

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 27 JANUARY 2010: Afternoon

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.**
- **A copy of the Periodic Table is provided.**

BLANK PAGE

Answer ALL the questions.

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

2	
3	Mg
4	K Ca
5	

**transition
elements**

	C				
	Al				

Which statements about these elements are TRUE and which are FALSE?

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

	<u>TRUE</u>	<u>FALSE</u>
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, as shown on page 7 opposite.

(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]

Group 1

lithium
Li

sodium
Na

potassium
K

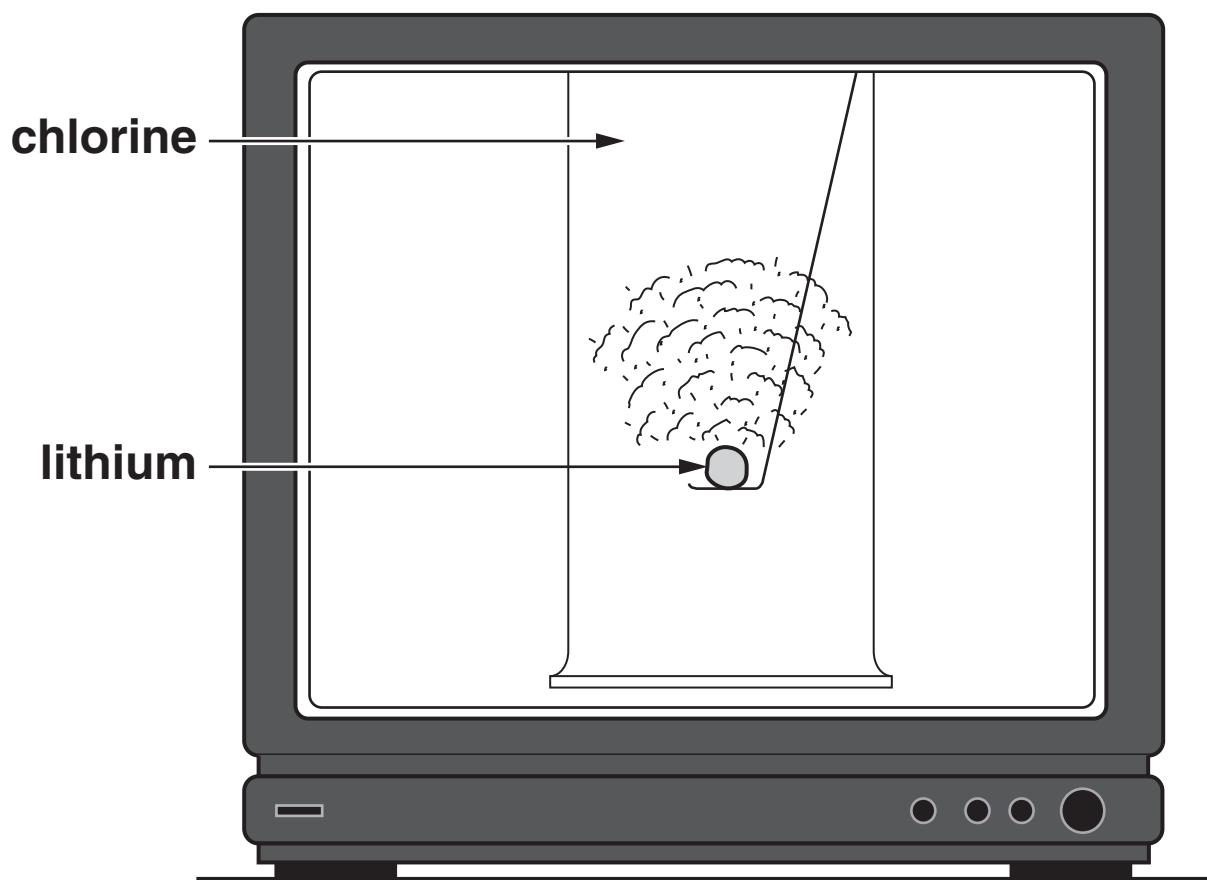
rubidium
Rb

Lithium
Atomic number: 3
Melting point : 181 °C
Density: 0.53 g / cm³

Sodium
Atomic number: 11
Melting point : 98 °C
Density: 0.97 g / cm³

Rubidium
Atomic number: 37
Melting point : 39 °C
Density: 1.53 g / cm³

(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.

