NO:

DATE: 25.08.18

Topic 9 - Group VII Elements (Halogens)

→ **Trends**, Going down the group :

- → colour intensity ↑
- → "soliolity" ↑
- → Bp ↑
- → electro-veity ↓ (because shielding effect ↑, atomic radii ↑ less able to attract e^- towards itself)
- → oxidising power ↓ (because ↑) → reducing power of ions ↑

F_2	(yelow)
Cl_2	(green)
Br_2	(red-brown)
I_2	(grey)

* more reactive halogen will displace less reactive one.

→ Test for halogens → F ⇒ starch iodide paper ($I^- \rightarrow I_2$) ∴ blue black } or $2Br^- \rightarrow Br_2$

Cl ⇒ "

I ⇒ add starch solution, hexane → purple, ethanol → brown

→ Hydrogen halides → form white fumes when add ammonia. (ammonium salt sublimes)

→ Hydrogen halides as acids → dissociation of halides depends on H-X bond strength (strength ↓, dissociation ↑)

→ HCl < HBr < HI (HF forms strong Hbonds w/ each other)

→ Hydrogen halides reducing ability → Iodide strongest ⇒ bigger ion, more e^-, e^- less attracted ∴ can donate e^-

→ Test for halides ions ⇒ like test in Halogenoalkanes, but no need to use NaOH to use nucleophilic substitution to remove the halogen.

TEST ①

→ just start w/ HNO_3 to remove carbonate,

↳ then Add $AgNO_3$ then ammonia (decant ppt first before adding NH_3)

F	no ppt (AgF soluble)	-	
Cl	white ppt	soluble in dilute ammonia	* exam won't give conc. ammonia
Br	cream ppt	insoluble in dilute ammonia soluble in conc. ammonia	
I	yellow ppt	insoluble in both	

→ when they dissolve, a colourless diammine complex formed, $[Ag(NH_3)_2]^+(aq)$

$AgCl + NH_3 \rightarrow [Ag(NH_3)_2]^+ Cl^-$

TEST ②

→ add conc. H_2SO_4 to salts

→ forms (HCl, HBr, HI), then from $2B^- \rightarrow Br_2$, $2I^- \rightarrow I_2$ by displacement

BUT not $2Cl^- \rightarrow Cl_2$ too strong...

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O: ~~misty fumes~~

→ CHLORIDE : $NaCl(s) + H_2SO_4(l) \rightarrow HCl(g) + NaHSO_4(s)$ or Na_2SO_4

→ BROMIDE : $NaBr(s) + H_2SO_4(l) \rightarrow HBr(g) + NaHSO_4(s)$ — stage 1

$HBr(g) + H_2SO_4(l) \rightarrow Br_2(l) + 2H_2O(l) + SO_2(g)$ — stage 2

O : misty fumes (HBr), red brown vapour (Br_2), colourless gas (SO_2)

→ IODIDE : $NaI(s) + H_2SO_4(l) \rightarrow NaHSO_4(s) + HI(g)$ * product formed depends on amount of NaI

- $2HI(g) + H_2SO_4(l) \rightarrow I_2(s) + SO_2(g) + 2H_2O(l)$
- $6HI(g) + H_2SO_4(l) \rightarrow 3I_2(s) + S(s) + 4H_2O(l)$
- $8HI(g) + H_2SO_4(l) \rightarrow 4I_2(s) + H_2S(g) + 4H_2O(l)$

oxidising agent (H_2SO_4) gets reduced more & more

O : misty fumes (HI), purple vapour (I_2), colourless gas (SO_2), yellow solid (S), bad egg smell (H_2S).

→ Chlorine's oxidation states.

→ with cold NaOH (15°C) = disproportionation.

$2NaOH(aq) + Cl_2(aq) \rightarrow NaOCl(aq) + NaCl(aq) + H_2O(l)$

(0) → sodium chlorate (I) NaOCl: bleach, (+1) oxi; NaCl: (-1) red

→ with hot NaOH (70°C).

$6NaOH(aq) + 3Cl_2(aq) \rightarrow NaClO_3(aq) + 5NaCl(aq) + H_2O(l)$

sodium chlorate (V)

* sodium chlorate (I) disproportionates when heated

$3OCl^-(aq) \rightarrow 2Cl^-(aq) + ClO_3^-(aq)$

(+1) (-1) (+5)

to manufacture bleach.

→ ClO^- (chlorate (I)) ions are oxidising agents

$ClO^- + 2H^+ + 2e^- \rightarrow Cl^- + H_2O$ [eg. redox titrations $ClO^-(aq) + 2H^+(aq) + 2I^-(aq) \rightarrow Cl^-(aq) + H_2O(l) + I_2(aq)$

→ Uses of chlorine
- → manufacture of bleach
- → use as disinfectant in pools & water treatment
- → manufacture PVC
- → halogenated hydrocarbons as solvents (CCl_4) → i) toxic ii) ozone layer depletion ~~from chlorofluorocarbons~~.
- → refrigerants & aerosols