**      **neutrons**      **protons**

The shells around a lithium nucleus contain three .....

The central nucleus of the atom is made up of three .....

and four .....

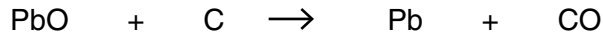
[2]

[Total: 6]

3 Some types of car batteries contain metals such as lead.

(a) Lead can be extracted by heating lead oxide with carbon.

The equation shows what happens when lead oxide is heated with carbon.



(i) Which statement about the reaction is true?

Put a tick (✓) in the box next to the correct answer.

The reaction involves only oxidation.

The reaction involves only reduction.

The reaction involves both oxidation and reduction.

The reaction does not involve either oxidation or reduction.

[1]

(ii) Which other metals can be extracted by heating their oxides with carbon?

Put a ring around each of the **two** correct answers.

aluminium

copper

potassium

sodium

zinc

[2]

Some car batteries also contain small amounts of other metals including lithium and calcium.

(b) Lithium cannot be extracted by heating lithium oxide with carbon.

Which of the statements gives the **best** reason for this?

Put a tick (✓) in the box next to the correct answer.

Lithium metal reacts with water.

Lithium oxide is ionic.

Lithium is very reactive.

Lithium oxide has a very high melting point.

[1]

(c) Calcium can be extracted using electrolysis.

Complete the passage about the extraction of calcium.

Choose words from this list.

<b>electrodes</b>	<b>evaporates</b>	<b>ions</b>	<b>melts</b>
<b>molecules</b>	<b>negative</b>	<b>neutral</b>	<b>positive</b>

Calcium oxide is heated until it .....

This allows the ..... to move.

During electrolysis calcium metal collects at the ..... electrode.

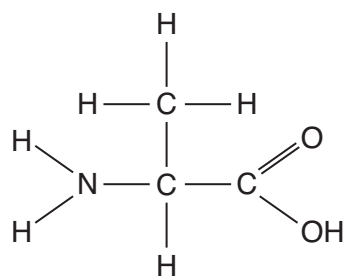
Oxygen gas is made at the ..... electrode.

[3]

[Total: 7]

- 4 Proteins in the human body are formed from amino acids.

The diagram shows the structure of an amino acid.



The table below shows some information about the elements in the amino acid.

Complete the table by filling in the three empty boxes.

name of element	number of atoms in molecule	percentage (%) by mass
carbon	3	40
oxygen	2	36
.....	1	16
hydrogen	.....	.....

[3]

[Total: 3]



5 Space probes have gathered data about the atmosphere on Mars.

The table compares the gases in the atmosphere on Mars and on Earth.

name of gas	percentage (%) in atmosphere on Mars	percentage (%) in atmosphere on Earth
carbon dioxide	95.3	less than 1.0
nitrogen	2.7	78.0
argon	1.6	0.9
oxygen	0.2	20.7

(a) Put ticks (✓) in the correct boxes to show whether each gas is an element or a compound.

name of gas	element	compound
carbon dioxide	<input type="checkbox"/>	<input type="checkbox"/>
nitrogen	<input type="checkbox"/>	<input type="checkbox"/>
argon	<input type="checkbox"/>	<input type="checkbox"/>
oxygen	<input type="checkbox"/>	<input type="checkbox"/>

[2]

(b) Look at the table.

Describe two ways that the atmospheres of Mars and Earth are **similar** and two ways that they are **different**.

.....

.....

.....

.....

..... [4]

(c) The percentages in the table for gases on Mars do not add up to 100%.

Suggest a reason why.

