

1 This question is about Group 2 and Group 17 (7).

(a) Barium chloride can be prepared from barium hydroxide in a neutralisation reaction.

Write the equation for this reaction. State symbols are **not** required.

..... [1]

(b) The reactivity of the Group 2 elements Mg–Ba increases down the group.

Explain why.

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(c) On gently heating, the compound KClO_3 reacts as shown in the equation.



This reaction is an example of disproportionation.

(i) State what is meant by *disproportionation* and use oxidation numbers to show that disproportionation has taken place.

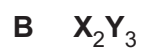
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(ii) What is the systematic name for KClO_4 ?

..... [1]

- 2 In the Periodic Table, element **X** is in Group 2 and element **Y** is in Group 15 (5).

What is the likely formula of an ionic compound of **X** and **Y**?



Your answer

[1]

3 Which statement about ammonium carbonate is **not** correct?

- A It reacts with $\text{Ba}(\text{NO}_3)_2(\text{aq})$ to form a white precipitate.
- B It effervesces with dilute nitric acid.
- C It release an alkaline gas with warm $\text{NaOH}(\text{aq})$.
- D It has the formula NH_4CO_3 .

Your answer

[1]

- 4 This question is about the halogen group of elements and some of their compounds.

(a) The halogens show trends in their properties down the group.

The boiling points of three halogens are shown below.

Halogen	Boiling point/°C
Chlorine	−35
Bromine	59
Iodine	184

Explain why the halogens show this trend in boiling points.

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5 Which statement about the reactions of halogens with halide ions is correct?

- A $I_2(aq)$ can oxidise $Br^-(aq)$.
- B $Cl_2(aq)$ can reduce $Br^-(aq)$.
- C $Br^-(aq)$ can reduce $Cl_2(aq)$.
- D $Cl^-(aq)$ can oxidise $I_2(aq)$.

Your answer

[1]

- 6 Which statement is **not** correct for Group 2 hydroxides?
- A** $\text{Mg}(\text{OH})_2$ can be used to treat indigestion.
- B** $\text{Ca}(\text{OH})_2$ is used in agriculture to neutralise alkaline soils.
- C** The anion in $\text{Sr}(\text{OH})_2$ contains 10 electrons.
- D** $\text{Ba}(\text{OH})_2$ is a product from the reaction of barium and water.

Your answer

[1]

- 7(a)** A student adds an excess of calcium oxide to water in a test tube.
In a separate test tube, the student adds an excess of strontium oxide to water.

(i) Write the equation for the reaction of calcium oxide with water.

State symbols are **not** required.

..... [1]

(ii) Suggest the approximate pH of the two solutions formed in the test tubes.

pH with calcium oxide

pH with strontium oxide

[1]

8 Which statement(s) for Group 2 elements is/are correct?

- 1 The 2nd ionisation energy of magnesium is greater than the 2nd ionisation energy of calcium.
- 2 A strontium ion, Sr^{2+} , contains a total of 6 electrons in s orbitals.
- 3 The equation for the reaction of barium with water is:
$$2\text{Ba} + 2\text{H}_2\text{O} \rightarrow 2\text{BaOH} + \text{H}_2.$$

- A** 1, 2 and 3
- B** Only 1 and 2
- C** Only 2 and 3
- D** Only 1

Your answer

[1]

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(a)

The student adds aqueous sodium chloride to one test tube, and aqueous sodium iodide to the other test tube.

The student shakes the mixtures, allows them to settle, and records the colour of the organic layer in each mixture.

Sodium halide	Colour of organic layer
Sodium chloride	orange
Sodium iodide	violet

Explain how the student's results provide evidence for the trend in reactivity of the halogens down group 17(7) and write an ionic equation for any reaction that takes place.

Use your chemical knowledge to explain the trend in reactivity.

[5]

(b) Chlorine is used in water treatment.

State **one** benefit and **one** risk of using chlorine in water treatment.

Benefit

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Risk

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[1]

10 Which statement(s) explain(s) the trend in boiling points down the halogens group?

1: The induced dipole–dipole interactions (London forces) become stronger.

2: The covalent bonds become stronger.

3: The permanent dipole–dipole interactions become stronger.

A 1, 2 and 3

B Only 1 and 2

C Only 2 and 3

D Only 1

Your answer

[1]

- 11** An aqueous solution contains a mixture of chloride, bromide and iodide ions.

