

## Questions

Q1.

Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

This question is about gases.

When sodium is added to water, hydrogen gas is produced.

Which observation shows that a gas has been produced?

- A a white precipitate forms
- B effervescence is seen
- C the sodium sinks in the water
- D the water changes to a pink colour

(1)

(Total for question = 1 mark)

Q2.

Complete the following sentences.

(i) The name given to group 7 in the periodic table is .....

(1)

(ii) The name given to group 0 in the periodic table is .....

(1)

(Total for question = 2 marks)

Q3.

Lithium, sodium and potassium are reactive metals in group 1 of the periodic table.

Sodium reacts with water to form sodium hydroxide in solution and hydrogen.

Complete the balancing of the equation for this reaction and add the state symbols for each substance.

(3)



(Total for question = 3 marks)

Q4.

Lithium, sodium and potassium are reactive metals in group 1 of the periodic table.

In an experiment equal-sized pieces of lithium, sodium and potassium are added to separate samples of water.

(i) A flame is produced only with potassium because potassium

(1)

- A is the softest metal
- B has the lowest melting point
- C is the most reactive
- D is the only flammable metal

\* (ii) A teacher demonstrated this experiment.

The results are shown in Figure 14.

	<b>lithium</b>	<b>sodium</b>	<b>potassium</b>
position of metal in water	floats	floats	floats
movement of metal	slow	fast	very fast
effervescence / bubbling	slow	fast	very fast

Figure 14

Describe, in detail, how the teacher would demonstrate this experiment safely, showing how the results give the order of reactivity of the metals.

(Total for question = 7 marks)

Q5.

Lithium, sodium and potassium are reactive metals in group 1 of the periodic table.

In an experiment equal-sized pieces of lithium, sodium and potassium are added to separate samples of water.

A flame is produced only with potassium because potassium

(1)

- A is the softest metal
- B has the lowest melting point
- C is the most reactive
- D is the only flammable metal

(Total for question = 1 mark)

Q6.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

\* Group 1 metals react with the elements from group 7 to form salts.

Some examples of these reactions are shown in Figure 10.

reaction	word equation
W	lithium + chlorine → lithium chloride
X	potassium + fluorine → potassium fluoride
Y	rubidium + iodine → rubidium iodide
Z	potassium + bromine → potassium bromide

Figure 10

You will find the position of these elements in their groups on the periodic table.

Explain, in terms of their electronic configurations and the relative reactivity of these elements, which of the reactions shown in Figure 10 would be the most violent.

(6)

(Total for question = 6 marks)

Q7.

This question is about elements in group 1 of the periodic table.

The elements in group 1 react very vigorously with water.

A student suggests this method to see what happens when sodium reacts with water.

~~step 1~~ step 1: wear safety glasses and a laboratory coat

~~step 2~~ step 2: use a 2 cm × 2 cm × 2 cm cube of sodium

~~step 3~~ step 3: add a few drops of water in the container shown in Figure 4

~~step 4~~ step 4: add the sodium to the water in the container and observe the reaction

(i) Figure 4 shows a diagram of the container the student suggested for step 3.

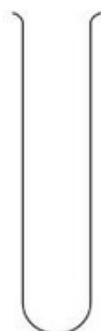


Figure 4

Give the name of the container shown in Figure 4.

(1)

.....

(ii) A teacher says that the method is not safe because the reaction is too vigorous.

Explain changes that could be made to step 2 and to step 3 that would make the method safer.

(3)

step 2: change and explanation

.....  
.....  
.....

step 3: change and explanation

.....  
.....  
.....

(Total for question = 4 marks)

Q8.

This question is about elements in group 1 of the periodic table.

Figure 3 shows the symbols of the first three elements in group 1 of the periodic table and their melting points.

symbol	melting point in °C
Li	181
Na	98
K	64

**Figure 3**

Use the periodic table to answer these questions.

(i) Give the symbol of another element in group 1.

(1)

.....

(ii) Give the atomic number of lithium.

(1)

.....

(iii) Describe the trend in the melting points of the elements in Figure 3.

(2)

.....

.....

