

1. Rubidium is found in Group 1 of the Periodic Table. Bromine is found in Group 7. They react together to form an ionic compound.

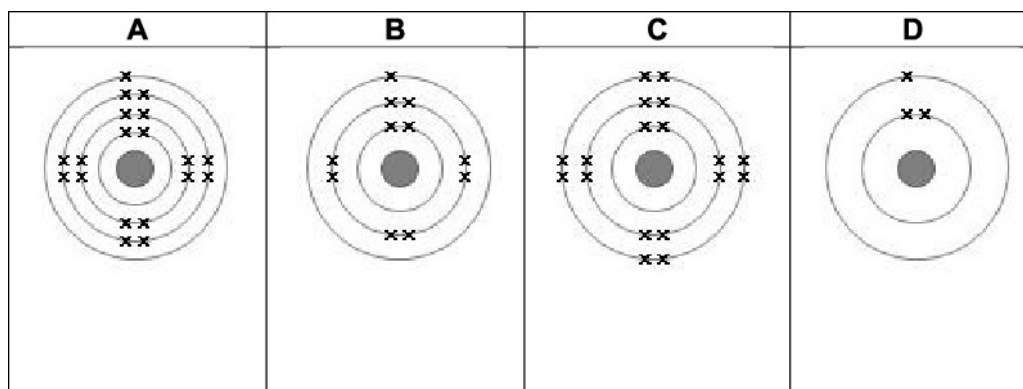
Which row shows the electron change that occurs for rubidium and the correct formula of a rubidium ion?

	Electron change	Formula of ion
A	Electron gained	$\text{Rb}^+$
B	Electron gained	$\text{Rb}^-$
C	Electron lost	$\text{Rb}^+$
D	Electron lost	$\text{Rb}^-$

Your answer

[1]

2. Look at the diagrams of the electron structures of four elements.



Which element is the most reactive?

Your answer

[1]

3. Which statement is correct for a Group 1 element?

- A It dissolves in water to form a bleach.
- B It is a non-metal.
- C It is an inert gas.
- D It reacts with water to form hydrogen.

Your answer

[1]

4. This question is about the reactivity series of metals.

Kevin heats mixtures of metals and metal oxides.

Look at the table. It shows Kevin's results.

	Magnesium, Mg	Lead, Pb	Iron, Fe	Copper, Cu
Magnesium oxide, MgO	no reaction	no reaction	no reaction	no reaction
Copper oxide, CuO	magnesium oxide and copper formed	lead oxide and copper formed	iron oxide and copper formed	no reaction
Lead oxide, PbO	magnesium oxide and lead formed	no reaction	iron oxide and lead formed	no reaction
Iron oxide, Fe <sub>2</sub> O <sub>3</sub>	magnesium oxide and iron formed	no reaction	no reaction	no reaction

Use Kevin's results to deduce an order of reactivity for the metals.

Explain how you used the results to put the metals in order of reactivity.

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[4]

5. Magnesium reacts rapidly with hydrochloric acid.

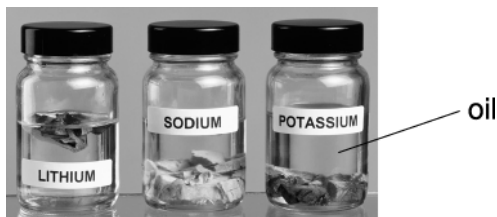
Barium reacts **more** rapidly with hydrochloric acid.

Explain why. Use ideas about loss of electrons.

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[2]

6(a). Group 1 elements are stored under oil.



Explain why Group 1 elements are stored under oil.

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----- [2]

(b). Lithium, sodium and potassium are all Group 1 elements.

Write down the name of one **other** Group 1 element.

Use the Periodic Table to help you.

----- [1]

7. Professor Hills investigates the reactions of the Group 1 metals, lithium, sodium and potassium, with water.

Look at his observations.

Metal	Observations
lithium	fizzes, moves across surface
sodium	fizzes rapidly, moves quickly across surface
potassium	fizzes violently, moves very quickly across surface, lilac flame seen

He concludes that the order of reactivity of the three metals is:

- potassium (most reactive)
- sodium
- lithium (least reactive).

Write about how the evidence from Professor Hills' observations supports his conclusion.

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[2]

8(a). This question is about Group 7 elements.

Look at the table.

It shows some information about the Group 7 elements.