$\text{AgNO}_3(\text{aq})$ is added to this mixture, followed by an excess of dilute $\text{NH}_3(\text{aq})$.

The resulting mixture is then filtered.

Which compound(s) is/are present in the residue on the filter paper?

- A** AgCl only
- B** AgCl and AgBr
- C** AgBr only
- D** AgBr and AgI

Your answer

[1]

12 This question is about the reactions of Group 2 metals and their compounds.

- (a)** A student adds magnesium to dilute hydrochloric acid in one test tube.
The student adds calcium to dilute hydrochloric acid in a second test tube.

A redox reaction takes place in each test tube.

- (i)** Suggest **two** observations from the student's experiment that would show that calcium is more reactive than magnesium.

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..... **[1]**

- (ii)** Write half-equations for the reaction of magnesium with hydrochloric acid.

Oxidation half-equation:

Reduction half-equation:

[2]

- 13** A student adds aqueous potassium carbonate to one test tube and aqueous silver nitrate to a second test tube.

The student adds dilute hydrochloric acid to each test tube.

Which row has the correct observations?

	Aqueous potassium carbonate	Aqueous silver nitrate
A	no change	precipitate
B	no change	no change
C	effervescence	no change
D	effervescence	precipitate

Your answer

[1]

14 Which compounds of magnesium can be used as 'antacids'?

- A** Chlorides
- B** Hydroxides
- C** Nitrates
- D** Sulfates

Your answer

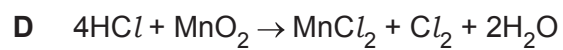
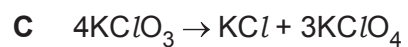
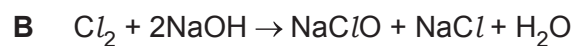
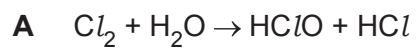
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- 15** Which statement explains the trend in boiling points down the halogens group?
- A** The bond enthalpy of the covalent bonds increases.
 - B** The halogens become less electronegative.
 - C** The induced dipole–dipole interactions (London forces) become stronger.
 - D** The reactivity of the halogens decreases.

Your answer

[1]

16 Which equation does **not** represent a disproportionation reaction?



Your answer

[1]

17 Chlorine has the electron configuration $[\text{Ne}]3s^23p^5$.

Which statement(s) about chlorine is/are correct when it reacts in redox reactions?

- 1** It can gain one electron to form $1-$ ions.
- 2** It can lose its $3s^2$ electrons to form $2+$ ions.
- 3** It can lose its $3p^5$ electrons to form $5+$ ions.

- A** 1, 2 and 3
- B** Only 1 and 2
- C** Only 2 and 3
- D** Only 1

Your answer

[1]

18 This question is about elements in the periodic table.

(a) Chlorine has many uses.

(i) Chlorine is used to treat water in large-scale water treatment plants.

Suggest why chlorine is added to water in large-scale water treatment plants.

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..... **[1]**

(ii) Sea water contains aqueous bromide ions.

Chlorine is used to extract bromine from sea water.

Construct the ionic equation for this reaction and explain why chlorine is suitable for this extraction of bromine but iodine is **not**.

Equation

Explanation

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..... **[2]**

(b)* The table shows the melting points of some of the elements in Period 3 of the periodic table.

Element	Al	Si	P ₄	S ₈
Melting point/°C	660	1410	44	119

Explain the melting points in terms of bonding and structure. [6]

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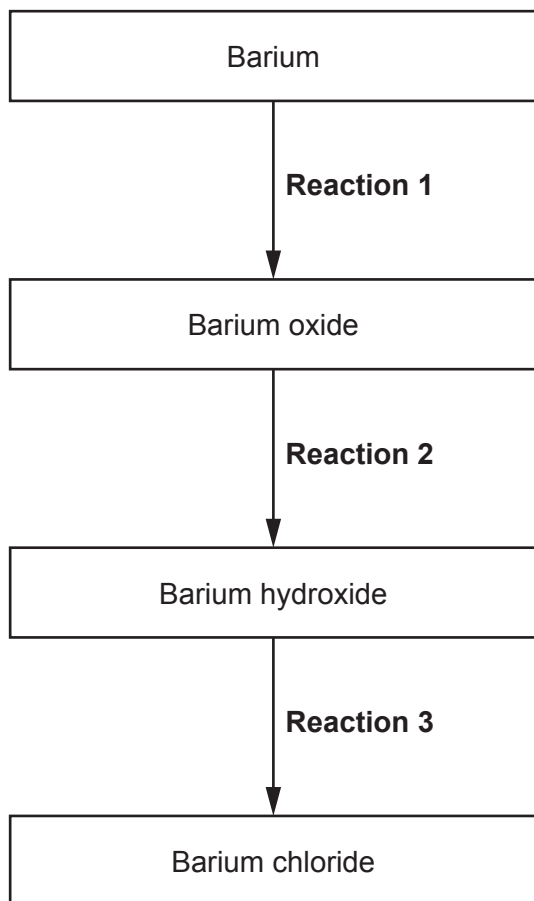
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19(a) The flowchart shows some reactions of barium and its compounds.



