

Answer **all** the questions.

1. 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]

2(a). The Group 7 elements are known as the halogens.

The halogens have similar chemical properties.

Their physical properties vary with increasing atomic number.

Look at the table of information about the halogens.

Halogen	Atomic symbol	Atomic number	Molecular formula	Atomic radius in pm	Reaction of halogen with sodium iodide solution
fluorine	F	9	F ₂	64	Makes iodine and sodium fluoride
chlorine	Cl	17	Cl ₂	99	Makes iodine and sodium chloride
bromine	Br	35	Br ₂	114
iodine	I	53	I ₂	133	No reaction
astatine	At	85	No reaction

(i) Predict the molecular formula and atomic radius of astatine.

Put your answers in the table.

[2]

(ii) Predict the reaction of bromine with sodium iodide solution.

Put your answer in the table.

[1]

(iii) Explain your answer to (ii) in terms of the reactivity of the halogens.

----- [1]

(b). All halogens react with alkali metals to make a salt.

(i) All halogens have similar chemical reactions.

Explain why in terms of electronic structure.

----- [1]

(ii) Sodium reacts with bromine to make sodium bromide, NaBr.

Construct the **balanced symbol** equation for this reaction.

----- [2]

(iii) What is the formula of the product of the reaction between astatine and potassium?

----- [1]

3. This question is about the Group 7 elements.

Chlorine and iodine are Group 7 elements.

What is the name given to the Group 7 elements?

----- [1]

4. Colin investigates some displacement reactions.

He puts a small sample of metal powder into a salt solution.

Colin does five different experiments.

Look at his results.

		Colour of solution	
Metal	Salt solution	At start	At end
magnesium	iron(II) sulfate	green	colourless
iron	copper(II) sulfate	blue	green
copper	iron(II) sulfate	green	green
magnesium	copper(II) sulfate	blue	colourless
copper	silver nitrate	colourless	blue

Predict the order of reactivity of the metals, copper, iron, magnesium and silver.

Put the most reactive metal first.

most reactive -----

least reactive -----

Explain your answer.

[3]

5(a). The Group 7 elements are known as the halogens.

The halogens have similar chemical properties.

Their physical properties vary with increasing atomic number.

All halogens react with alkali metals to make a salt.

(i) All halogens have similar chemical reactions.

Explain why in terms of electronic structure.

----- [1]

(ii) Sodium reacts with bromine to make sodium bromide, NaBr.

Construct the **balanced symbol** equation for this reaction.

----- [2]

(iii) What is the formula of the product of the reaction between astatine and potassium?

----- [1]

(b). Look at the table of information about the halogens.

Halogen	Atomic symbol	Atomic number	Molecular formula	Atomic radius in pm	Reaction of halogen with sodium iodide solution
fluorine	F	9	F ₂	64	Makes iodine and sodium fluoride
chlorine	Cl	17	Cl ₂	99	Makes iodine and sodium chloride
bromine	Br	35	Br ₂	114
iodine	I	53	I ₂	133	No reaction
astatine	At	85	No reaction

(i) Predict the molecular formula and atomic radius of astatine.

Put your answers in the table.

[2]

(ii) Predict the reaction of bromine with sodium iodide solution.

Put your answer in the table.

[1]

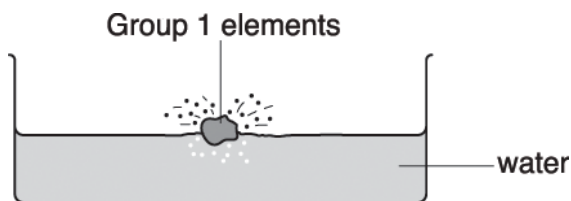
(iii) Explain your answer to (ii) in terms of the reactivity of the halogens.

----- [1]

7. This question is about the reaction of Group 1 elements with water.

Lithium, sodium and potassium are Group 1 elements.

They all react with water.



Look at the table.