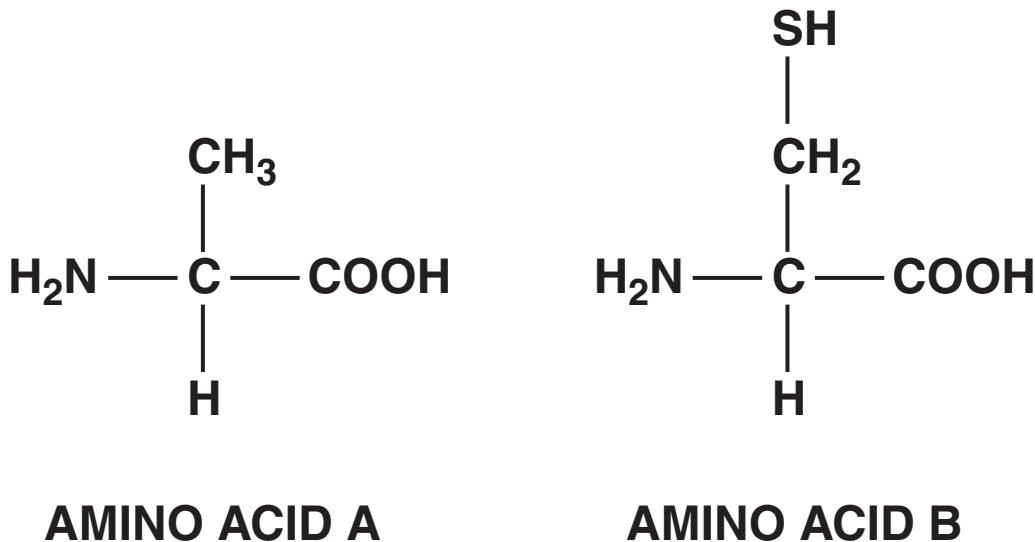
Li + →

[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.

C_3 _____

[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.

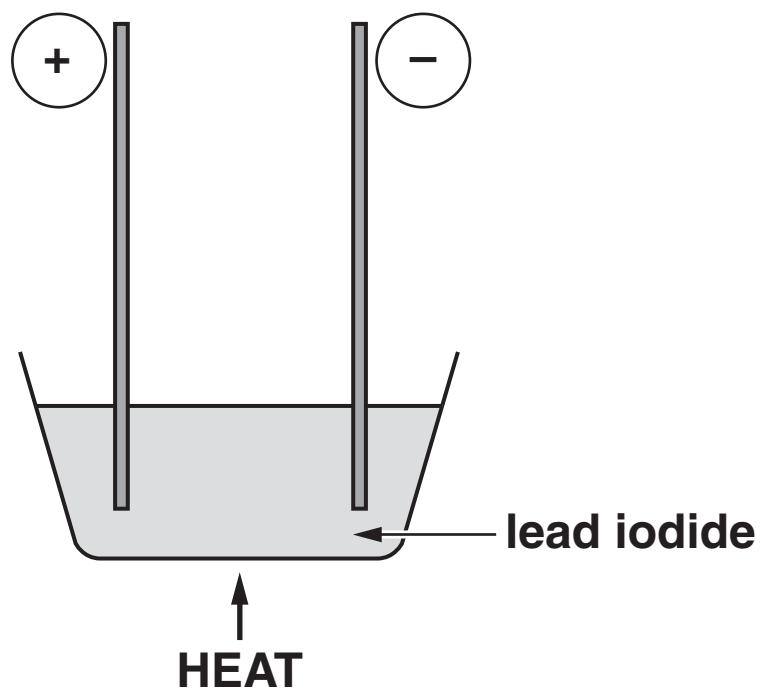
Hydrogen atoms are much lighter than the other atoms.

