OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE CHEMISTRY A

A322/02

Unit 2: Modules C4 C5 C6
(Higher 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 24 June 2009
Morning

Duration: 40 minutes

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

MODIFIED LANGUAGE

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**.
- This document consists of **20** pages. Any blank pages are indicated.
- The Periodic Table is printed on the back page.

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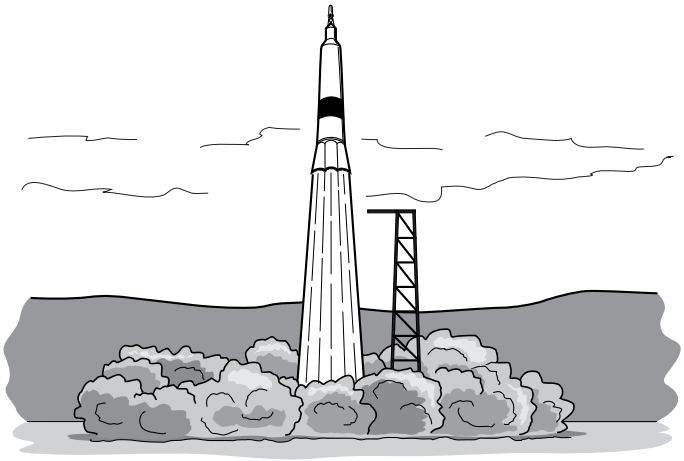
Answer **all** the questions.

1 Lithium is an element in Group 1.

It can be added to rocket fuel to give an extra boost for take off.



(a) Lithium works well in rocket fuels because it is very reactive.

Which of the following statements about the reactivity of lithium are **true** and which are **false**?

Put ticks (✓) in the correct boxes.

	true	**false**
Lithium reacts with cold water.		
Lithium reacts with other group 1 elements to form compounds.		
Lithium tarnishes in moist air more quickly than potassium.		
Lithium chloride is very unstable.		

[2]

(b) When the fuel burns, the lithium also burns.

Complete the balanced symbol equation to show what happens when lithium burns.

word equation lithium + oxygen → lithium oxide

balanced symbol equation ..... + ... → $2Li_2O$ **[2]**

[Total: 4]

2 Iodine solution can be used as a treatment for cuts.

(a) Solid iodine is used to make iodine solution.

Solid iodine is kept in sealed jars because it easily changes into iodine gas.

Iodine gas is very harmful to people.

(i) Draw straight lines to show the correct **colour** for solid iodine and for iodine gas.

	dark grey
solid iodine	red-brown
	orange
	purple
iodine gas	yellow
	green

[2]

(ii) Draw straight lines to show the correct **symbols** for solid iodine and for iodine gas.

	I(g)
solid iodine	I(s)
	I(aq)
	I_2(l)
iodine gas	I_2(s)
	I_2(g)

[2]

(b) Iodine is used on cuts because it stops the cuts from becoming infected.

Which two statements **when put together** explain why iodine stops infection?

Put ticks (✓) in the boxes next to the **two** correct answers.

Iodine is in group 7.	☐
Iodine is a non-metal.	☐
Iodine tablets purify water.	☐
All group 7 elements kill bacteria.	☐
All group 7 elements form negative ions.	☐

[1]

[Total: 5]

3 Astronomers study the light from the outer layers of the Sun during an eclipse.

They use spectroscopes to look at this light.

This is what they see.

(a) Why does the spectrum show a pattern of lines?

Put ticks (✓) in the boxes next to the **two** correct answers.

Light is lost due to the distance from the Sun. ☐

The Sun emits light in a series of flashes. ☐

Different elements in the Sun give out light of different colours. ☐

Planets orbiting the Sun make shadows on its surface. ☐

Elements in the Sun are very hot and so emit light. ☐

[2]

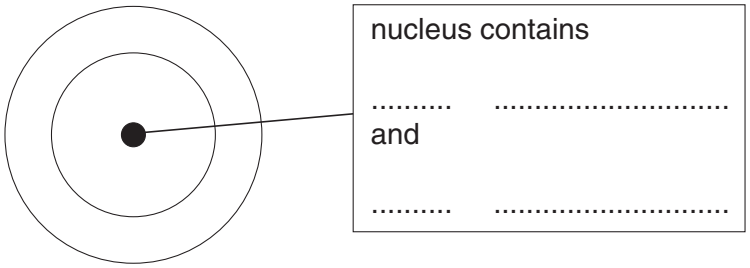
(b) Beryllium is one of the elements in the Sun.

This is how beryllium is shown in the Periodic Table.