Group 1 element	Time for 0.5 g of metal to react in seconds	Observations
sodium	15	melts moves across surface of water makes a gas which burns with a 'pop' makes an alkaline solution
potassium	7	melts and catches fire moves quickly across surface of water makes a gas which burns with a 'pop' makes an alkaline solution
lithium	25	moves slowly across surface of water makes a gas which burns with a 'pop' makes an alkaline solution

Rubidium is another Group 1 element.

It is **below** potassium in Group 1 of the periodic table.

Predict the reaction time, and name the products, of the reaction between rubidium and water.

Include a **balanced symbol** equation for the reaction.



The quality of written communication will be assessed in your answer to this question.

9. Lithium, Li, is in Group 1 of the Periodic Table.

Laura's teacher adds a small piece of lithium to a bowl of water.



The lithium reacts with the water, H_2O .

The lithium moves about on the surface of the water.

Laura sees bubbles of hydrogen, H_2 , being made.

The piece of lithium gets smaller and smaller until it has completely reacted.

A solution of lithium hydroxide, LiOH , is made.

Caesium, Cs, is another element in Group 1.

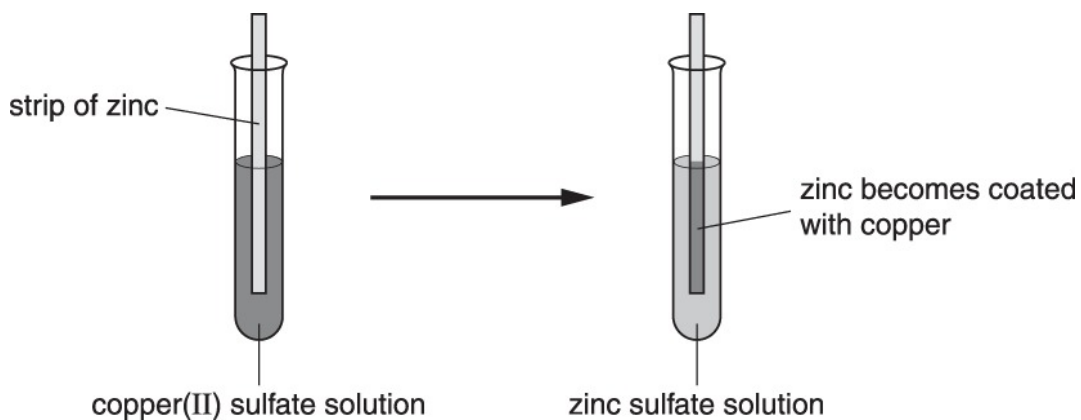
Predict, including a balanced symbol equation, how the reaction of **caesium** with water compares with the reaction of **lithium** with water.



The quality of written communication will be assessed in your answer to this question.

10. Jill investigates the reactivity of some metals.

Look at the diagram. It shows what happens when she puts a strip of zinc into copper(II) sulfate solution.



Jill finds out that copper reacts with silver nitrate solution.

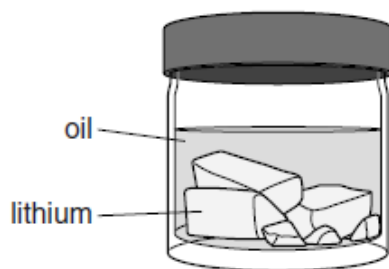
Predict what will happen if Jill puts a strip of **copper** into a solution of **silver nitrate**.

Explain your answer.

[2]

11(a). Lithium, Li, is in Group 1 of the Periodic Table.

Lithium is stored under oil in a sealed bottle.



Explain why lithium is stored under oil.

[2]

(b). Laura's teacher adds a small piece of lithium to a bowl of water.



The lithium reacts with the water.

The lithium moves about on the surface of the water.

Laura sees bubbles of hydrogen being made.

The piece of lithium gets smaller and smaller until it has completely reacted.

A solution of lithium hydroxide is made.

Caesium, Cs, is another element in Group 1.

Predict, including a word equation, how the reaction of **caesium** with water compares with the reaction of **lithium** with water.



The quality of written communication will be assessed in your answer to this question.