Hydrogen is a gas, carbon is a solid.

[1]

[Total: 3]

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 their oxides 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.

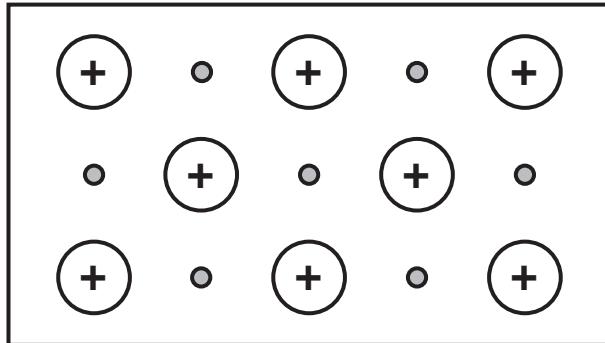
Complete the two equations.



[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.

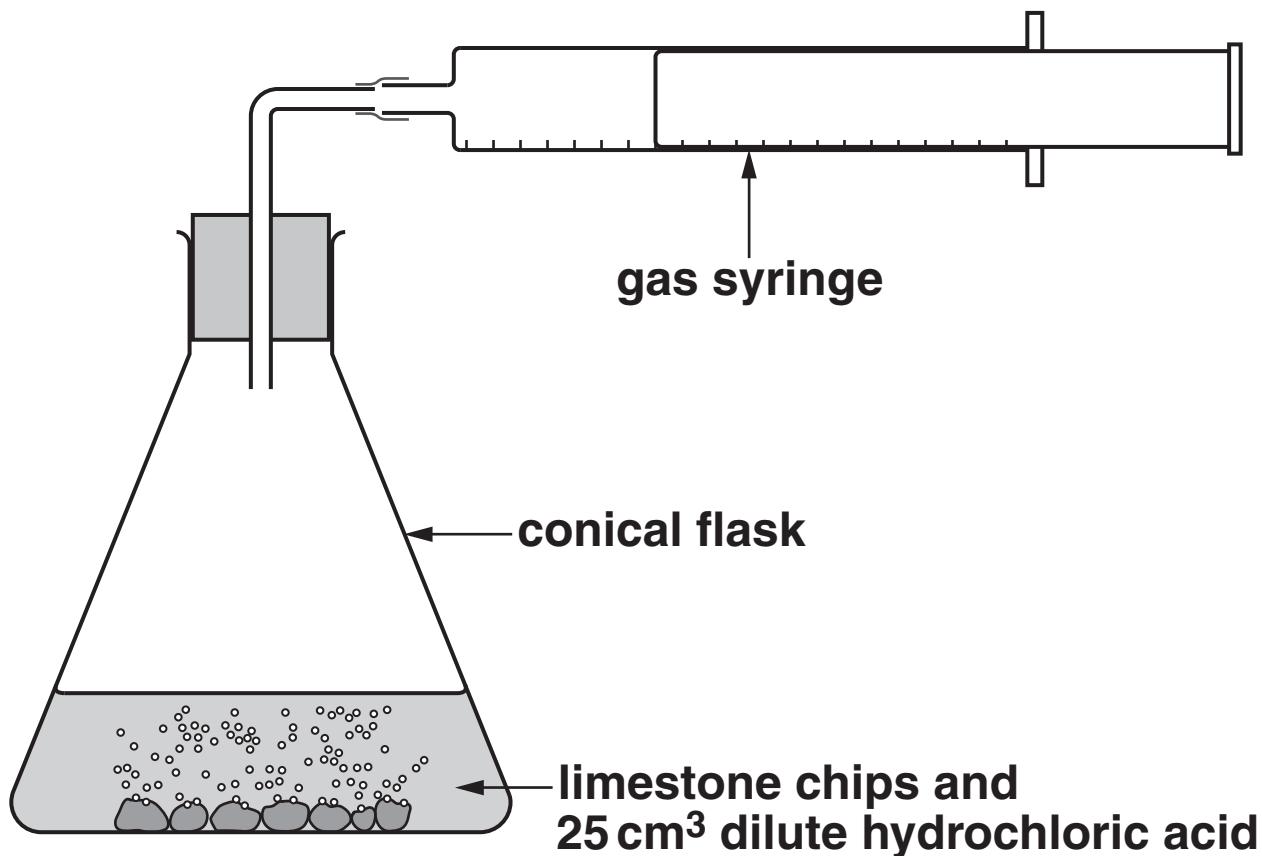
[1]

[Total: 9]

6 Eve carries out an experiment.

She adds 25 cm³ 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.

