

Candidate Forename						Candidate Surname				
Centre Number						Candidate Number				

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**A322/02**

**TWENTY FIRST CENTURY SCIENCE  
CHEMISTRY A**

**UNIT 2: Modules C4 C5 C6  
(Higher Tier)**

**WEDNESDAY 24 JUNE 2009: Morning  
DURATION: 40 minutes**

**SUITABLE FOR VISUALLY IMPAIRED CANDIDATES**

**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)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **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.**
- **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 page 32.**

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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.**

	<b>TRUE</b>	<b>FALSE</b>
<b>Lithium reacts with cold water.</b>		
<b>Lithium reacts with other group 1 elements to form compounds.</b>		
<b>Lithium tarnishes in moist air more quickly than potassium.</b>		
<b>Lithium chloride is very unstable.</b>		

**[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<sub>2</sub>O [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<sub>2</sub>(l)

iodine gas

I<sub>2</sub>(s)

I<sub>2</sub>(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 During an eclipse, astronomers study the light from the outer layers of the Sun.

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]

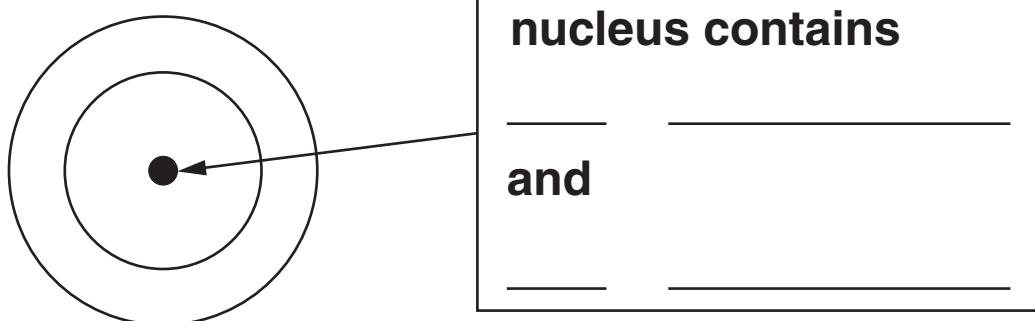
(b) One of the elements in the Sun is beryllium.

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).

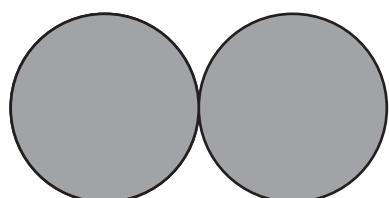


[3]

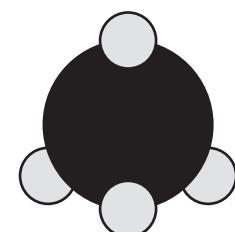
[Total: 5]

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



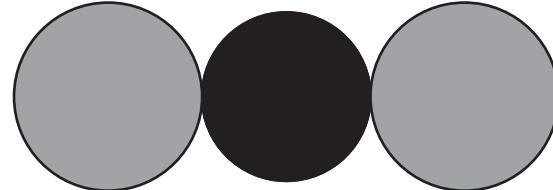
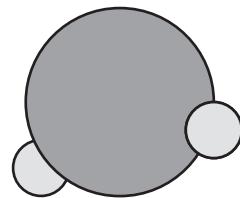
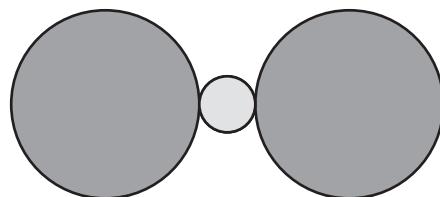
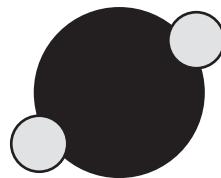
OXYGEN  
O<sub>2</sub>



METHANE  
CH<sub>4</sub>

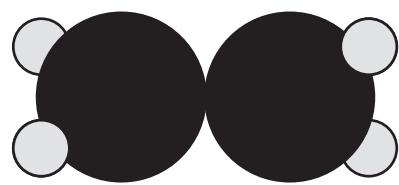
**(a) Which of the diagrams below shows a molecule of water,  $\text{H}_2\text{O}$ ?**

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



**[1]**

**(b) What is the formula for this molecule?**



**formula** \_\_\_\_\_ [2]

**[Total: 3]**

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

The diagram on the opposite page 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.

