

1. Group 2 compounds can be used in agriculture to neutralise acid soils and in medicine to treat indigestion.

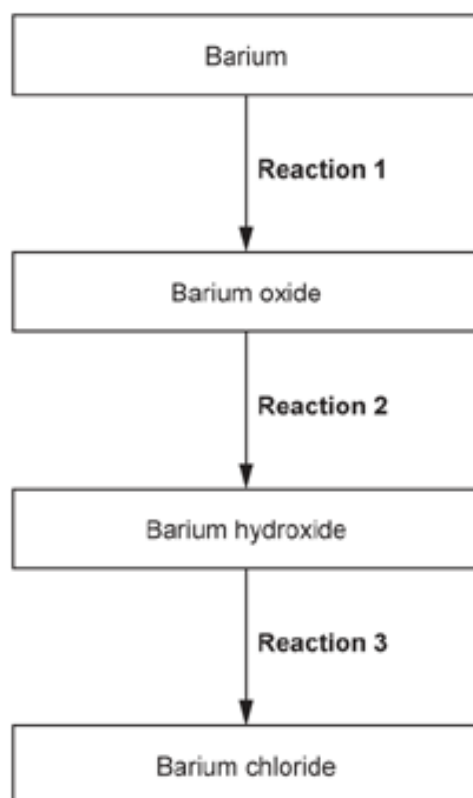
Which Group 2 compound is **not** suitable for either use?

- A $\text{Mg}(\text{OH})_2$
- B MgSO_4
- C CaCO_3
- D CaO

Your answer

[1]

2. 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]

3. Which compounds of magnesium can be used as 'antacids'?

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

Your answer

☐

[1]

4(a). This question is about periodicity and the reaction of some Group 2 metals.

Periodicity is the repeating trend in properties of elements across different periods in the periodic table.

- i. Complete the table below with the electron configurations and blocks.

	Group 2	Group 17 (7)
Period 2	Be 1s ²	F 1s ²
Period 3	Mg 1s ²	Cl 1s ²
Block

[3]

- ii. Use your answers to (i) to explain why electron configuration is an example of a periodic trend.

[2]

- iii. Mg forms 2+ ions but Cl usually forms 1- ions in their reactions. Explain why.

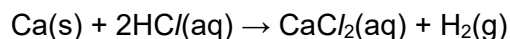
[2]

- iv. Magnesium reacts with oxygen in the air.

Write the equation for this reaction.

-----[1]

- (b). The reaction between calcium and hydrochloric acid is a redox reaction.



Equation 2.1

- i. Explain, in terms of electron transfer, why the reaction shown in **equation 2.1** is a redox reaction.

-----[2]

- ii. A student plans to add 0.0100 mol of Ca to 120 cm³ of 0.100 mol dm⁻³ HCl (aq).

When the student carries out this reaction, they are surprised that all the calcium reacts, despite being in excess of the HCl(aq).

- Show by calculation that calcium is in excess of the HCl(aq).
- Suggest a reason for this unexpected result.

-----[3]

5. This question is about acids and bases.

A student reacts an excess of magnesium with 25.0 cm³ of 0.500 mol dm⁻³ hydrochloric acid, HCl.

The student also reacts an excess of magnesium with 25.0 cm³ of 0.500 mol dm⁻³ ethanoic acid, CH₃COOH.

- i. Construct an ionic equation for the reaction of magnesium with an acid.

-----[1]

- ii. Explain why these two reactions of magnesium produce the same volume of gas but at different rates.

-----[3]

6. This question is about energy changes.

The first and second ionisation energies of magnesium, Mg, and strontium, Sr, in Group 2 are given in the table below.

Element	First ionisation energy / kJ mol^{-1}	Second ionisation energy / kJ mol^{-1} 1
Mg	+738	+1451
Sr	+550	+1064

- Explain why the first ionisation energy of Mg is greater than the **first** ionisation energy of Sr.
- Explain why the second ionisation energy of Sr is greater than the **first** ionisation energy of Sr.

-----[4]

7. This question is about some elements in Period 3 and compounds they form.

A student adds a small piece of calcium to a beaker containing an excess of water.

- i. Construct the equation for the reaction and predict **one** observation that the student would make.

Equation _____

Observation _____

----- [2]

- ii. Suggest **one** difference that the student would observe in the reaction of barium with water compared to the reaction of calcium with water.

----- [1]

8(a). This question is about the reactions of Group 2 metals and their compounds.

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.

1 _____

2 _____

[1]

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

Oxidation half-equation: _____

Reduction half-equation: _____

[2]

(b). A sample of barium oxide is added to distilled water at 25 °C.
A colourless solution forms containing barium hydroxide, Ba(OH)₂.

The solution is made up to 250.0 cm³ with distilled water.
The pH of this solution is 13.12.

- i. Determine the mass of barium oxide that was used.

Give your answer to **3** significant figures.

mass of barium oxide = g **[5]**

- ii. 10 cm³ of dilute sulfuric acid is added to 10 cm³ of the colourless solution of Ba(OH)₂. Write an ionic equation, including state symbols, for the reaction.

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

9(a). This question is about some Group 2 elements and their compounds.

A student adds barium oxide, BaO, to water.

A reaction takes place forming a colourless solution.

- i. Predict the approximate pH of the colourless solution.

pH = **[1]**

- ii. A student adds a few drops of dilute sulfuric acid to the colourless solution.

Describe what the student would observe, and give the formula of the barium compound produced.

Observation

Formula of barium compound

[2]

(b). Strontium and calcium both react with water.

- i. Write an equation for the reaction of strontium with water.

-----[1]

- ii. Using oxidation numbers, explain why the reaction of strontium with water is a redox reaction.

-----[2]

- iii. Explain why calcium reacts more slowly with water than strontium does.

-----[3]

END OF QUESTION PAPER