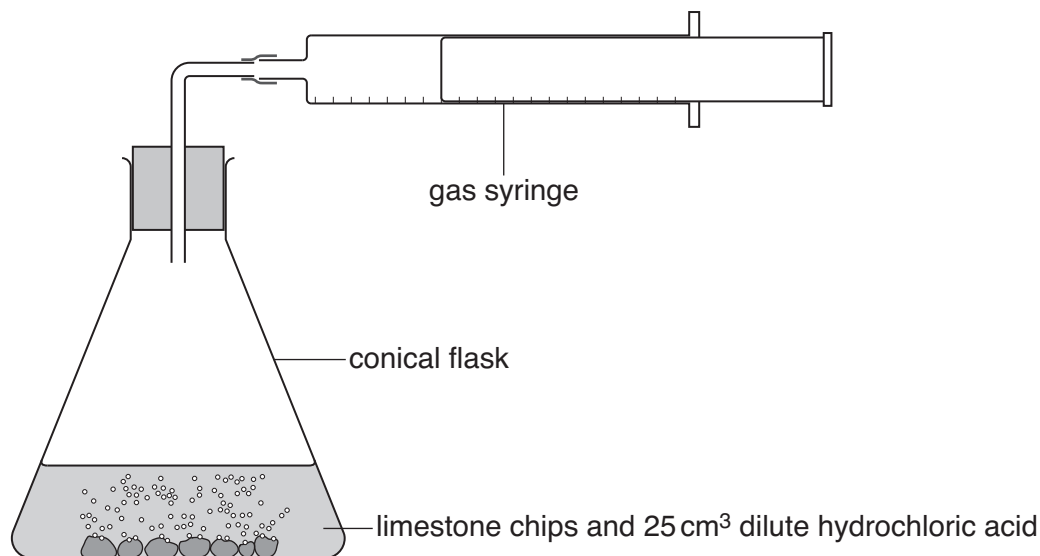
.....

..... [1]

[Total: 7]

Turn over

- 6 Eve carries out an experiment. She adds  $25\text{ cm}^3$  of dilute hydrochloric acid to limestone chips (calcium carbonate). Once every 30 seconds she records the total volume of gas that has been given off.



The table shows her results.

time in s	total volume of gas in $\text{cm}^3$
0	0
30	80
60	120
90	140
120	150
150	150

- (a) (i) How long does it take for the reaction to finish?

answer ..... s [1]

- (ii) When the reaction ends, lumps of limestone are left in the flask. Why does the reaction stop?

Put a tick (✓) in the box next to the correct answer.

The temperature cools during the reaction.

All the gas has been used up.

All the acid has been used up.

The limestone chips become unreactive.

[1]

- (b) During the reaction, solid calcium carbonate reacts with dilute hydrochloric acid and the gas syringe fills with a gas.

At the end of the experiment the flask contains a solution of calcium chloride in water.

- (i) What is the name of the gas made during the reaction?

Put a ring around the correct answer.

carbon dioxide      carbon monoxide      hydrogen      nitrogen      oxygen

[1]

- (ii) Draw a line from each **chemical** to the correct **state symbol**.

chemical	state symbol
water	(s)
calcium carbonate	(g)
gas made in the reaction	(aq)
calcium chloride solution	(l)

[2]

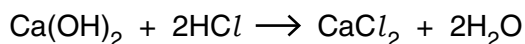
- (iii) Draw a line from each **chemical** to the correct **formula**.

chemical	formula
water	CaCO <sub>3</sub>
calcium carbonate	H <sub>2</sub> O
hydrochloric acid	CaCl <sub>2</sub>
calcium chloride	HCl

[2]

[Total: 7]

- 7 Joe carries out an experiment to make a salt.  
He makes calcium chloride by reacting calcium hydroxide with dilute hydrochloric acid.



- (a) Joe works out what mass of calcium chloride he can make.

The box below shows some of Joe's working.

Complete Joe's working by filling in the gaps.

	relative atomic mass
Ca	.....
O	.....
H	.....
Cl	35.5

relative formula mass of  $\text{Ca(OH)}_2 = 74$

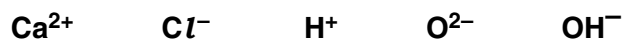
relative formula mass of  $\text{CaCl}_2 = \dots\dots\dots$

[2]

- (b) The reaction between calcium hydroxide and hydrochloric acid is a neutralisation reaction.

Which ion is always present in a solution of an alkali?

Put a ring around the correct answer in this list.



[1]

- (c) Write the general equation for a neutralisation reaction by filling in the boxes.

Choose from the formulae in this list.

