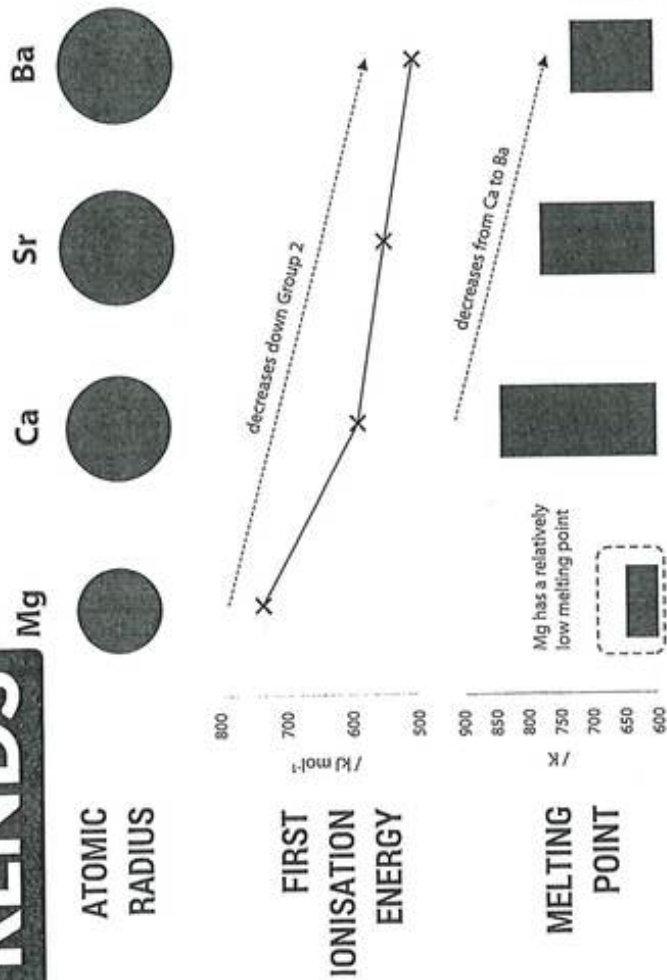


GROUP 2: the ALKALINE EARTH METALS

Y12 TEEM 5

2

TRENDS



SOLUBILITY IN WATER

HYDROXIDES

Hydroxides of Group 2 metals

increase

in solubility down the group.

Mg(OH)_2 sparingly soluble
 Ca(OH)_2 slightly soluble
 Sr(OH)_2 soluble to 0.1 mol dm^{-3}
 Ba(OH)_2 soluble

EXAM TIP

Don't forget to mention all the factors which can affect ionisation energy.

SULFATES

Hydroxides of Group 2 metals

decrease

in solubility down the group.

MgSO_4 soluble
 CaSO_4 slightly soluble
 SrSO_4 insoluble
 BaSO_4 insoluble

EXAM TIP

You won't be asked to explain the solubility trends in an exam, but you will need to know the trends, and that Mg(OH)_2 is sparingly soluble.

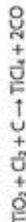
REACTIONS WITH WATER

USES OF GROUP 2 AND THEIR COMPOUNDS

EXTRACTION OF TITANIUM

Magnesium is used in the extraction of titanium from titanium ore (rutile).

Rutile, chlorine and coke are heated to 1000°C and the titanium oxide reacts.



TiCl_4 is separated from impurities and magnesium is added as a reducing agent.



Mg acts as a reducing agent because Ti changes oxidation state from +4 to 0.

BASES IN MEDICINE AND AGRICULTURE

Mg(OH)_2 is used as an antacid, which means it reacts with stomach acid to alleviate some of the symptoms of indigestion.



Ca(OH)_2 is used as a base in agriculture. Ca(OH)_2 is spread on fields to reduce the acidity of the soil.



SCRUBBING FLUE GASES

A flue is a chimney from a factory. Flue gases may contain sulfur dioxide or other gases. To prevent these gases entering the environment, Ca(OH)_2 is injected into the chimney.

Ca(OH)_2 reacts with SO_2 in this reaction:



The CaSO_3 is a solid which can be easily disposed of.

This process is known as scrubbing.

TESTING FOR SULFATE IONS

Acidified BaCl_2 solution can be added to a solution to test for sulfate ions.



BaSO_4 is insoluble, so precipitates out of the solution. The solution goes cloudy white.

The BaCl_2 is acidified with HCl. The acid reacts with carbonates, removing carbonate ions from the solution. If this isn't done, $\text{BaCO}_3(\text{s})$ will be formed, which is also a cloudy white precipitate.

CONTRAST AGENT

Barium sulfate, BaSO_4 , is used in medicine as a contrast agent.

A patient is given a 'barium meal', which is a drink containing a milky suspension of barium sulfate.

When the barium sulfate is in the gastrointestinal tract, it can be easily seen using an X-ray, because barium absorbs X-rays.

EXAM TIP

You should be able to explain why BaCl_2 is acidified.

THE TREND

The metals are more reactive down Group 2.

Mg reacts with steam.



Ca, Sr and Ba all react with cold water, with the same general reaction.



This reaction is more vigorous down the group.

Metals lower in the group produce a more alkaline solution and less of the hydroxide precipitate because the hydroxides are more soluble down the group.

EXPLAINING THE TREND

When Group 2 metals react with water, M^{2+} ions are formed.

Metals further down Group 2 have lower first and second ionisation energies, so forming the M^{2+} ion requires less energy. As a result, the reactions have lower activation energies down the group so the reactivity increases.