(Total for question = 4 marks)

Q9.

Lithium, sodium and potassium are reactive metals in group 1 of the periodic table.

Explain, in terms of electronic configurations, the increase in reactivity from lithium to sodium to potassium.

(2)

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.....

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.....

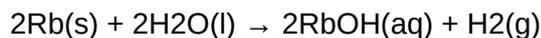
(Total for question = 2 marks)

Q10.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

The first four elements in group 1 are lithium, sodium, potassium and rubidium.

Rubidium reacts with water to form rubidium hydroxide and hydrogen.



(i) Predict what you would see when a small piece of rubidium is placed in a large volume of water.

(3)

.....

.....

.....

.....

.....

(ii) Why is rubidium more reactive than potassium?

(1)

- A the metallic bonds in rubidium are weaker than those in potassium
- B rubidium is a softer metal than potassium
- C the outer electron of a rubidium atom is further from the nucleus than potassium's
- D rubidium has a more exothermic reaction with water than potassium does

(iii) 8.5 g of rubidium are reacted completely with water.

The reaction makes a solution of rubidium hydroxide.

The volume of this solution is 2.5 dm<sup>3</sup>.

Calculate the concentration of the rubidium hydroxide solution in g dm<sup>-3</sup>.

(relative atomic mass: Rb = 85; relative formula mass: RbOH = 102)

(4)

.....

.....

.....

.....

.....

concentration = ..... g dm<sup>-3</sup>

(Total for question = 8 marks)

Q11.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

What are the elements in group 1 of the periodic table called?

(1)

- A alkali metals
- B fullerenes
- C halogens
- D noble gases

(Total for question = 1 mark)

Q12.

Some of the elements in the periodic table are metals.

Lithium, potassium and rubidium are alkali metals.

(i) Describe what you would see when a small piece of rubidium is dropped on to water.

(2)

.....  
.....  
.....  
.....

(ii) The electronic configuration of lithium is 2.1

The electronic configuration of potassium is 2.8.8.1

Lithium is less reactive than potassium.

Explain, in terms of their electronic configurations, why lithium is less reactive than potassium.

(3)

.....  
.....  
.....  
.....  
.....  
.....

(Total for question = 5 marks)

Q13.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

This question is about potassium and zinc.

Which of the following temperatures is most likely to be the melting point of potassium?

(1)

- A  $-63\text{ }^{\circ}\text{C}$
- B  $6.3\text{ }^{\circ}\text{C}$
- C  $63\text{ }^{\circ}\text{C}$
- D  $630\text{ }^{\circ}\text{C}$

(Total for question = 1 mark)

Mark Scheme

Q1.

Question number	Answer	Mark
	<b>B</b> effervescence is seen is the only correct answer. <b>A, C and D</b> are incorrect as they are not linked to gas production	<b>(1)</b> <b>AO1 2</b>

Q2.

Question number	Answer	Additional guidance	Mark
<b>(i)</b>	halogens or halogen	reject halide	<b>(1)</b>
<b>(ii)</b>	noble gases or inert gases or rare gases	Do not allow gases alone	<b>(1)</b>

Q3.

Question Number	Answer	Additional guidance	Mark
	$2\text{Na(s)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{NaOH(aq)} + \text{H}_2\text{(g)}$ 2Na (1) 2NaOH (1) s, l, aq, g (1)	allow S, L, AQ, G ignore words	<b>(3)</b> <b>AO 2 1</b>

Q4.

Question Number	Answer	Mark
(i)	<p>C is the most reactive</p> <p><b>The only correct answer is C</b></p> <p><i>A is not correct because this is irrelevant</i></p> <p><i>B is not correct because this is irrelevant</i></p> <p><i>D is not correct because this is irrelevant</i></p>	(1) AO 2 1

