

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

A322/02

Unit 2: Modules C4 C5 C6 (Higher Tier)

**Wednesday 27 January 2010
Afternoon**

Duration: 40 minutes

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)



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.

Answer **all** the questions.

- 1 The diagram shows the position of some elements in the Periodic Table.

2								
3		Mg		Al				
4	K	Ca	transition elements					
5								

Which statements about these elements are **true** and which are **false**?

Put a tick (✓) in the correct box for each statement.

	true	false
Magnesium and calcium are in the same period.	<input type="checkbox"/>	<input type="checkbox"/>
All of the elements are metals.	<input type="checkbox"/>	<input type="checkbox"/>
Two of the elements have two electrons in their outer shell.	<input type="checkbox"/>	<input type="checkbox"/>
One of the elements has the electronic configuration 2.8.2.	<input type="checkbox"/>	<input type="checkbox"/>
Carbon has the highest atomic number of these elements.	<input type="checkbox"/>	<input type="checkbox"/>

[2]

[Total: 2]

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

Group 1	
lithium	Li
sodium	Na
potassium	K
rubidium	Rb

Lithium
Atomic number: 3
Melting point: 181°C
Density: 0.53g/cm^3

Rubidium
Atomic number: 37
Melting point: 39°C
Density: 1.53g/cm^3

Sodium
Atomic number: 11
Melting point: 98°C
Density: 0.97g/cm^3

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

.....

.....

..... [2]

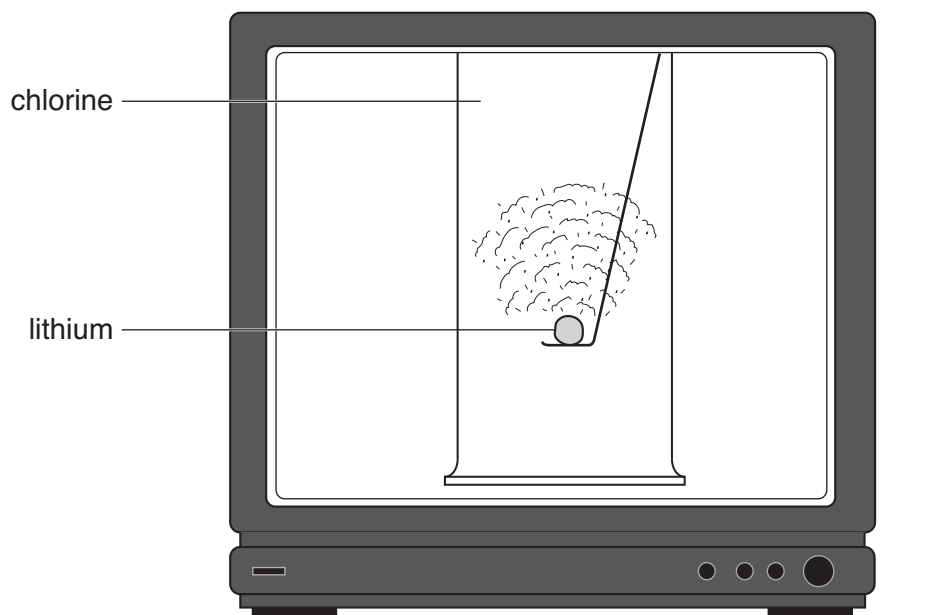
- (b) Describe **two** patterns in the properties of Group 1 elements shown by the information.

.....

.....

..... [2]

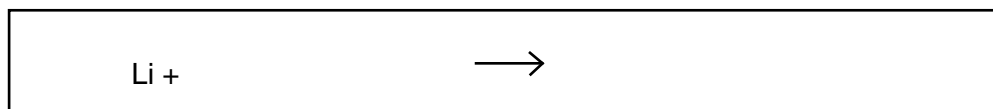
(c) Liz watches a video about the reaction between lithium and chlorine.



(i) What is the name of the product that forms during the reaction?

answer [1]

(ii) Complete and balance the symbol equation for the reaction.