[6]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			D	1	
			Total	1	
2	a	i	Molecular formula: At ₂ (1) Atomic radius: 148 – 168 (1)	2	DO NOT ALLOW AT ₂ / At2 ALLOW any range of numbers provided it is completely within the range given for the answer
		ii	Makes iodine and sodium bromide (1)	1	
		iii	Bromine is more reactive than iodine (1)	1	ALLOW ORA
	b	i	Same number of electrons in outer shell / all have 7 electrons in outer shell (1)	1	ALLOW outer electrons or valence electrons rather than electrons in the outer shell ALLOW valence shell rather than outer shell DO NOT ALLOW the wrong number of electrons in the outer shell
		ii	2Na + Br₂ → 2NaBr Correct formulae of reactants and products (1) Balancing – depend on correct formulae (1)	2	ALLOW any correct multiple of the equation including fractions ALLOW = or ≡ instead of → DO NOT ALLOW and or & instead of + ALLOW one mark for correct balanced equation with minor errors of case and subscript e.g. 2NA + Br2 □ 2NaBr
		iii	KAt (1)	1	
			Total	8	
3			halogens (1)	1	Examiner's Comments Examiners saw a wide range of incorrect responses.
			Total	1	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
4		<p>magnesium, iron, copper, silver (1)</p> <p>AND</p> <p>any two from:</p> <p>magnesium will displace iron or magnesium reacts with iron(II) sulfate so magnesium is more reactive than iron (1)</p> <p>iron will displace copper so iron reacts with copper(II) sulfate so iron is more reactive than copper (1)</p> <p>magnesium will displace copper or magnesium reacts with copper(II) sulfate so magnesium is more reactive than copper (1)</p> <p>copper will displace silver or copper reacts with silver nitrate so copper is more reactive than silver (1)</p>	3	<p>allow Mg, Fe, Cu, Ag (1)</p> <p>Examiner's Comments</p> <p>Most candidates were unable to interpret the data to predict the order of reactivity of the metals.</p>
		Total	3	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
5	a	i	Same number of electrons in outer shell / all have 7 electrons in outer shell (1)	1	ALLOW outer electrons or valence electrons rather than electrons in the outer shell ALLOW valence shell rather than outer shell DO NOT ALLOW the wrong number of electrons in the outer shell
		ii	$2\text{Na} + \text{Br}_2 \rightarrow 2\text{NaBr}$ Correct formulae of reactants and products (1) Balancing – depend on correct formulae (1)	2	ALLOW any correct multiple of the equation including fractions ALLOW = or \rightleftharpoons instead of \rightarrow DO NOT ALLOW and or & instead of + ALLOW one mark for correct balanced equation with minor errors of case and subscript, e.g. $2\text{NA} + \text{Br}_2 \rightarrow 2\text{NaBr}$
		iii	KAt (1)	1	
	b	i	Molecular formula: At_2 (1) Atomic radius: 148 – 168 (1)	2	DO NOT ALLOW AT_2 / At_2 ALLOW any range of numbers provided it is completely within the range given for the answer
		ii	Makes iodine and sodium bromide (1)	1	
		iii	Bromine is more reactive than iodine (1)	1	ALLOW ORA
			Total	8	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
6	a	lithium / rubidium / caesium / francium (1)	1	<p>allow Li / Rb / Cs / Fr (1)</p> <p>Examiner's Comments</p> <p>Most candidates correctly gave the name of another Group 1 element.</p>
	b	bubbles or gas or hydrogen given off (1) (sodium) reacts quickly (1) (sodium) melts (1) (sodium) skates across surface of water (1) (sodium) floats (1)	2	<p>allow fizz (1)</p> <p>allow (yellow) flame observed (1)</p> <p>allow sodium gets smaller or disappears (1)</p> <p>allow forms a colourless solution (1)</p> <p>Examiner's Comments</p> <p>Good responses described several observations when sodium reacts with water. Most candidates scored at least one mark for stating that you see bubbles or fizzing. Centres are to be encouraged to advise candidates that a question worth two marks requires two points in their answer. Many candidates only wrote one observation.</p>
		Total	3	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
7	<p>Level 3 Candidate applies knowledge to predict the name of both products AND predicts a reaction time for rubidium AND writes a correctly balanced symbol equation. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>Level 2 EITHER Candidate applies knowledge to predict the names of both products AND predicts a reaction time for rubidium OR predicts a reaction time for rubidium AND attempts a symbol equation. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>Level 1 EITHER Candidate applies knowledge to predict the names of both products OR predicts a reaction time for rubidium and the name of one product OR candidate attempts a symbol equation. 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 A*.</p> <p>Indicative scientific points may include:</p> <p>Names of Products</p> <ul style="list-style-type: none"> hydrogen must be stated but can be in a word equation rubidium hydroxide must be stated but can be in a word equation <p>Reaction Time</p> <ul style="list-style-type: none"> any time less than 7 seconds / reaction time less than potassium <p>Equation</p> <ul style="list-style-type: none"> $2\text{Rb} + 2\text{H}_2\text{O} \rightarrow 2\text{RbOH} + \text{H}_2$ or correct multiple <p>note $\text{Rb} + \text{H}_2\text{O} \rightarrow$ product / formula is an attempt to write an equation</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p> <p><u>Examiner's Comments</u></p> <p>This question involved the chemistry of the alkali metals and also assessed quality of written communication. Most candidates could predict a reaction time for rubidium although some forgot to include the unit in their answer. Candidates found writing the symbol equation and naming the products much more demanding. Candidates often wrote the incorrect formulae and/or the incorrect products. The most common answers involved the formation of rubidium oxide and hydrogen.</p> <p>Level 3 was only available for candidates that could write the balanced symbol equation and gave the names of the correct products.</p>