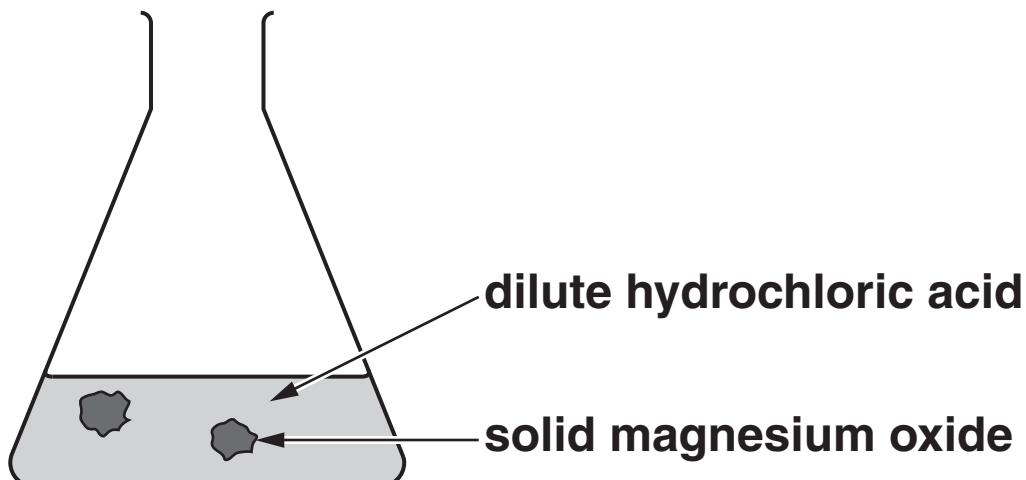
Give TWO ways that the results of the second experiment will be different to the first experiment.

[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.

<u>TRUE</u>	<u>FALSE</u>
-------------	--------------

The mixture has a high pH at the start of the reaction.

The pH stays constant during the reaction.

Hydrogen is made during the reaction.

Water is made during the reaction.

[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 $\text{CaCl}_2 = _____$

[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.

Ca²⁺ **Cl**⁻ **H**⁺ **O**²⁻ **OH**⁻

[1]

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

Choose from the formulae in this list.

Ca²⁺ **Cl**⁻ **H**⁺ **HCl**

O²⁻ **OH**⁻ **H**₂**O** **CaCl**₂



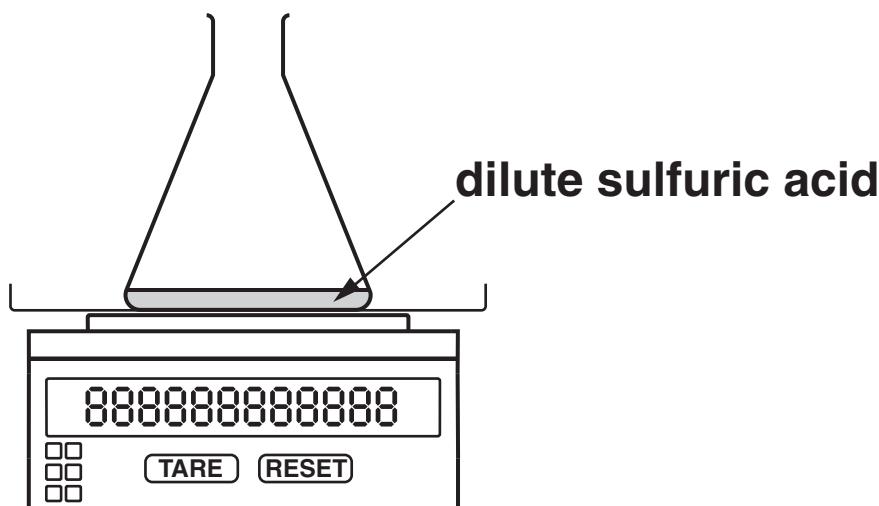
[Total: 8]

