Group 2 and 7

Q1) Group 2

① Outer most electronic configuration is ns^2

② Oxidation state = +2

③ They are alkaline earth metals
↳ their oxides react with water to form alkaline sol^n

④ Good conductors of heat & electricity
↳ Metalic bonding ∴ free e^- available

⑤ They are all shiny metals
↳ On oxidation they form solid white metal oxides

⑥ They all burn with a characteristic flame
Mg : White
Ca : Brick Red
Sr : Red
Ba : Apple green

⑦ Down the group reactivity increses
↳ because ionization energy decreses
(Reactivity depends on the loss/gain of e^-)

⑧ Down the group MP and BP decreases
↳ size of atom increases ∴ strength of metillic bond decreses

Q2) Reaction of group II elements in air
- All react with oxygen to form oxides which are white solids

$$2M_{(s)} + O_{2(g)} \longrightarrow 2MO_{(s)}$$

$$MO_{(s)} + H_2O_{(l)} \longrightarrow M(OH)_{2(aq)}$$

down the group pH increases (more alkaline)

Q3) Reaction of Group II elements with water

$$M_{(s)} + 2H_2O_{(l)} \xrightarrow{\text{slow}} M(OH)_{2(aq)} + H_{2(g)}$$
cold

$$M_{(s)} + H_2O_{(g)} \xrightarrow{\text{fast}} MO_{(s)} + H_{2(g)}$$
steam

* down the group reactivity increases, ∴ H_2 is released more easily.

Q4) Thermal decomposition of Group II carbonates & Nitrates

$$CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$$

↳ colourless gas produced.

$$2Ca(NO_3)_2(s) \xrightarrow{\Delta} 2CaO(s) + 4NO_2(g) + O_2(g)$$

↳ brown gas produced.

Decomposition temperature down the group increases.
↳ stability increases

Q-5) Reaction of group II elements & its compounds with HCl.

$$Mg + 2HCl \longrightarrow MgCl_2 + H_2$$

$$MgO + 2HCl \longrightarrow MgCl_2 + H_2O$$

$$MgCO_3 + 2HCl \longrightarrow MgCl_2 + H_2O + CO_2$$

Q6) Uses of Group II compounds

- $CaCO_3$:
  - lime-stone ; provide rocks for building to make cement
- $Ca(OH)_2$:
  - used to neutralise acidic soil
- MgO :
  - used to line furnaces because of its high MP

Q7) Group 7 elements (Halogens)

① Outermost electronic configuration is $ns^2\ np^5$

② Oxidation state is -1

(3) They all exist as diatomic molecules and all are non metals
- They all have single covalent bond between two atoms in each molecule

(4) Down the group the colour darkens
F : yellow
Cl : greenish yellow
Br : orange / red
I : grey solid (purple vapour)

(5) Down the group reactivity decreases → get less powerful as oxidising agents.
↳ electronegativity decreases

(6) Down the group MP and BP increases (reactivity decreases)
- As no. of e^- increases, VVF increases

(Q8) Reaction of Group VII elements with Hydrogen.

$H_2(g) + Cl_2(g) \longrightarrow 2HCl(g)$ (react explosively in sunlight)

(*) Stability of hydrogen halides decreases down the group because bond length increases down the group (size of atom increases) ∴ less energy is required to break the bonds.

(Q9) Displacement reactions of Halogens.
- A more reactive halogen displaces a less reactive halogen from a halide solution of the less reactive halogen

	Cl^-	Br^-	I^-
Cl_2	—	orange colour ($Br_2(aq)$)	purple ($I_2(aq)$)
Br_2	—	—	purple ($I_2(aq)$)
I_2	—	—	—

Q-8) ✱ $H_2(g) + F_2(g) \longrightarrow 2HF(g)$ (reacts explosively even in cool dark conditions)

$H_2(g) + Br_2(g) \longrightarrow 2HBr$ (reacts slowly on heating)

$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ (forms an equilibrium mixture on heating)

Q10) Testing for halide ions

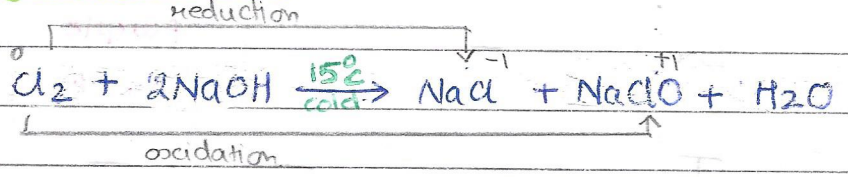
	dilute HNO_3 + $AgNO_3(aq)$	dilute $NH_3(aq)$	concentrated $NH_3(aq)$	
Cl^-	white ppt.	soluble	soluble	$Ag^+_{(aq)} + Cl^-_{(aq)} \rightarrow AgCl(s)$
Br^-	cream ppt. (pale yellow)	insoluble	soluble	$Ag^+(aq) + Br^-(aq) \rightarrow AgBr(s)$
I^-	yellow ppt.	insoluble	insoluble.	$Ag^+(aq) + I^-(aq) \rightarrow AgI(s)$

* $AgNO_3(aq) + X^-(aq) \longrightarrow AgX(s) + NO_3^-(aq)$
  ↳ $AgX(aq) + 2NH_3(aq) \rightarrow Ag(NH_3)_2(aq) + X^-(aq)$
* $NaX(s) + H_2SO_4(l) \longrightarrow NaHSO_4(s) + HX(g)$
  ↓
* $2HX(g) + H_2SO_4(l) \longrightarrow X_2(g) + SO_2(g) + 2H_2O(l)$ (F and Cl doesn't react)
  ↳ H_2SO_4 not strong enough to oxidise.

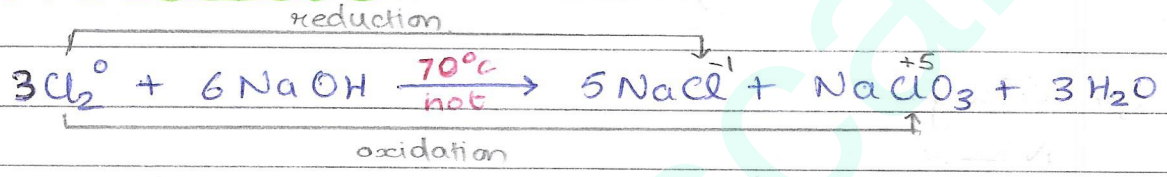
Q11) Disproportionation reactions of Halogens

- when the same elements goes under oxidation & reduction reaction, it is known as disproportionation.

- Chlorine in cold alkali



- Chlorine with hot alkali



Q12) Uses of halogens & its compounds

- ~~Eto~~ Chlorination of water (HClO)
- Bleach (NaCl + NaClO)
- Plastic PVC