- Write balanced equations for **Reaction 1** and **Reaction 2**.
- Identify the type of reaction in **Reaction 3**.

Reaction 1: equation

Reaction 2: equation

Reaction 3: type of reaction

[3]

20 Barium is in Group 2 of the periodic table.

Which statement(s) about barium is/are correct?

- 1** Its outer shell electrons are in an s-orbital.
- 2** It reacts more vigorously with water than magnesium.
- 3** It has a higher first ionisation energy than magnesium.

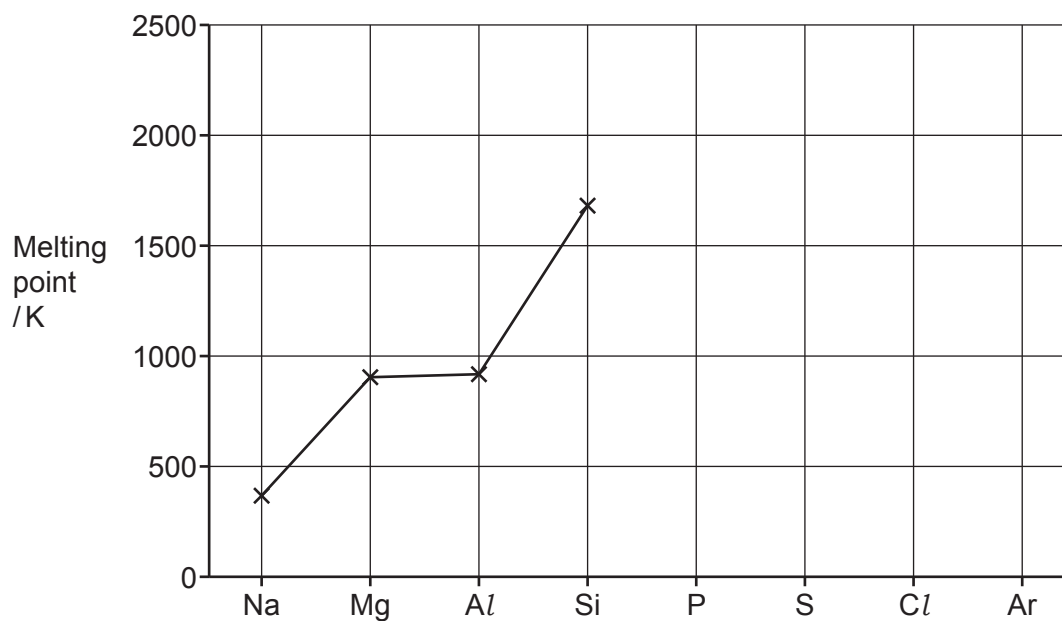
- A** 1, 2 and 3
- B** Only 1 and 2
- C** Only 2 and 3
- D** Only 1

Your answer

[1]

21 This question is about trends in the periodic table.

(a) The graph shows the melting points for Period 3 elements from sodium to silicon.



(i) Complete the graph to show approximate melting points for P, S, Cl and Ar. [2]

(ii) Explain why silicon has a higher melting point than aluminium.

Use ideas about structure and bonding in your answer.

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..... [3]

(b) A student adds an aqueous solution of bromine, Br₂(aq), to two test tubes.

The student adds aqueous sodium iodide, NaI(aq), to the Br₂(aq) in one test tube, and aqueous sodium chloride, NaCl(aq), to the Br₂(aq) in the other test tube.

Complete the table to show the student's observations.

Write ionic equation(s) for any reaction(s) that take place.

Solutions	Observations
Br ₂ (aq) + NaI(aq)	
Br ₂ (aq) + NaCl(aq)	

Ionic equation(s)
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..... [3]