9 **Be** beryllium 4

Complete the diagram to show the structure of a beryllium atom. You need to show

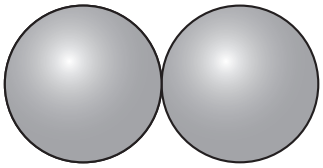
- the **numbers** and **names** of the particles in the nucleus.
- the **arrangement of electrons** in the electron shells (show each electron as **x**).



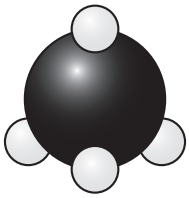
[3]

[Total: 5]

4 These diagrams show the arrangement of atoms in oxygen and methane molecules.



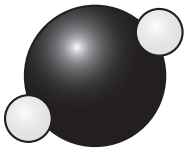
oxygen
O_2



methane
CH_4

(a) Which of the diagrams below shows a molecule of water, H_2O?

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



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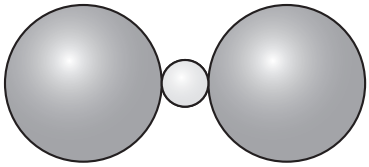

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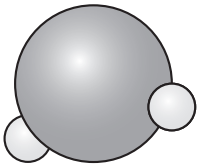

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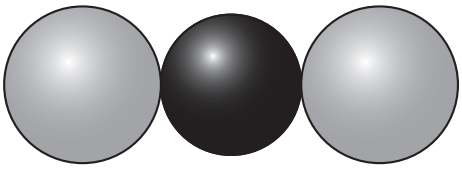
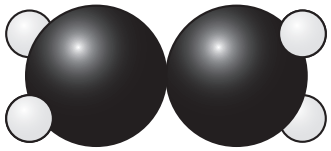


☐

[1]

(b) What is the formula for this molecule?

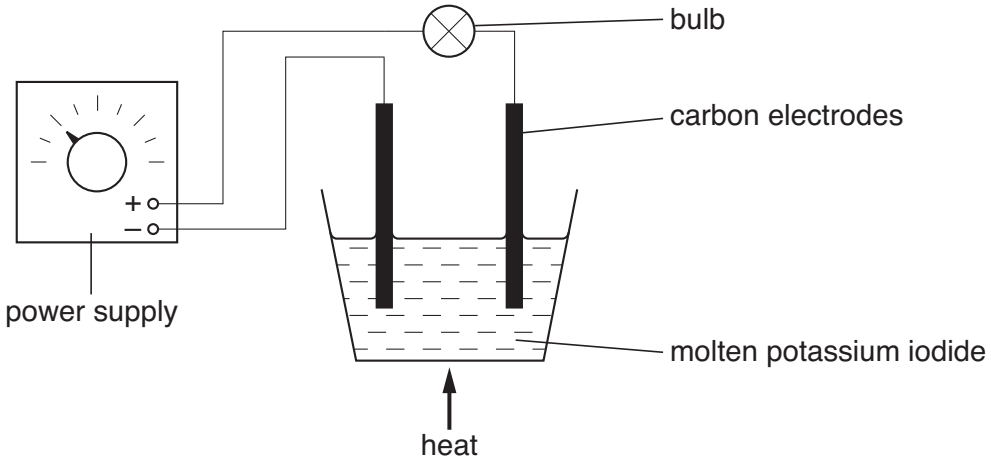


formula ..... **[2]**

[Total: 3]

5 Joe does an experiment. He passes electricity through molten potassium iodide.

The diagram shows how he sets up his experiment.



(a) Why does molten potassium iodide conduct electricity?

Put ticks (✓) in the boxes next to the **two** correct answers.

Atoms can move freely between electrodes.	☐
Potassium iodide is an ionic compound.	☐
Ions in the liquid are free to move.	☐
Ions in the liquid are randomly arranged.	☐
Electrons can move freely through the liquid.	☐
The positive electrode is attracted to the negative electrode.	☐

[2]

(b) Molten lead bromide also conducts electricity.

What is the name of the element that forms at the **negative** electrode?

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

(c) Joe finds out that atoms of sodium metal can be made from sodium chloride by electrolysing molten sodium chloride.

Complete the equation to show what happens when a sodium ion forms a sodium atom.

$$Na^+ + \text{.....} \rightarrow Na$$

[1]

[Total: 4]

6 The table shows information about some chemicals.

chemical	melting point in °C	boiling point in °C	does it conduct electricity when it is a solid?	does it conduct electricity when it is a liquid?
A	–95	69	no	no
B	1261	2239	no	yes
C	1240	2100	yes	yes
D	1650	2230	no	no
E	–138	0	no	no

(a) Which chemical is most likely to be a metal?

answer ..... **[1]**

(b) Which chemical is a liquid at room temperature?

answer ..... **[1]**

(c) Which chemical is most likely to be silicon dioxide?

answer ..... **[1]**

(d) Chemical **E** is a **molecular** compound.