8 Sam works for a medicine company.

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

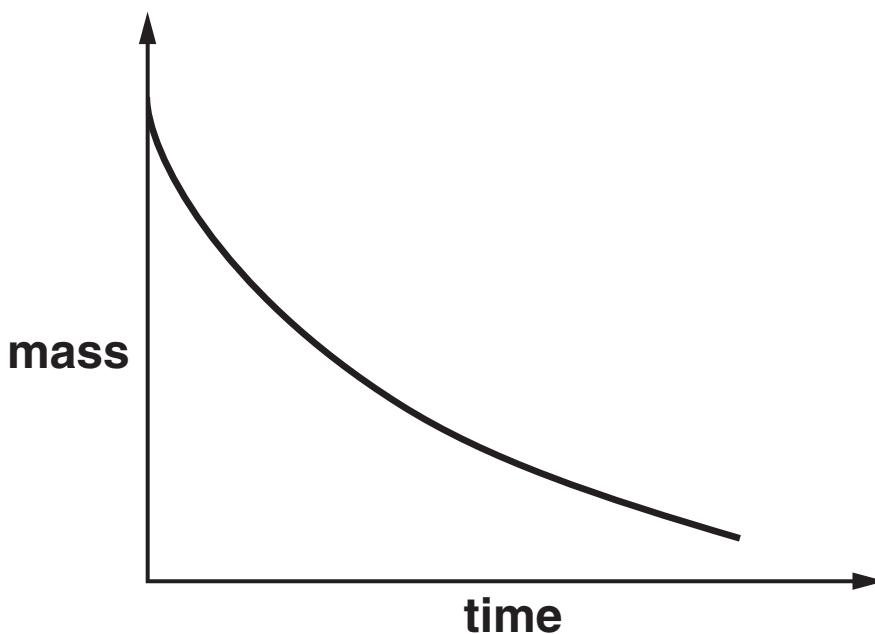
Sam carries out some experiments to find the best method of making zinc sulfate.

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 2g of zinc sulfate.

Which chemical is needed in the SMALLEST MASS to make 2g 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

BLANK PAGE

BLANK PAGE



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations, is given to all schools that receive assessment material and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