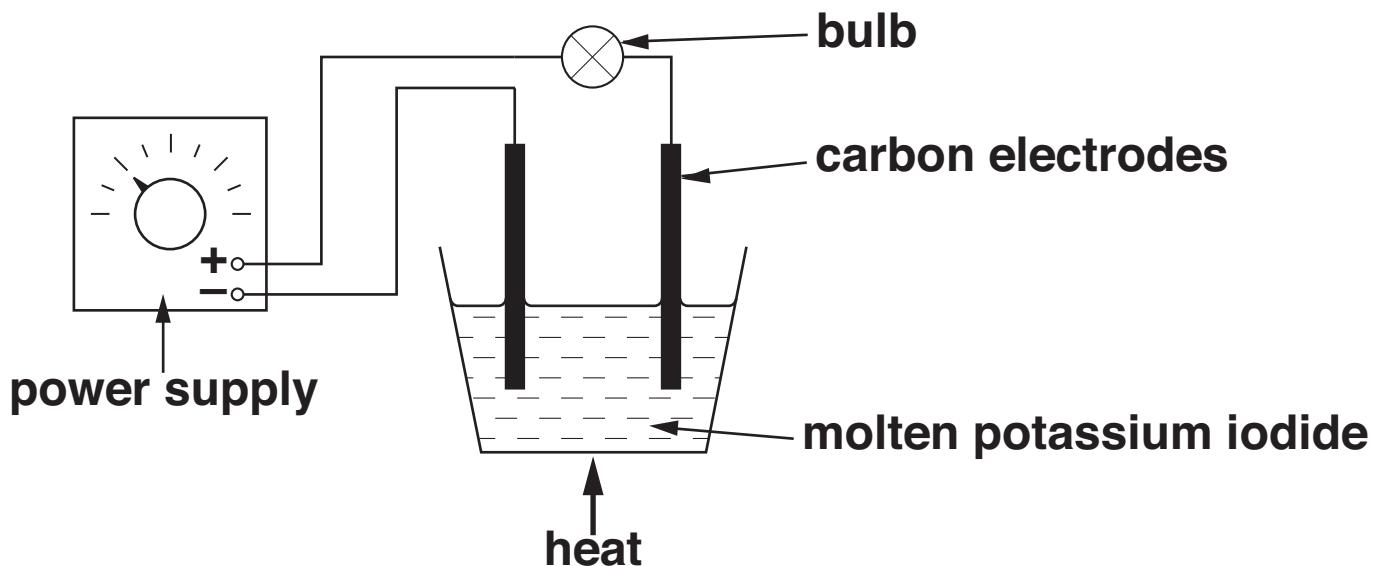
Ions in the liquid are free to move.

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) Lead bromide also conducts electricity when it is molten.**

**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.**



[1]

**[Total: 4]**

6 The table on the page opposite shows information about some chemicals.

(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]

<u>CHEMICAL</u>	<u>MELTING POINT IN °C</u>	<u>BOILING POINT IN °C</u>	<u>DOES IT CONDUCT ELECTRICITY WHEN IT IS A SOLID?</u>	<u>DOES IT CONDUCT ELECTRICITY WHEN IT IS A LIQUID?</u>
<u>A</u>	-95	69	no	no
<u>B</u>	1261	2239	no	yes
<u>C</u>	1240	2100	yes	yes
<u>D</u>	1650	2230	no	no
<u>E</u>	-138	0	no	no