Which statements about the bonding in chemical **E** are correct?

Put ticks (✓) in the boxes next to the **two** correct answers.

Electrons are gained or lost to form a full outer shell. ☐

Electrons are shared between atoms. ☐

The nucleus of each bonded atom attracts electrons. ☐

Charged ions are attracted together. ☐

The nuclei of the atoms attract each other. ☐

[2]

(e) One of the chemicals is magnesium fluoride.

Magnesium fluoride contains magnesium ions (Mg^{2+}) and fluoride ions (F^{-}).

What is the formula for magnesium fluoride?

formula ..... **[1]**

[Total: 6]

7 Ben makes some magnesium sulfate crystals for a school display.

(a) He makes magnesium sulfate by reacting a solid with an acid.

(i) Give the name of the acid Ben should use.

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

(ii) Two of the following compounds react with the acid to make magnesium sulfate.

Put a (ring) around the **two** correct compounds.

magnesium carbonate **magnesium chloride** **magnesium bromide**

magnesium oxide **magnesium nitrate**

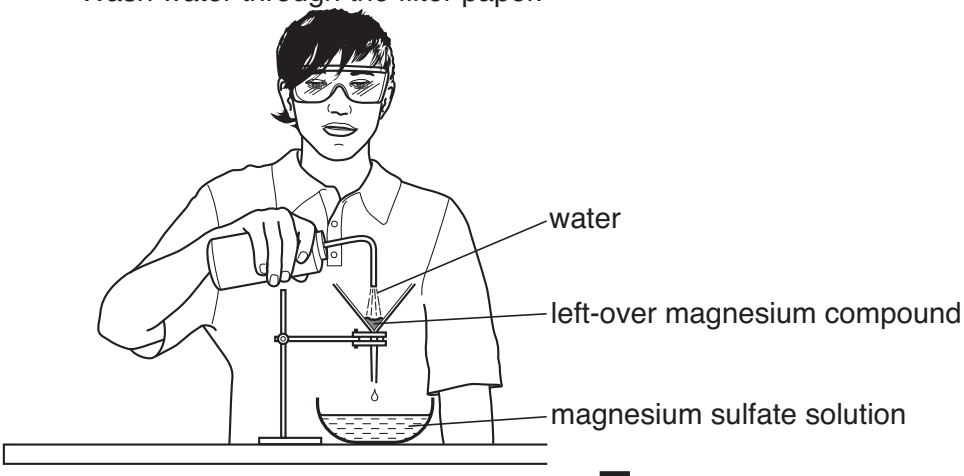
[2]

(b) The flow chart shows how Ben makes his crystals.

Step 1 Add the solid magnesium compound to the acid until no more reacts.

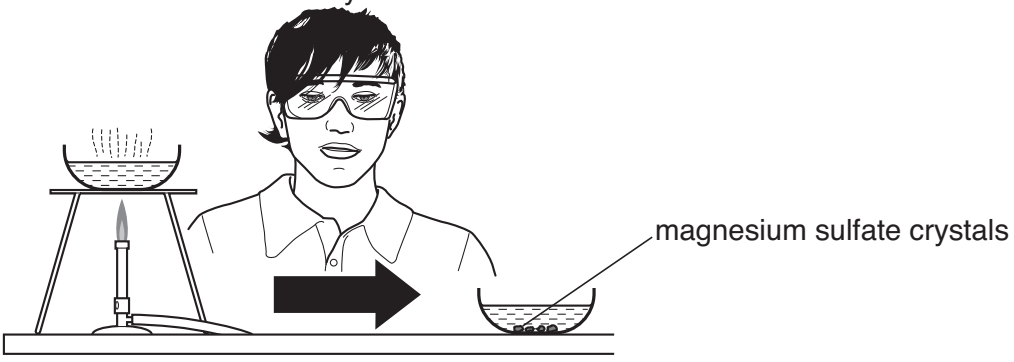
↓

Step 2 Filter off the left-over magnesium compound.
Wash water through the filter paper.



↓

Step 3 Heat the magnesium sulfate solution until about half has evaporated away.
Leave to cool and crystals form.



(i) Why does the solid compound stop reacting?

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

The pH of the acid falls. ☐

All the gas is used up. ☐

The magnesium compound becomes less reactive. ☐

All the acid is used up. ☐

[1]

(ii) Why does Ben wash water through the filter paper?

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

to dilute the solution ☐

to stop the reaction ☐

to get more magnesium sulfate through the filter ☐

to remove impurities ☐

[1]

(iii) Ben evaporates the solution. He stops heating when about half the solution is left.

Read the following statements and decide whether they are **true** or **false**.