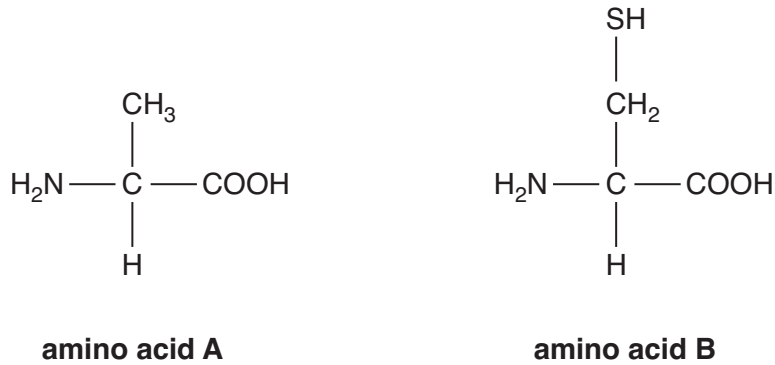


[1]

[Total: 6]

3 Proteins in the human body are formed from amino acids.

The diagram shows the structures of two amino acids in the human body.



(a) Complete the formula for amino acid B.

C₃

[2]

(b) The table shows the percentage by mass of each element in amino acid A.

	percentage (%) by mass
carbon	40
oxygen	36
nitrogen	16
hydrogen	8

Why is the percentage by mass of hydrogen lower than the other elements?

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

There are very few atoms of hydrogen in each molecule.

The molecules are very small.

Hydrogen atoms are much lighter than the other atoms.

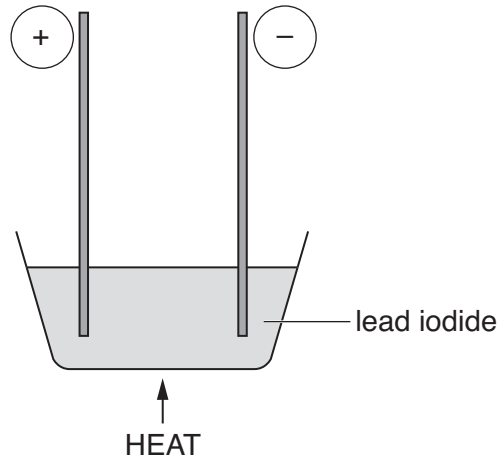
Hydrogen is a gas, carbon is a solid.

[1]

[Total: 3]

Turn over

4 Les sets up an experiment to pass electricity through lead iodide.



(a) Why must the lead iodide be heated?
Put ticks (✓) in the boxes next to the **two best** answers.

Heating provides energy for the reaction.

When heated, ionic compounds melt.

Ions in molten compounds can move.

Heating breaks down the compound.

The compound needs to vapourise.

[2]

(b) During the experiment, iodine vapour forms.
On cooling, the iodine changes to its normal state at room temperature.

Complete the sentences that describe this change.

Choose words from this list.

brown
grey
liquid
orange
precipitate
purple
solid

The colour of iodine vapour is

This changes to a on cooling.

[2]

(c) A similar experiment can be carried out using copper bromide or potassium iodide.

The formula for potassium iodide is KI.

Iodide ions have the symbol I^- .

(i) What is the symbol for a potassium ion?

answer [1]

(ii) Copper ions have the symbol Cu^{2+} .
What is the formula for copper bromide?

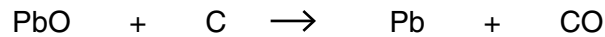
answer [1]

[Total: 6]

5 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 with carbon?

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

aluminium

copper

potassium

sodium

zinc

[2]

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

(i) 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]

- (ii) Lithium and calcium are formed from their ions during electrolysis.

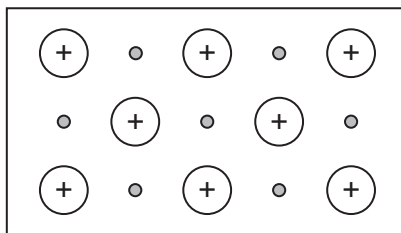
Complete the two equations.



[2]

- (c) One reason metals are used in batteries is that they are very good electrical conductors.

- (i) The diagram shows the structure of a metal.



Use the diagram to help you to describe the structure of this metal.

.....