**(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 on the page opposite shows how Ben makes his crystals.**

**(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**

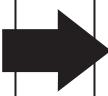
**to stop the reaction**

**to get more magnesium sulfate through the filter**

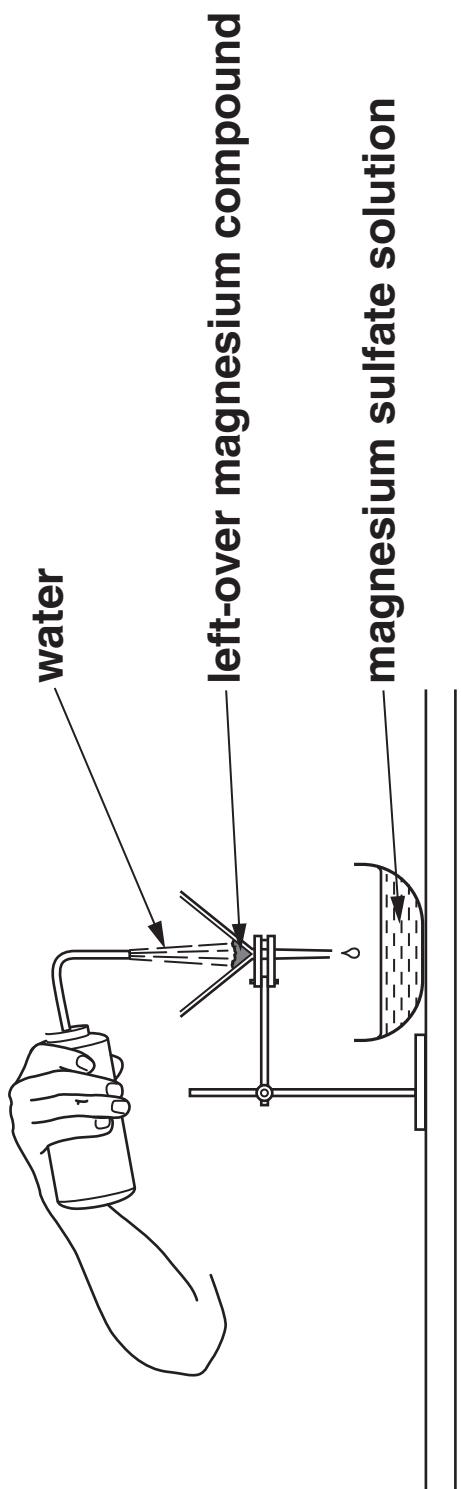
**to remove impurities**

**[1]**

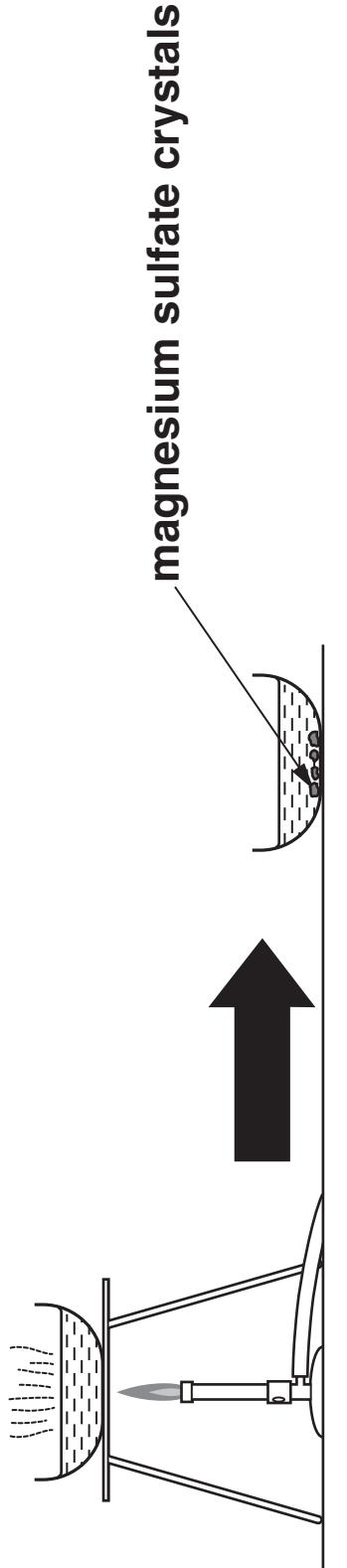
**Step 1** Add the solid magnesium compound to the acid until no more reacts.