Question Number	Indicative content	Mark
* (ii)	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p><b>Aspect one: METHOD</b></p> <ul style="list-style-type: none"> <li>• trough/large container of water</li> <li>• equal volumes of water for each experiment</li> <li>• remove metal from container with tongs</li> <li>• remove oil</li> <li>• cut small piece</li> <li>• add metal with tongs/tweezers etc. to water</li> <li>• teacher wears safety glasses</li> <li>• gloves</li> <li>• use of safety screen</li> <li>• class well back</li> <li>• class wear goggles</li> </ul> <p>ignore general safety ideas – hair tied back, lab coat etc. ignore equal sized pieces of metal</p> <p><b>Aspect 2: ANALYSIS</b></p> <ul style="list-style-type: none"> <li>• most vigorous effervescence of hydrogen with potassium and least with lithium</li> <li>• fastest movement with potassium and slowest with lithium</li> <li>• potassium is most reactive, then sodium, then lithium</li> </ul> <p>ignore copying of results from table e.g potassium bubbles very fast ignore writing up of results/ put in table etc</p>	(6) AO 2 2 AO 3 1a AO 3 1b

Level	Descriptor
	No rewardable material.
Level 1	<ul style="list-style-type: none"> <li>• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail.</li> <li>• Presents an explanation with some structure and coherence.</li> </ul>
Level 2	<ul style="list-style-type: none"> <li>• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed.</li> <li>• Presents an explanation that has a structure which is mostly clear, coherent and logical.</li> </ul>
Level 3	<ul style="list-style-type: none"> <li>• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed.</li> <li>• Presents an explanation that has a well-developed structure which is clear, coherent and logical.</li> </ul>

Q5.

Question Number	Answer	Mark
	<p>C is the most reactive</p> <p><b>The only correct answer is C</b></p> <p><i>A is not correct because this is irrelevant</i></p> <p><i>B is not correct because this is irrelevant</i></p> <p><i>D is not correct because this is irrelevant</i></p>	<p><b>(1)</b> AO 2 1</p>

Q6.

Question number	Indicative content	Mark
	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <ul style="list-style-type: none"> <li>• group 1 metals form positive ions</li> <li>• outer electron lost</li> <li>• further down the group outer electron more easily lost</li> <li>• due to electron shell further from nucleus OR greater electron shielding</li> <li>• so lower nuclear attraction</li> <li>• group 1 metal becomes more reactive</li> <li>• order of reactivity <math>\text{Li} &lt; \text{K} &lt; \text{Rb}</math></li> <li>• group 7 elements form negative ions</li> <li>• gains electron to complete outer shell</li> <li>• further down the group electron is less easily gained</li> <li>• due to outer electron shell further from nucleus OR greater electron shielding</li> <li>• so lower nuclear attraction</li> <li>• group 7 element becomes less reactive</li> <li>• order of reactivity <math>\text{F} &gt; \text{Br} &gt; \text{I}</math></li> <li>• most reactive pair likely to be potassium + fluorine with suitable justification (K low in group 1 and F is at the top of group 7)</li> <li>• allow rubidium + iodine with justification (Rb lower in group 1 than K and so more reactive)</li> </ul>	<p><b>(6)</b> <b>A01</b> <b>A02</b></p>

Level	Mark	Additional Guidance	General additional guidance – the decision within levels Eg - At each level, as well as content, the scientific coherency of what is stated backed up by detail will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	<u>Additional guidance</u> States some simple facts about group 1 OR group 7 elements OR Correctly identifies most violent reaction(s) with simple reasoning	<u>Possible candidate responses</u> <ul style="list-style-type: none"> <li>Group 1 elements lose 1 electron from outer shell.</li> <li>Group 7 elements are more reactive up the group.</li> <li>The most violent reaction could be potassium with fluorine as fluorine is the most reactive group 7 element (2)</li> </ul>
Level 2	3–4	<u>Additional guidance</u> Correctly identifies most violent reaction(s) with a simple justification  OR  A simple explanation of the reactivity of group 1 AND group 7 elements.  OR  A detailed explanation of the reactivity of group 1 OR group 7 elements.	<u>Possible candidate responses</u> <ul style="list-style-type: none"> <li>The most violent reaction could be rubidium with iodine as rubidium is the most reactive of the group 1 elements given. Rubidium is so reactive because it loses its outer electron easily.</li> <li>Group 1 elements are more reactive down the group as the distance between the nucleus and the outer electron is further, so the force of attraction between them is weaker and the electron is more easily lost.</li> <li>Fluorine is the most reactive halogen because its outer electron shell is closer to the nucleus. Group 1 elements are more reactive down the group as their outer shell gets further from the nucleus.</li> </ul>
Level 3	5–6	<u>Additional guidance</u> Correctly identifies the most violent reaction with a detailed justification.  OR  A detailed explanation of the reactivity of group 1 AND group 7 elements.	<u>Possible candidate responses</u> <ul style="list-style-type: none"> <li>The most violent reaction is potassium and fluorine as fluorine is the most reactive element in group 7. Potassium loses its outer electron easily as there is a weak nuclear attraction, and fluorine gains this electron easily as it has a strong nuclear attraction.</li> <li>Group 1 elements become more reactive down the group. They lose 1 electron to form cations and the larger the distance between the nucleus and the outer shell, the more easily the electron is lost. Group 7 elements gain 1 electron to form anions and the smaller elements gain this electron more easily. This is because the force between the nucleus and the outer shell is stronger.</li> </ul>