Put ticks (✓) in the correct boxes.

	true	**false**
Heating the solution to dryness gives the largest crystals.		
The solution becomes more concentrated as he heats it.		
The more water left after heating, the faster the crystals form.		
Heating the solution for too long makes the solid salt evaporate.		

[2]

(c) Ben thinks the rate of reaction between the solid and the acid is too fast.

Which of the following changes will **slow down** the rate of reaction?

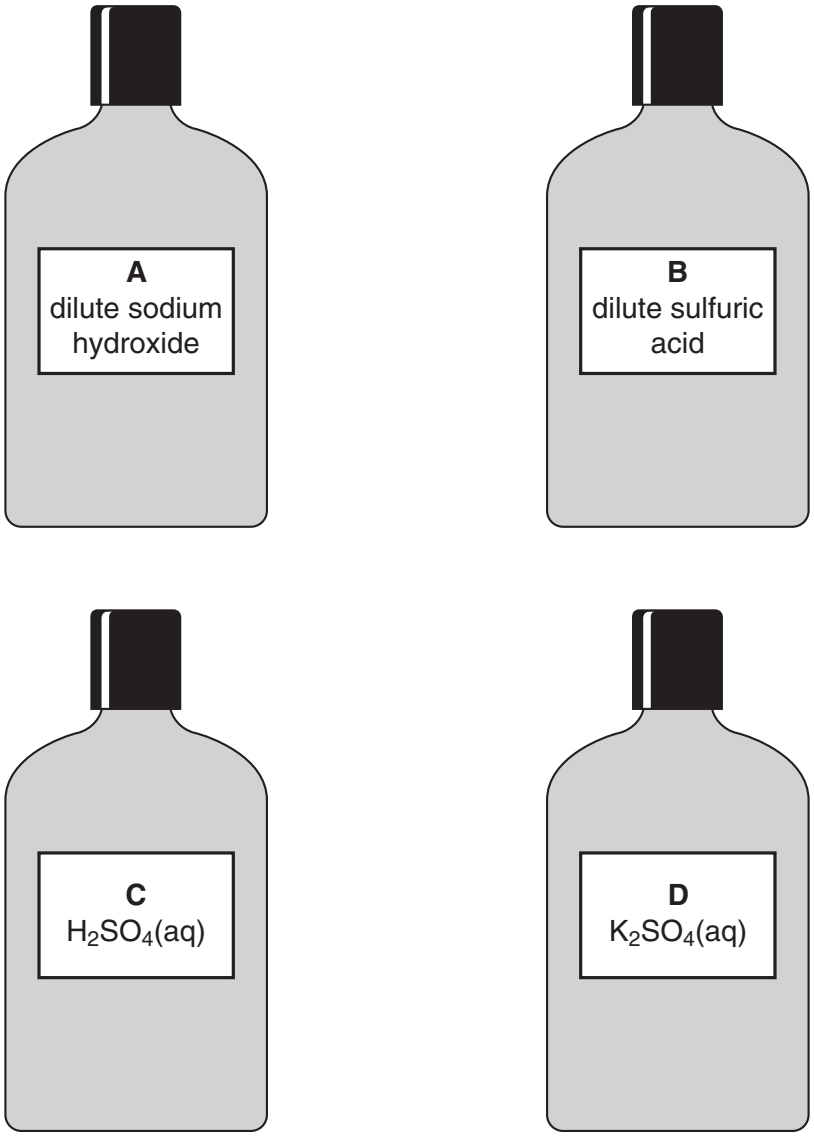
Put a tick (✓) in the box next to the correct answer.

increase the temperature	☐
use a catalyst	☐
use acid that is more dilute	☐
grind the solid into smaller pieces	☐

[1]

[Total: 8]

8 Look at the labels on the following solutions of chemicals.



(a) (i) Which chemical has a high pH?

Put a (ring) around the correct answer.

A **B** **C** **D** **[1]**

(ii) Which **two** solutions contain the same compound?

Put a (ring) around each correct answer.

A **B** **C** **D** **[1]**

(b) What ions are present in K_2SO_4?

Put (rings) around the correct ions.

K^+ K_2^{2+} K^{2+} SO_4^{2-} S^{2-} O^{2-}

[2]

(c) Sodium hydroxide reacts with sulfuric acid to make a soluble salt.

Which of the following statements about the reaction are **true**, and which are **false**?

Put ticks (✓) in the correct boxes.

	true	**false**
The reaction produces a precipitate.		
The reaction is a neutralisation reaction.		
The acid produces OH^- ions.		
An equation for the reaction is $H^+ + OH^- \rightarrow H_2O$.		
Hydrogen gas is given off.		

[3]

[Total: 7]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **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	63.5 **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	[98] **Tc** technetium 43	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	128 **Te** tellurium 52	127 **I** iodine 53	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	186 **Re** rhenium 75	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	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

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.