**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.



**(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.**

	<b><u>TRUE</u></b>	<b><u>FALSE</u></b>
<b>Heating the solution to dryness gives the largest crystals.</b>		
<b>The solution becomes more concentrated as he heats it.</b>		
<b>The more water left after heating, the faster the crystals form.</b>		
<b>Heating the solution for too long makes the solid salt evaporate.</b>		

**[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

dilute sodium hydroxide

B

dilute sulfuric acid

C

$\text{H}_2\text{SO}_4(\text{aq})$

D

$\text{K}_2\text{SO}_4(\text{aq})$

(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

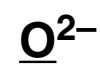
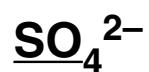
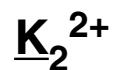
C

D

[1]

(b) What ions are present in  $\text{K}_2\text{SO}_4$ ?

Put **ring** around the correct ions.



[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.

	<u>TRUE</u>	<u>FALSE</u>
<b>The reaction produces a precipitate.</b>		
<b>The reaction is a neutralisation reaction.</b>		
<b>The acid produces <math>\text{OH}^-</math> ions.</b>		
<b>An equation for the reaction is  <math>\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}</math>.</b>		
<b>Hydrogen gas is given off.</b>		

[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
7	9	11	12	14	16	19	
<b>Li</b> lithium 3	<b>Be</b> beryllium 4	<b>B</b> boron 5	<b>C</b> carbon 6	<b>N</b> nitrogen 7	<b>O</b> oxygen 8	<b>F</b> fluorine 9	
23	24	27	28	31	32	35.5	
<b>Na</b> sodium 11	<b>Mg</b> magnesium 12	<b>Al</b> aluminum 13	<b>Si</b> silicon 14	<b>P</b> phosphorus 15	<b>S</b> sulfur 16	<b>Cl</b> chlorine 17	
39	40	45	48	51	52	55	
<b>K</b> potassium 19	<b>Ca</b> calcium 20	<b>Sc</b> scandium 21	<b>Ti</b> titanium 22	<b>Cr</b> chromium 24	<b>Fe</b> iron 26	<b>Co</b> cobalt 27	
85	88	89	91	93	96	98	
<b>Rb</b> rubidium 37	<b>Sr</b> strontium 38	<b>Y</b> yttrium 39	<b>Zr</b> zirconium 40	<b>Nb</b> niobium 41	<b>Mo</b> molybdenum 42	<b>Tc</b> technetium 43	
133	137	139	178	181	184	186	
<b>Cs</b> caesium 55	<b>Ba</b> barium 56	<b>La*</b> lanthanum 57	<b>Hf</b> hafnium 72	<b>Ta</b> tantalum 73	<b>W</b> tungsten 74	<b>Re</b> rhenium 75	
[223]	[226]	[227]	[261]	[262]	[266]	[264]	
<b>Fr</b> francium 87	<b>Ra</b> radium 88	<b>Ac*</b> actinium 89	<b>Rf</b> rutherfordium 104	<b>Db</b> dubnium 105	<b>Sg</b> seaborgium 106	<b>Hs</b> meitnerium 108	
[271]	[268]	[277]	[264]	[266]	[264]	[268]	
<b>Ds</b> darmstadtium 110	<b>Mt</b> meitnerium 109	<b>Rg</b> roentgenium 111					

\* 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.