Element	Molecular formula	Physical appearance	Melting point in °C	Boiling point in °C
fluorine	F <sub>2</sub>	pale yellow gas	-----	-188
chlorine	Cl <sub>2</sub>	pale green gas	-101	-35
bromine	Br <sub>2</sub>	orange liquid	-7	59
iodine	I <sub>2</sub>	-----	114	184

Complete the table to show the **physical appearance** of iodine.

[1]

(b). Use ideas about trends in a group to predict the **melting point** of fluorine.

[1]







11. Look at the table.

	State at room temperature	Electronic structure
A	Gas	2.7
B	Gas	2.8.7
C	Liquid	2.8.7
D	Solid	2.7

Which row in the table has the correct information about chlorine?

Your answer

[1]

12. The Group 0 elements are unreactive.

Why are they unreactive?

- A They all exist as single atoms.
- B They are all gases.
- C They have a full outer electron shell.
- D They need one electron to gain a full outer electron shell.

Your answer

[1]

13. Look at the boiling points of some Group 7 elements.

Element	Boiling point in °C
Fluorine	-188
Chlorine	-34
Bromine	59

What is the most likely boiling point of iodine?

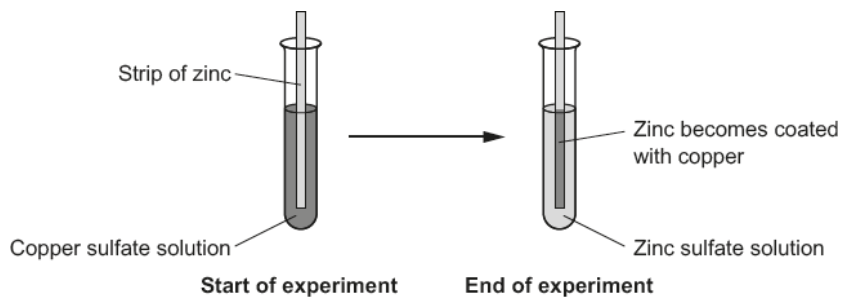
- A -20 °C
- B 50 °C
- C 184 °C
- D 350 °C

Your answer

[1]

14. A student investigates the reactivity of some metals with metal salts.

The diagram shows one of the experiments that he does.



He repeats the experiment using other metals and solutions.

Look at his results.

Solution	Metal added				
	Silver	Zinc	Magnesium	Copper	Iron
Copper sulfate	x	✓	✓		✓
Zinc sulfate	x		✓	x	x
Silver nitrate		✓	✓	✓	✓
Magnesium sulfate	x	x		x	x
Iron sulfate	x	✓	✓	x	

✓ = Metal reacts

x = Metal does not react

Use the results to place the metals in order of reactivity.

Most reactive metal

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Least reactive metal

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Explain your reasoning.

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[4]

15. Which of these solutions will react with each other?

- A Sodium bromide and iodine
- B Sodium chloride and bromine
- C Sodium chloride and iodine
- D Sodium iodide and bromine

Your answer

[1]

16. Which statement about the halogens (Group 7 elements) is correct?

- A Astatine is the most reactive halogen.
- B Chlorine has the electronic structure 2.8.7.
- C Fluorine is the element with the darkest colour.
- D The halogens have the molecular formula  $X_3$ .

Your answer

[1]

**END OF QUESTION PAPER**

### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			C	1	
			<b>Total</b>	<b>1</b>	
2			A	1	
			<b>Total</b>	<b>1</b>	
3			D	1	
			<b>Total</b>	<b>1</b>	
4			<p><b>Order of reactivity (most to least)</b> magnesium iron lead copper</p> <p>magnesium as most reactive and copper as least (1) iron and lead in correct order (1)</p> <p><b>Explanation</b> <b>Any two from</b> idea that none of the metals displace magnesium (from magnesium oxide) / magnesium displaces all the other metals from their metal oxides so magnesium is most reactive (1) idea that copper is displaced from copper oxide by all three other metals / copper cannot displace any of the other metals so copper is least reactive (1) idea that lead will displace iron or copper so is more reactive than these metals / lead cannot displace magnesium so is less reactive (1)</p>	4	<p><b>ALLOW</b> correct explanation for iron (1)</p>
			<b>Total</b>	<b>4</b>	
5			<p>(in barium) outer shell electrons are further from the nucleus/(in barium) nuclear attraction for outer shell electrons is less (1) so are lost more easily (1)</p>	2	<p><b>ALLOW</b> ora for magnesium</p> <p><b>IGNORE</b> electrons are lost faster</p>
			<b>Total</b>	<b>2</b>	

### Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
6	a	<p>any two from:</p> <p>very reactive (1)</p> <p>reacts with oxygen / reacts with air (1)</p> <p>reacts with water (1)</p>	2	<p>allow idea of preventing reaction with oxygen / air (1)</p> <p>allow idea of preventing reaction with water (1)</p> <p>allow two marks for reacts with moist air or with damp air</p> <p>allow they do not react with oil (1)</p> <p><b>Examiner's Comments</b></p> <p>Good responses explained that Group 1 elements react with water and with oxygen.</p>
	b	rubidium / caesium / francium (1)	1	<p>allow Rb / Cs / Fr (1)</p> <p>ignore lithium / sodium / potassium</p> <p><b>Examiner's Comments</b></p> <p>Most candidates correctly identified another Group 1 element.</p>
		<b>Total</b>	<b>3</b>	

### Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
7		<p>any two from: Mark can be awarded for a correct comparison between at least two of the three metals</p> <p>Idea that potassium fizzes more than sodium / sodium fizzes more than lithium / potassium fizzes more than lithium (1)</p> <p>Idea that potassium moves more quickly than sodium / sodium moves more quickly than lithium / potassium moves more quickly than lithium (1)</p> <p>a flame is <b>only</b> seen with potassium (1)</p>	2	<p>answer must be comparative,</p> <p><b>ignore</b> potassium reacts more than the other two <b>allow</b> potassium is the <b>only</b> one to fizz violently (1) <b>allow</b> e.g. potassium fizzes violently and sodium fizzes rapidly (1)</p> <p><b>allow</b> e.g. sodium moves quickly (across the surface) and lithium moves (across the surface) (1)</p> <p><b>Examiner's Comments</b></p> <p>Good responses to this question analysed the experimental observations and used the observations to describe how they supported the conclusion. When candidates did not gain credit it was usually because they did support their answer with evidence, simply restating the order of reactivity given in the question.</p>
		<b>Total</b>	<b>2</b>	



### Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
8	a	(dark) grey solid (1)	1	<p><b>allow</b> purple solid or violet solid  <b>ignore</b> blue solid or black solid or blue / black solid  <b>allow</b> crystals for solid</p> <p><b>Examiner's Comments</b></p> <p>Answers contained a variety of descriptions, including different colours and solids or liquids.</p>
	b	?189 to ?260 (1)	1	<p><b>allow</b> answers given as range if it falls within the stated values</p> <p><b>Examiner's Comments</b></p> <p>Candidates generally made a fair attempt at the melting point by following the trend. Wrong answers almost invariably gave temperatures that were too high.</p>
		<b>Total</b>	<b>2</b>	

### Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
9	<p>[Level 3] Explains how far the results support the conclusion by reference to one supporting result and one that is not supporting AND a description of the flame test Quality of written communication does not impede communication of the science at this level  (5 – 6 marks)</p> <p>[Level 2] Explains how far the results support the conclusion by reference to one supporting result or one that is not supporting AND a description of the flame test Quality of written communication partly impedes communication of the science at this level  (3 – 4 marks)</p> <p>[Level 1] Explains the results of any one test OR gives a description of the flame test OR states what two of the chemical tests are testing for Quality of written communication impedes communication of the science at this level  (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit.  (0 marks)</p>	6	<p>This question is targeted at grades C and D</p> <p>Relevant scientific points supporting could include</p> <ul style="list-style-type: none"> <li>• barium chloride / white precipitate indicates sulfate present</li> </ul> <p>Relevant scientific points not supporting could include</p> <ul style="list-style-type: none"> <li>• flame test / yellow flame indicates presence of sodium</li> <li>• silver nitrate / the yellow precipitate indicates iodide present / silver nitrate doesn't test for either iron (II) or sulfate</li> <li>• sodium hydroxide / brown precipitate indicates iron(III) / should go green with iron (II)</li> </ul> <p>Relevant scientific points about flame tests could include</p> <ul style="list-style-type: none"> <li>• put substance into a (blue Bunsen) flame</li> <li>• use of a flame test wire / splint / spray</li> <li>• observe the colour of the flame</li> </ul> <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p> <p><u>Examiner's Comments</u></p> <p>?Candidates found this question particularly challenging. Many managed to give a description of a functional flame test but found the test results very difficult to interpret. In many cases they had not seemed to have learnt these tests.</p>
	<b>Total</b>	<b>6</b>	

### Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
10	<p>[Level 3] Explains that the results do not support the conclusion AND a complete description of the flame test Quality of written communication does not impede communication of the science at this level  (5–6 marks)</p> <p>[Level 2] Explains that the results do not support the conclusion OR a complete description of the flame test OR partial explanation of results and a partial description of the flame test Quality of written communication partly impedes communication of the science at this level  (3–4 marks)</p> <p>[Level 1] Explains that flame test indicates sodium or flame test does not indicate potassium OR barium chloride result indicates sulfate OR a partial description of the flame test Quality of written communication impedes communication of the science at this level.  (1–2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit.  (0 marks)</p>	6	<p>This question is targeted at grades up to C. Indicative scientific points at levels could include Explanation of results:</p> <ul style="list-style-type: none"> <li>• flame test indicates presence of sodium / yellow flame indicates sodium / potassium would give a lilac flame</li> <li>• barium chloride indicates sulfate present</li> </ul> <p>Description of flame test:</p> <ul style="list-style-type: none"> <li>• use a flame test wire or splint / spray sample through the flame</li> <li>• dip wire or splint into solution</li> <li>• put wire or substance into a (blue Bunsen) flame</li> <li>• observe the colour of the flame</li> </ul> <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p> <p><u>Examiner's Comments?</u></p> <p>This six-mark question was targeted up to grade C. To gain credit at level 3 (five – six marks) candidates needed to give a complete description of the flame test. They also needed to explain that the test with barium chloride indicates the presence of sulfate but that the flame test indicates the presence of sodium rather than potassium. Most candidates were unable to describe how to do a flame test and could not analyse the results to explain whether they supported the idea that the water was polluted with potassium sulfate.</p>
	<b>Total</b>	<b>6</b>	

### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
11			B ✓	1 (AO 1.1)	<p><b><u>Examiner's Comments</u></b></p> <p>A large number of candidates thought chlorine to be a liquid, incorrectly selecting C as their response.</p>
			<b>Total</b>	<b>1</b>	
12			C ✓	1 (AO 1.1)	<p><b><u>Examiner's Comments</u></b></p> <p>B and D were popular incorrect responses. Less than half of candidates chose the correct response.</p>
			<b>Total</b>	<b>1</b>	
13			C ✓	1 (AO 2.1)	<p><b><u>Examiner's Comments</u></b></p> <p>B was a popular incorrect response. About two thirds of candidates answered this question well selecting the correct response.</p>
			<b>Total</b>	<b>1</b>	

### Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
14		<p>order of reactivity (most to least) magnesium zinc iron copper silver</p> <p>magnesium as most reactive and silver least reactive ✓</p> <p>zinc, iron and copper in the correct order ✓</p> <p><b>Explanation</b> <b>Any two from:</b> idea that magnesium displaces all the other metals (from solutions of their salts so is most reactive) ✓</p> <p>idea that silver does not displace any of the other metals (from solutions of their salts so is the least reactive) ✓</p> <p>any other correct statement about displacement / reactions ✓</p>	4 (AO 4 × 2.2)	<p><b>ALLOW</b> magnesium reacts with all of the solutions</p> <p><b>ALLOW</b> silver reacts with none of the solutions</p> <p>e.g. zinc displaces copper from copper sulfate solution so zinc is more reactive than copper/ more reactive metal displaces a less reactive metal (from solution)</p> <p><b>IF no marks are awarded for explanation then MAX 1 mark can be awarded for: in order of number of ticks / in order of the number of solutions it reacts with</b></p> <p><b><u>Examiner's Comments</u></b></p> <p>Candidates who put metals into the list usually put them into the correct order but a significant number put the solutions into the list. The explanation proved challenging and lower ability candidates could not explain why they had chosen the order they had written.</p>
		<b>Total</b>	<b>4</b>	

### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
15			D ✓	1 (AO 1.1)	<b>Examiner's Comments</b> Only the more able answered this question correctly. Candidates need to apply their knowledge here.
			<b>Total</b>	<b>1</b>	
16			B ✓	1 (AO 1.1)	<b>Examiner's Comments</b> Almost all candidates answered this correctly.
			<b>Total</b>	<b>1</b>	