The Periodic Table of the Elements

1	2	3	4	5	6	7	0
Li lithium 3	Be beryllium 4	9	11	12	14	16	20
7	9	H hydrogen 1	B boron 5	C carbon 6	N nitrogen 7	O oxygen 8	Ne neon 10
23	24	13	11	12	14	16	20
Na sodium 11	Mg magnesium 12	21	22	23	24	25	26
39	40	45	48	51	52	55	56
K potassium 19	Ca calcium 20	Sc scandium 21	Ti titanium 22	V vanadium 23	Cr chromium 24	Mn manganese 25	Fe iron 26
85	88	89	91	93	96	98	101
Rb rubidium 37	Sr strontium 38	Y yttrium 39	Zr zirconium 40	Nb niobium 41	Mo molybdenum 42	Tc technetium 43	Ru ruthenium 44
133	137	139	178	181	184	186	190
Cs caesium 55	Ba barium 56	La* lanthanum 57	Hf hafnium 72	Ta tantalum 73	W tungsten 74	Re rhenium 75	Os osmium 76
[223]	[226]	[227]	[261]	[262]	[264]	[266]	[268]
Fr francium 87	Ra radium 88	Ac* actinium 89	Rf rutherfordium 104	Db dubnium 105	Bh bohrium 107	Hs meitnerium 106	Ds damstadtium 109
Key	relative atomic mass atomic symbol name atomic (proton) number	1	2	3	4	5	6
4	He helium 2	11	12	14	16	19	20
1	B boron 5	12	C carbon 6	N nitrogen 7	O oxygen 8	F fluorine 9	Ne neon 10
27	Al aluminum 13	28	Si silicon 14	31	P phosphorus 15	32	Cl chlorine 17
1	11	12	14	16	19	20	20
3	4	5	6	7	8	9	Ne neon 10
75	As arsenic 33	76	Ge germanium 32	77	Se selenium 34	78	Br bromine 35
70	Ga gallium 31	71	In indium 49	72	Sb antimony 51	73	I iodine 53
115	Zn zinc 30	116	Sn tin 50	117	Te telurium 52	128	Kr krypton 36
108	Pd palladium 46	109	Cd cadmium 48	110	Sb antimony 51	127	Xe xenon 54
106	Rh rhodium 45	107	Ru ruthenium 44	108	In indium 49	122	Rn radon 86
103	Tc technetium 43	104	Pt platinum 78	105	Ir iridium 77	204	At astatine 85
91	Nb niobium 41	92	Os osmium 76	93	Hg mercury 80	209	[210]
93	Zr zirconium 40	94	Re rhenium 75	95	At astatine 85	[209]	[210]
96	Mo molybdenum 42	97	Tl thallium 81	98	Pb lead 82	207	[209]
97	Tc technetium 43	98	Os osmium 76	99	Bi bismuth 83	209	[210]
98	Ru ruthenium 44	99	Ir iridium 77	100	Hg mercury 80	207	[209]
101	Ru ruthenium 44	102	Pt platinum 78	103	Ir iridium 77	204	[209]
102	Pd palladium 46	103	Os osmium 76	104	Tl thallium 81	204	[209]
103	Rh rhodium 45	104	Re rhenium 75	105	Os osmium 76	204	[209]
104	Ir iridium 77	105	Pt platinum 78	106	Ir iridium 77	204	[209]
105	Ir iridium 77	106	Os osmium 76	107	Pt platinum 78	204	[209]
106	Os osmium 76	107	Ir iridium 77	108	Os osmium 76	204	[209]
107	Ir iridium 77	108	Os osmium 76	109	Ir iridium 77	204	[209]
108	Os osmium 76	109	Ir iridium 77	110	Ir iridium 77	204	[209]
109	Ir iridium 77	110	Ir iridium 77	111	Ir iridium 77	204	[209]
110	Ir iridium 77	111	Ir iridium 77	112	Ir iridium 77	204	[209]
111	Ir iridium 77	112	Ir iridium 77	113	Ir iridium 77	204	[209]
112	Ir iridium 77	113	Ir iridium 77	114	Ir iridium 77	204	[209]
113	Ir iridium 77	114	Ir iridium 77	115	Ir iridium 77	204	[209]
114	Ir iridium 77	115	Ir iridium 77	116	Ir iridium 77	204	[209]
115	Ir iridium 77	116	Ir iridium 77	117	Ir iridium 77	204	[209]
116	Ir iridium 77	117	Ir iridium 77	118	Ir iridium 77	204	[209]
117	Ir iridium 77	118	Ir iridium 77	119	Ir iridium 77	204	[209]