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	<ul style="list-style-type: none"> <li>• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1)</li> <li>• Lines of reasoning are unsupported or unclear. (AO2)</li> </ul>
Level 2	3-4	<ul style="list-style-type: none"> <li>• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1)</li> <li>• Lines of reasoning mostly supported through the application of relevant evidence. (AO2)</li> </ul>
Level 3	5-6	<ul style="list-style-type: none"> <li>• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1)</li> <li>• Lines of reasoning are supported by sustained application of relevant evidence. (AO2)</li> </ul>

Q7.

Question number	Answer	Additional guidance	Mark
(i)	test tube / boiling tube	ignore just 'tube', testing tube	(1) AO2 2

Question number	Answer	Additional guidance	Mark
(ii)	<p>An explanation to include any three from:</p> <p><b>Step 2</b></p> <ul style="list-style-type: none"> <li>cut a <b>smaller</b> piece of sodium (1)</li> <li>so less reaction / slower reaction (1)</li> </ul> <p><b>Step 3</b></p> <ul style="list-style-type: none"> <li>use a larger {container / trough} (of water) (1)</li> <li>there is more water so more heat is absorbed (1)</li> </ul>	<p>reject use powdered sodium for MP1 and MP2</p> <p>MP2 is dependent on MP1</p> <p>allow less sodium / smaller volume of sodium / <math>1(\text{cm}^3) \times 1(\text{cm}^3) \times 1(\text{cm}^3)</math> cube / smaller mass of sodium</p> <p>ignore use less cubes</p> <p>allow smaller reaction / it is less reactive ignore so reaction is less vigorous</p> <p>MP4 is dependent on MP3</p> <p>allow name of larger container: beaker/ flask ignore use larger test tube / boiling tube ignore change container ignore add more water</p> <p>ignore add a safety screen / observe from a distance</p>	(3) A03 3a

Q8.

Question number	Answer	Additional guidance	Mark
(i)	Rb / Cs / Fr	<p>symbols must have uppercase letter then lowercase letter reject answers with any other symbols ignore any names</p>	(1) A02 1

Question number	Answer	Mark
(ii)	3 / three	(1) A02 1

Question number	Answer	Additional guidance	Mark
(iii)	<p>A description including</p> <ul style="list-style-type: none"> <li>(the melting points) decrease (1)</li> <li>as the atomic number increases/ as you go down {the group / the alkali metals / group 1} (1)</li> </ul>	<p>allow (melting points) {go down / get smaller} ignore less heat needed to melt it</p> <p>MP2 depends on MP1</p> <p>allow (going) down (the table / list) allow down the periodic table</p> <p>ignore references to boiling point</p> <p>higher the atomic number, lower the melting point (2) ORA</p> <p>higher in {group/ table} the higher the melting point (2) ORA</p>	(2) A03 1

Q9.