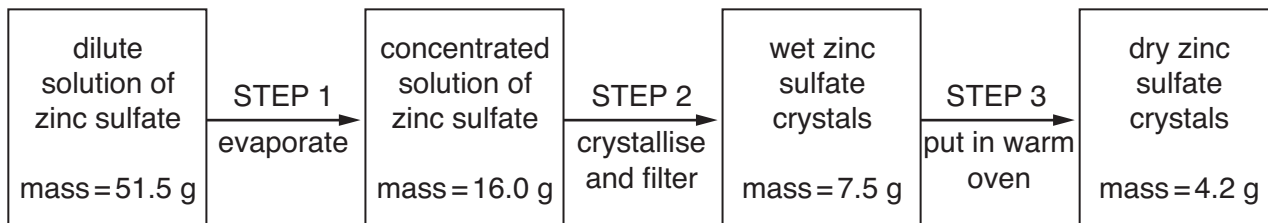


[1]

[Total: 4]

- 8 Sam works for a medicine company.  
 The company makes zinc sulfate for use in medicines.  
 She makes some zinc sulfate crystals from zinc sulfate solution.  
 She measures the mass after each step.

The flow chart shows what she does.



- (a) What happens to the mass of zinc sulfate solution during STEP 1?  
 Explain why.

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

- (b) Suggest why the crystals were put in a warm oven.

..... [1]

- (c) What is the actual yield from the experiment?

answer ..... g [1]

[Total: 4]

**END OF QUESTION PAPER**

14  
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# The Periodic Table of the Elements

	1	2	3	4	5	6	7	0										
	7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	12 <b>C</b> carbon 6	13 <b>Al</b> aluminium 13	14 <b>N</b> nitrogen 7	15 <b>P</b> phosphorus 15	16 <b>O</b> oxygen 8	17 <b>Cl</b> chlorine 17	18 <b>Ar</b> argon 18								
	19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	23 <b>V</b> vanadium 23	24 <b>Cr</b> chromium 24	25 <b>Mn</b> manganese 25	26 <b>Fe</b> iron 26	27 <b>Co</b> cobalt 27	28 <b>Ni</b> nickel 28	29 <b>Cu</b> copper 29	30 <b>Zn</b> zinc 30	31 <b>Ga</b> gallium 31	32 <b>Ge</b> germanium 32	33 <b>As</b> arsenic 33	34 <b>Se</b> selenium 34	35 <b>Br</b> bromine 35	36 <b>Kr</b> krypton 36		
	37 <b>Rb</b> rubidium 37	38 <b>Sr</b> strontium 38	39 <b>Y</b> yttrium 39	40 <b>Zr</b> zirconium 40	41 <b>Nb</b> niobium 41	42 <b>Mo</b> molybdenum 42	43 <b>Tc</b> technetium 43	44 <b>Ru</b> ruthenium 44	45 <b>Rh</b> rhodium 45	46 <b>Pd</b> palladium 46	47 <b>Ag</b> silver 47	48 <b>Cd</b> cadmium 48	49 <b>In</b> indium 49	50 <b>Sn</b> tin 50	51 <b>Sb</b> antimony 51	52 <b>Te</b> tellurium 52	53 <b>I</b> iodine 53	54 <b>Xe</b> xenon 54
	55 <b>Cs</b> caesium 55	56 <b>Ba</b> barium 56	57 <b>La*</b> lanthanum 57	72 <b>Hf</b> hafnium 72	73 <b>Ta</b> tantalum 73	74 <b>W</b> tungsten 74	75 <b>Re</b> rhenium 75	76 <b>Os</b> osmium 76	77 <b>Ir</b> iridium 77	78 <b>Pt</b> platinum 78	79 <b>Au</b> gold 79	80 <b>Hg</b> mercury 80	81 <b>Tl</b> thallium 81	82 <b>Pb</b> lead 82	83 <b>Bi</b> bismuth 83	84 <b>Po</b> polonium 84	85 <b>At</b> astatine 85	86 <b>Rn</b> radon 86
	87 <b>Fr</b> francium 87	88 <b>Ra</b> radium 88	89 <b>Ac*</b> actinium 89	104 <b>Rf</b> rutherfordium 104	105 <b>Db</b> dubnium 105	106 <b>Sg</b> seaborgium 106	107 <b>Bh</b> bohrium 107	108 <b>Hs</b> hassium 108	109 <b>Mt</b> meitnerium 109	110 <b>Ds</b> darmstadtium 110	111 <b>Rg</b> roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

1  
**H**  
hydrogen  
1

**Key**  
relative atomic mass  
atomic symbol  
name  
atomic (proton) number

\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.