118	Ir iridium 77	119	Ir iridium 77	120	Ir iridium 77	204	[209]
119	Ir iridium 77	120	Ir iridium 77	121	Ir iridium 77	204	[209]
120	Ir iridium 77	121	Ir iridium 77	122	Ir iridium 77	204	[209]
121	Ir iridium 77	122	Ir iridium 77	123	Ir iridium 77	204	[209]
122	Ir iridium 77	123	Ir iridium 77	124	Ir iridium 77	204	[209]
123	Ir iridium 77	124	Ir iridium 77	125	Ir iridium 77	204	[209]
124	Ir iridium 77	125	Ir iridium 77	126	Ir iridium 77	204	[209]
125	Ir iridium 77	126	Ir iridium 77	127	Ir iridium 77	204	[209]
126	Ir iridium 77	127	Ir iridium 77	128	Ir iridium 77	204	[209]
127	Ir iridium 77	128	Ir iridium 77	129	Ir iridium 77	204	[209]
128	Ir iridium 77	129	Ir iridium 77	130	Ir iridium 77	204	[209]
129	Ir iridium 77	130	Ir iridium 77	131	Ir iridium 77	204	[209]
130	Ir iridium 77	131	Ir iridium 77	132	Ir iridium 77	204	[209]
131	Ir iridium 77	132	Ir iridium 77	133	Ir iridium 77	204	[209]
132	Ir iridium 77	133	Ir iridium 77	134	Ir iridium 77	204	[209]
133	Ir iridium 77	134	Ir iridium 77	135	Ir iridium 77	204	[209]
134	Ir iridium 77	135	Ir iridium 77	136	Ir iridium 77	204	[209]
135	Ir iridium 77	136	Ir iridium 77	137	Ir iridium 77	204	[209]
136	Ir iridium 77	137	Ir iridium 77	138	Ir iridium 77	204	[209]
137	Ir iridium 77	138	Ir iridium 77	139	Ir iridium 77	204	[209]
138	Ir iridium 77	139	Ir iridium 77	140	Ir iridium 77	204	[209]
139	Ir iridium 77	140	Ir iridium 77	141	Ir iridium 77	204	[209]
140	Ir iridium 77	141	Ir iridium 77	142	Ir iridium 77	204	[209]
141	Ir iridium 77	142	Ir iridium 77	143	Ir iridium 77	204	[209]
142	Ir iridium 77	143	Ir iridium 77	144	Ir iridium 77	204	[209]
143	Ir iridium 77	144	Ir iridium 77	145	Ir iridium 77	204	[209]
144	Ir iridium 77	145	Ir iridium 77	146	Ir iridium 77	204	[209]
145	Ir iridium 77	146	Ir iridium 77	147	Ir iridium 77	204	[209]
146	Ir iridium 77	147	Ir iridium 77	148	Ir iridium 77	204	[209]
147	Ir iridium 77	148	Ir iridium 77	149	Ir iridium 77	204	[209]
148	Ir iridium 77	149	Ir iridium 77	150	Ir iridium 77	204	[209]
149	Ir iridium 77	150	Ir iridium 77	151	Ir iridium 77	204	[209]
150	Ir iridium 77	151	Ir iridium 77	152	Ir iridium 77	204	[209]
151	Ir iridium 77	152	Ir iridium 77	153	Ir iridium 77	204	[209]
152	Ir iridium 77	153	Ir iridium 77	154	Ir iridium 77	204	[209]
153	Ir iridium 77	154	Ir iridium 77	155	Ir iridium 77	204	[209]
154	Ir iridium 77	155	Ir iridium 77	156	Ir iridium 77	204	[209]
155	Ir iridium 77	156	Ir iridium 77	157	Ir iridium 77	204	[209]
156	Ir iridium 77	157	Ir iridium 77	158	Ir iridium 77	204	[209]
157	Ir iridium 77	158	Ir iridium 77	159	Ir iridium 77	204	[209]
158	Ir iridium 77	159	Ir iridium 77	160	Ir iridium 77	204	[209]
159	Ir iridium 77	160	Ir iridium 77	161	Ir iridium 77	204	[209]
160	Ir iridium 77	161	Ir iridium 77	162	Ir iridium 77	204	[209]
161	Ir iridium 77	162	Ir iridium 77	163	Ir iridium 77	204	[209]
162	Ir iridium 77	163	Ir iridium 77	164	Ir iridium 77	204	[209]
163	Ir iridium 77	164	Ir iridium 77	165	Ir iridium 77	204	[209]