Question Number	Answer	Additional guidance	Mark
	<p>An explanation linking</p> <ul style="list-style-type: none"> <li>atoms become larger/ <b>outer</b> electron becomes further from the nucleus / ORA (1)</li> <li>so <b>outer</b> electron more easily <b>lost</b> / less energy needed to <b>lose outer</b> electron / ORA (1)</li> </ul>	<p>allow atomic radius increases / increased shielding effect (by inner complete(electron) shells)/ more (inner) shells/ decreased force of attraction between outer shell electron and nucleus / correct electronic configurations (at least two)</p> <p>reject 'more outer shells' / incorrect forces such as intermolecular</p>	(2) AO 1 1

Q10.

Question number	Answer		Mark
(i)	A description to include any three from <ul style="list-style-type: none"> <li>• metal disappears <b>(1)</b></li> <li>• metal moves around <b>(1)</b></li> <li>• fizzing/ effervescence/ bubbling <b>(1)</b></li> <li>• (any colour) flame <b>(1)</b></li> <li>• explodes/reacts violently <b>(1)</b></li> </ul>	ignore floats/ sinks/ on surface of water allow dissolves/gets smaller ignore gas / smoke / steam / water vapour / hydrogen allow forms a ball / melts	<b>(3)</b>

Question number	Answer	Mark
(ii)	C rubidium atoms outer electrons are further from the nucleus than potassium atoms is the only correct answer. A, B and D are true but does not affect the reactivity	<b>(1)</b>

Question number	Answer	Additional guidance	Mark
(iii)	4.08 as final answer with or without working scores 4 <ul style="list-style-type: none"> <li>• moles Rb = <math>8.5/85</math> (= 0.1 mol) <b>(1)</b></li> <li>• moles RbOH = 0.1 mol <b>(1)</b></li> <li>• mass RbOH = <math>0.1 \times 102</math> (=10.2 g) <b>(1)</b></li> <li>• conc = <math>10.2/2.5</math> (= 4.08 gdm<sup>-3</sup>) <b>(1)</b></li> </ul> <b>OR</b> <ul style="list-style-type: none"> <li>• 2Rb – 2 RbOH/ 1:1 ratio <b>(1)</b></li> <li>• 85 (x2) (g) – 102 (x2) (g) <b>(1)</b></li> <li>• 8.5 (g) – 10.2 (g) <b>(1)</b></li> <li>• conc = <math>10.2/2.5</math> (= 4.08 gdm<sup>-3</sup>) <b>(1)</b></li> </ul>	allow 8.5/ 2.5 (=3.4) to score MP4 working leading to 10.2 will score 3	<b>(4)</b>

Q11.

Question number	Answer	Mark
	A alkali metals A is the only correct answer. B is incorrect because fullerenes are not a group in the periodic table C is incorrect because halogens are group 7 D is incorrect because noble gases are group 0	<b>(1)</b>

Q12.

Question number	Answer	Additional guidance	Mark
(i)	<p>A description to include from</p> <ul style="list-style-type: none"> <li>effervescence / bubbles / fizz (1)</li> <li>disappears / gets smaller (1)</li> <li>explodes / flame / ignites / sparks (1)</li> </ul>	<p>ignore gas / smoke ignore hydrogen given off</p> <p>allow dissolves</p> <p>allow moves around very fast</p> <p>allow forms a ball / melts</p> <p>ignore floats /sinks</p> <p>ignore 'pops' / hydrogen</p>	(2)

Question number	Answer	Additional guidance	Mark
(ii)	<p>an explanation linking</p> <p><b>outer</b> {electron /shell} closer to nucleus (1)</p> <p>so more attraction for {electron/shell} (1)</p> <p>(therefore) electron is harder to lose (1)</p>	<p>allow smaller atomic radius / fewer shells reject less outer shells for MP1</p> <p>allow less shielding</p> <p>allow more energy to lose electron</p> <p>ORA for potassium</p>	(3)

Q13.

Question number	Answer	Mark
	<p><b>C</b> 63 °C Is the only answer. <b>A</b> would be a gas at room temperature <b>B</b> would be a liquid at room temperature <b>D</b> alkali metals have low melting points – this is too high</p>	<p>(1) AO1</p>