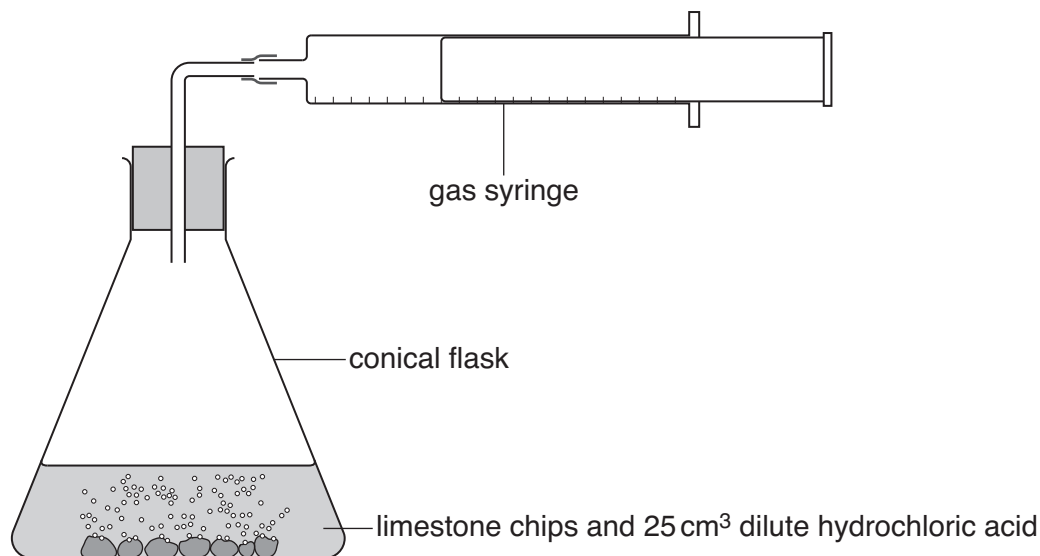
 [2]

- (ii) Suggest why this structure allows metals to be good electrical conductors.

.....
 [1]

[Total: 9]

- 6 Eve carries out an experiment. She adds 25 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.



When the reaction ends, lumps of limestone are left in the flask.

The table shows her results.

time in s	total volume of gas in cm^3
0	0
30	80
60	120
90	140
120	150
150	150

- (a) Explain the change in the rate of reaction during the experiment. Include in your answer

- how the rate changes
- an explanation of why this happens.

.....

.....

.....

.....

[3]

(b) Eve carries out a second experiment using 25 cm³ of a more concentrated hydrochloric acid solution.

She uses the same amount of limestone chips.

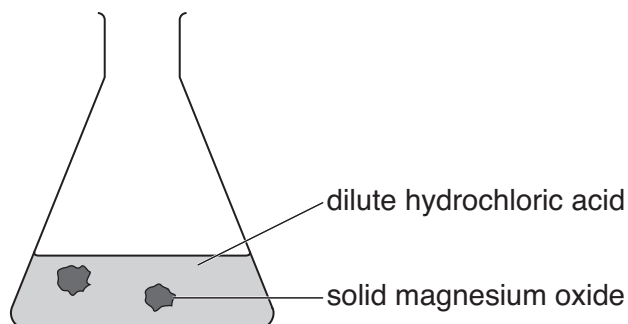
Give **two** ways that the results of the second experiment will be different to the first experiment.

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

[Total: 5]

7 Joe adds dilute hydrochloric acid to solid magnesium oxide.

The reaction produces a solution of magnesium chloride.



(a) Which of the following statements about the reaction are **true** and which are **false**?

Put a tick (✓) in the correct box for each statement.

	true	false
The mixture has a high pH at the start of the reaction.	<input type="checkbox"/>	<input type="checkbox"/>
The pH stays constant during the reaction.	<input type="checkbox"/>	<input type="checkbox"/>
Hydrogen is made during the reaction.	<input type="checkbox"/>	<input type="checkbox"/>
Water is made during the reaction.	<input type="checkbox"/>	<input type="checkbox"/>

[2]

(b) Joe takes the solution of magnesium chloride and makes some crystals.

He measures his yield.

He uses some of the steps below.

- A** measure the mass
- B** dessicate
- C** crystallise
- D** evaporate
- E** titrate

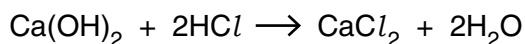
Choose which steps are correct and put them into the correct order.

correct order

--	--	--	--

[2]

- (c) Joe carries out more experiments to make other salts.
He makes calcium chloride by reacting calcium hydroxide with dilute hydrochloric acid.