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					Many candidates also included lots of extra material, for example explaining why rubidium reacted faster in terms of electron loss. Candidates must take care that they address the question that is set and not waste time including irrelevant material.
			Total	6	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
8	a	$2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ correct formulae (1) balancing – dependent on correct formulae (1)	2	<p>allow any correct multiple including fractions e.g. $4\text{Na} + 4\text{H}_2\text{O} \rightarrow 4\text{NaOH} + 2\text{H}_2$</p> <p>allow = or \rightarrow for arrow</p> <p>not 'and' or & for +</p> <p>allow one mark for correct balanced equation with minor errors of case, subscript or superscript e.g. $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}^2$ (1)</p> <p>Examiner's Comments</p> <p>Although many candidates could construct the balanced equation for the reaction between sodium and water there was a significant proportion of candidates that did not attempt to balance the equation. Only a small proportion of candidates tried to change the formulae of the reactants or products.</p>

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	b	all have one electron in their outer shell (1)	1	<p>allow orbit or energy level rather than shell</p> <p>allow have same number of electrons in outer shell (1)</p> <p>allow all lose one electron to make an ion / all lose one electron to get a stable outer shell / all lose 1 electron to get a stable outer octet / all lose 1 electron to get a complete outer shell (1)</p> <p>they all lose 1 electron is not sufficient on its own</p> <p>all have a single electron is not sufficient</p> <p>ignore to make stable atom</p> <p>Examiner's Comments</p> <p>Many candidates appreciated that all the elements in Group 1 had one electron in the outer shell. A small proportion of the candidates stated that the elements had the same number of electrons in the outer shell and this was also accepted in the mark scheme. Some candidates only referred to the elements losing one electron from the atom but this was not sufficient unless the answer referred to the formation of a stable outer shell. Other candidates made no reference to the outer shell electrons and just stated that the elements had similar properties.</p>
		Total	3	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
9	<p>Level 3 (5–6 marks) Candidate applies knowledge of the reaction of alkali metals to predict some observations or comments of the reaction of caesium with water including a comparison of the rate of reaction with lithium AND Constructs the balanced symbol equation for the reaction between caesium or lithium and water. Quality of written communication does not impede communication of science at this level.</p> <p>Level 2 (3–4 marks) Candidate applies knowledge of the reaction of alkali metals to predict some observations or makes comments about the reaction between caesium and water AND gives the names or formulae of products formed in the reaction between caesium and water. Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Candidate applies knowledge of the reaction of alkali metals to predict some observations or makes comments about the reaction between caesium and water OR gives the names or formulae of products formed in the reaction between caesium and water. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to A</p> <p>Indicative scientific points at level 3 must include:</p> <ul style="list-style-type: none"> • $2\text{Cs} + 2\text{H}_2\text{O} \rightarrow 2\text{CsOH} + \text{H}_2$ <p>OR</p> <ul style="list-style-type: none"> • $2\text{Li} + 2\text{H}_2\text{O} \rightarrow 2\text{LiOH} + \text{H}_2$. • faster reaction than with lithium / more reactive / more violent <p>Indicative scientific points at levels 1, 2 and 3 may include:</p> <ul style="list-style-type: none"> • caesium + water ? caesium hydroxide + hydrogen • lithium + water ? lithium hydroxide + hydrogen • hydrogen made • caesium hydroxide made • bubbles • fizzes • floats • moves on the surface • gives a flame • gets smaller • forms a colourless solution • alkaline solution formed • explodes • caesium loses electrons more easily <p>Examiner's Comments</p> <p>This six mark question was often well answered by candidates.</p> <p>The best answers gave the balanced equation for the reaction of caesium and water and then explained in terms of electron loss why caesium was more reactive than lithium. Candidates who did not know the symbol equation could get partial credit by writing the word equation. The production of hydrogen was well known but candidates were less likely to</p>

