CHAPTER 11: GROUP 2

Physical and chemical properties of G2 elements:

- Be • Number of valence electrons: 2
 - Fixed oxidation state of +2
 - Valence electrons occupy s orbital
- Going down the group, Sr

Mg

Ca

Ba

Ra

- · outer electrons occupy a new principal quantum shell further from the nucleus
- metallic radius increases, IE decreases
- reactivity increases

Solubility of G2 hydroxides and sulfates in water:

- **G2** Hydroxides
 - o Increases going down group 2
- **G2** Sulfates
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 - - Ba: barium
 - Ca: calcium
 - P: lead, Pb
 - S: strontium, Sr

Thermal decomposition (TD) of G2 carbonates and nitrates:

- **G2** Carbonates
 - Example: $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ limestone Δ
 - Observation:
 - White solid
 - Gas turns limewater chalky
 - Trend going down group 2:
 - Temperature at which TD occurs increases
 - Thermal stability increases
- **G2 Nitrates**
 - O Example: $2Ca(NO_3)_2(s) \rightarrow 2CaO(s) + 4NO_2(g) + O_2(g)$

G2 hydroxides + HCl:

Element	Chemical equation
Mg	$Mg(OH)_2(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + 2H_2O(l)$
Ca	$Ca(OH)_2(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + 2H_2O(l)$
Sr	$Sr(OH)_2(aq) + 2HCl(aq) \rightarrow SrCl_2(aq) + 2H_2O(l)$
Ва	$Ba(OH)_2(aq) + 2HCl(aq) \rightarrow BaCl_2(aq) + 2H_2O(l)$

(Similar to reaction between G2 oxides + HCl)

G2 hydroxides + H₂SO₄:

Element	Observation	Chemical equation	uk
Mg	Clear solution formed	Chemical equation $Mg(OH)_2(s) + H_2SO_4(aq) \rightarrow MgSO_2(aq) $	
Ca	Reaction stops quickly to form sparingly soluble ppt	Ca(OH) C	
Sr	Reaction stops quickly to four insoluble, white ppt	O $Sr(OH)_2(aq) + H_2S(2q+1) \rightarrow Sr(O_4(s) + 2H_2O(l)$	
Ba	Reaction so, Squickly to form insoluble, white ppt	(aq) + $H_2SO_4(aq) \rightarrow BaSO_4(s) + 2H_2O(l)$	

^{*}Trend: solubility of sulfates decrease down the group

G2 carbonates + HCl:

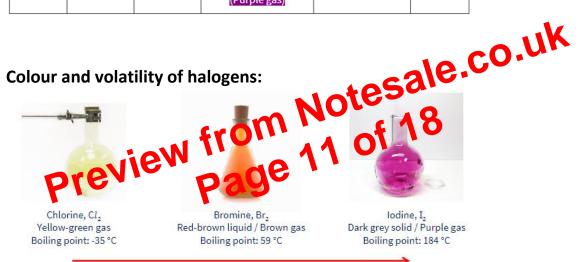
Element	Chemical equation		
Mg	$MgCO_3(s) + 2 HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l) + CO_2(g)$		
Ca	$CaCO_3(s) + 2 HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$		
Sr	$SrCO_3(s) + 2 HCl(aq) \rightarrow SrCl_2(aq) + H_2O(l) + CO_2(g)$		
Ва	$BaCO_3(s) + 2 HCl(aq) \rightarrow BaCl_2(aq) + H_2O(l) + CO_2(g)$		

 $^{{}^{*}}$ SuBaCaPS: sulfates of barium, calcium, lead and strontium are insoluble in water

CHAPTER 12: GROUP 17

Properties of halogens:

Halogen	Melting point /°C	Boiling point /°C	Appearance	E(X-X) / kJ mol ⁻¹	E(H-X) / kJ mol ⁻¹
F ₂ (extra)	-220	-188	Pale yellow gas	158	562
Cl ₂ (g)	-101	-35	Yellow-green gas	242	431
Br ₂ (l)	-7	59	Red-brown liquid (Brown gas)	193	366
I ₂ (s)	114	184	Dark grey solid (Purple gas)	151	299



Yellow-green gas Boiling point: -35 °C

- → Molecule size / number of electrons increase
- → Stronger id-id forces
- → Hence boiling point increases

Bond strength of halogens:

Bond	Bond enthalpy / kJ mol ⁻¹	Trend going down Group 17	
F-F	158	(extra) high electron density in F₂ causes additional repulsive forces, weakening the F–F bond	
Cl – Cl	242	→ Increasing distance between nuclei → Weaker orbital overlap → Attraction between nuclei and electrons decreases	
Br – Br	193		
I – I	151		