- (i) 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

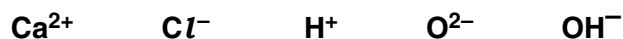
relative formula mass of $\text{Ca(OH)}_2 = 74$
relative formula mass of $\text{CaCl}_2 = \dots\dots\dots$

[2]

- (ii) 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]

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

Choose from the formulae in this list.



[1]

[Total: 8]

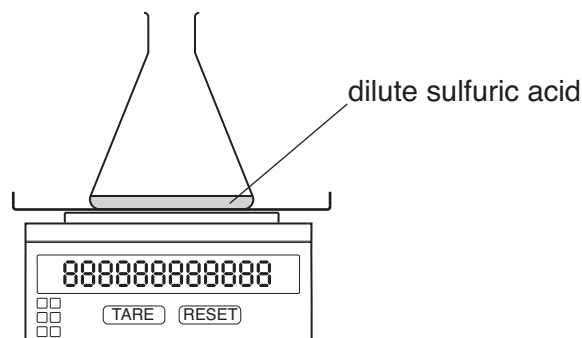
Turn over

8 Sam works for a medicine company.

The company makes zinc sulfate to treat patients who do not have enough zinc in their body.

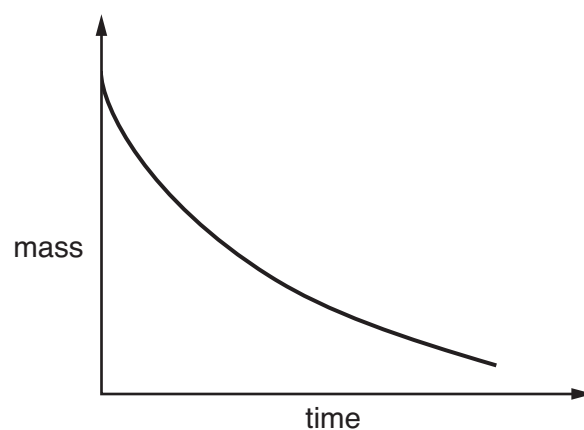
Sam carries out some experiments to find the best method of making zinc sulfate.

She adds different chemicals to dilute sulfuric acid and then measures the mass during each reaction.



experiment number	chemical added to sulfuric acid
1	zinc metal
2	zinc oxide
3	zinc carbonate
4	zinc hydroxide

Two of her experiments give graphs with this shape.



(a) Which two chemicals give graphs with this shape?

Put a tick (✓) in each of the **two** correct boxes.

zinc metal

zinc oxide

zinc carbonate

zinc hydroxide

[2]

(b) Sam works out how much of each chemical she needs to use to make 2 g of zinc sulfate.

Which chemical is needed in the **smallest mass** to make 2 g of zinc sulfate?

Put a **ring** around the correct answer.

zinc metal

zinc oxide

zinc carbonate

zinc hydroxide

[1]

[Total: 3]

END OF QUESTION PAPER

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The Periodic Table of the Elements

	1	2	3	4	5	6	7	0										
	7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 P phosphorus 15	16 O oxygen 8	17 Cl chlorine 17	18 Ar argon 18								
	19 K potassium 19	20 Ca calcium 20	23 V vanadium 23	24 Cr chromium 24	25 Mn manganese 25	26 Fe iron 26	27 Co cobalt 27	28 Ni nickel 28	29 Cu copper 29	30 Zn zinc 30	31 Ga gallium 31	32 Ge germanium 32	33 As arsenic 33	34 Se selenium 34	35 Br bromine 35	36 Kr krypton 36		
	37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium 43	44 Ru ruthenium 44	45 Rh rhodium 45	46 Pd palladium 46	47 Ag silver 47	48 Cd cadmium 48	49 In indium 49	50 Sn tin 50	51 Sb antimony 51	52 Te tellurium 52	53 I iodine 53	54 Xe xenon 54
	55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77	78 Pt platinum 78	79 Au gold 79	80 Hg mercury 80	81 Tl thallium 81	82 Pb lead 82	83 Bi bismuth 83	84 Po polonium 84	85 At astatine 85	86 Rn radon 86
	87 Fr francium 87	88 Ra radium 88	89 Ac* actinium 89	104 Rf rutherfordium 104	105 Db dubnium 105	106 Sg seaborgium 106	107 Bh bohrium 107	108 Hs hassium 108	109 Mt meitnerium 109	110 Ds darmstadtium 110	111 Rg 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.