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					<p>name caesium hydroxide as the other product.</p> <p>Answers were often well constructed and many candidates needed extra space to complete their answers</p>
			Total	6	
10			<p>silver is deposited on the copper (strip) (1)</p> <p>because copper is more reactive than silver / silver is less reactive than copper / copper is higher in the reactivity series / silver is lower in reactivity series (1)</p>	2	<p>allow solution goes blue / copper turns black</p> <p>allow copper displaces silver / copper nitrate formed</p> <p>Examiner's Comments</p> <p>Candidates who scored two marks usually stated that silver was formed and copper nitrate produced.</p>
			Total	2	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
11	a	<p>any two from: because it reacts with water (1)</p> <p>because it reacts with oxygen / because it reacts with air (1)</p> <p>because it is a reactive metal (1)</p>	2	<p>allow so that it does not react / prevent contact with oxygen / air and water (2)</p> <p>allow it reacts with moist air or damp air (2)</p> <p>ignore prevents corrosion / rusting</p> <p>Examiner's Comments</p> <p>Most candidates were able to score at least 1 mark for explaining that lithium reacts with water or air.</p>

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	b	<p>Level 3 (5–6 marks) Candidates recall word equation or an unbalanced symbol equation for the reaction between either caesium or lithium and water. Candidate applies knowledge of the reaction of alkali metals to predict observations and names of products formed in the reaction between caesium and water, including the idea that the reaction with caesium is faster. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Candidate applies knowledge of the reaction of alkali metals to predict an observation and gives the name or formulae of a product formed in the reaction between caesium and water. Quality of written communication partly impedes communication of the science at this level.</p> <p>OR Candidates recall word equation or an unbalanced symbol equation for the reaction between either caesium or lithium and water.</p> <p>Level 1 (1–2 marks) Candidate applies knowledge of the reaction of alkali metals to make a simple observation</p> <p>OR names a product formed in the reaction of caesium with water. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C</p> <p>Indicative Scientific points may include</p> <p>Word equations</p> <ul style="list-style-type: none"> • caesium + water ? caesium hydroxide + hydrogen • $\text{Cs} + \text{H}_2\text{O} ? \text{CsOH} + \text{H}_2$ (need not be balanced) • lithium + water ? lithium hydroxide + hydrogen • $\text{Li} + \text{H}_2\text{O} ? \text{LiOH} + \text{H}_2$ (need not be balanced). <p>Relevant points</p> <ul style="list-style-type: none"> • hydrogen made • caesium hydroxide made • bubbles • floats and moves on the surface • gives a flame • gets smaller and forms a colourless solution • faster reaction than with lithium / extremely rapid reaction • caesium is more reactive than lithium • reaction is more explosive. <p>Examiner's Comments</p> <p>Most candidates were able to reach level 1 with either a product or an observation. Better candidates were able to reach level 2, but only a very few were able to give a correct word equation to get level 3. A common error was to state that lithium was more reactive.</p>
		Total	8	