164	Ir iridium 77	165	Ir iridium 77	166	Ir iridium 77	204	[209]
165	Ir iridium 77	166	Ir iridium 77	167	Ir iridium 77	204	[209]
166	Ir iridium 77	167	Ir iridium 77	168	Ir iridium 77	204	[209]
167	Ir iridium 77	168	Ir iridium 77	169	Ir iridium 77	204	[209]
168	Ir iridium 77	169	Ir iridium 77	170	Ir iridium 77	204	[209]
169	Ir iridium 77	170	Ir iridium 77	171	Ir iridium 77	204	[209]
170	Ir iridium 77	171	Ir iridium 77	172	Ir iridium 77	204	[209]
171	Ir iridium 77	172	Ir iridium 77	173	Ir iridium 77	204	[209]
172	Ir iridium 77	173	Ir iridium 77	174	Ir iridium 77	204	[209]
173	Ir iridium 77	174	Ir iridium 77	175	Ir iridium 77	204	[209]
174	Ir iridium 77	175	Ir iridium 77	176	Ir iridium 77	204	[209]
175	Ir iridium 77	176	Ir iridium 77	177	Ir iridium 77	204	[209]
176	Ir iridium 77	177	Ir iridium 77	178	Ir iridium 77	204	[209]
177	Ir iridium 77	178	Ir iridium 77	179	Ir iridium 77	204	[209]
178	Ir iridium 77	179	Ir iridium 77	180	Ir iridium 77	204	[209]
179	Ir iridium 77	180	Ir iridium 77	181	Ir iridium 77	204	[209]
180	Ir iridium 77	181	Ir iridium 77	182	Ir iridium 77	204	[209]
181	Ir iridium 77	182	Ir iridium 77	183	Ir iridium 77	204	[209]
182	Ir iridium 77	183	Ir iridium 77	184	Ir iridium 77	204	[209]
183	Ir iridium 77	184	Ir iridium 77	185	Ir iridium 77	204	[209]
184	Ir iridium 77	185	Ir iridium 77	186	Ir iridium 77	204	[209]
185	Ir iridium 77	186	Ir iridium 77	187	Ir iridium 77	204	[209]
186	Ir iridium 77	187	Ir iridium 77	188	Ir iridium 77	204	[209]
187	Ir iridium 77	188	Ir iridium 77	189	Ir iridium 77	204	[209]
188	Ir iridium 77	189	Ir iridium 77	190	Ir iridium 77	204	[209]
189	Ir iridium 77	190	Ir iridium 77	191	Ir iridium 77	204	[209]
190	Ir iridium 77	191	Ir iridium 77	192	Ir iridium 77	204	[209]
191	Ir iridium 77	192	Ir iridium 77	193	Ir iridium 77	204	[209]
192	Ir iridium 77	193	Ir iridium 77	194	Ir iridium 77	204	[209]
193	Ir iridium 77	194	Ir iridium 77	195	Ir iridium 77	204	[209]
194	Ir iridium 77	195	Ir iridium 77	196	Ir iridium 77	204	[209]
195	Ir iridium 77	196	Ir iridium 77	197	Ir iridium 77	204	[209]
196	Ir iridium 77	197	Ir iridium 77	198	Ir iridium 77	204	[209]
197	Ir iridium 77	198	Ir iridium 77	199	Ir iridium 77	204	[209]
198	Ir iridium 77	199	Ir iridium 77	200	Ir iridium 77	204	[209]
199	Ir iridium 77	200	Ir iridium 77	201	Ir iridium 77	204	[209]
200	Ir iridium 77	201	Ir iridium 77	202	Ir iridium 77	204	[209]
201	Ir iridium 77	202	Ir iridium 77	203	Ir iridium 77	204	[209]
202	Ir iridium 77	203	Ir iridium 77	204	Ir iridium 77	204	[209]
203	Ir iridium 77	204	Ir iridium 77	205	Ir iridium 77	204	[209]
204	Ir iridium 77	205	Ir iridium 77	206	Ir iridium 77	204	[209]
205	Ir iridium 77	206	Ir iridium 77	207	Ir iridium 77	204	[209]
206	Ir iridium 77	207	Ir iridium 77	208	Ir iridium 77	204	[209]
207	Ir iridium 77	208	Ir iridium 77	209	Ir iridium 77	204	[209]
208	Ir iridium 77	209	Ir iridium 77	210	Ir iridium 77	204	[209]</

* 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.