Halogens Map

Edexcel International A Level Chemistry · Unit 2 · Topic 8C Inorganic Chemistry of Group 7

1 Physical trends

8.24

- Boiling temperature **rises**: more electrons
- Cl_2 gas, Br_2 liquid, I_2 solid
- Electronegativity **falls**: F 4.0 → I 2.5
- More shells, more shielding



2 Displacement

8.25

- Oxidising power: **Cl_2 > Br_2 > I_2**
- $Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$
- Hexane: Br_2 **orange-red**, I_2 **purple**
- Water: Br_2 yellow-orange, I_2 brown

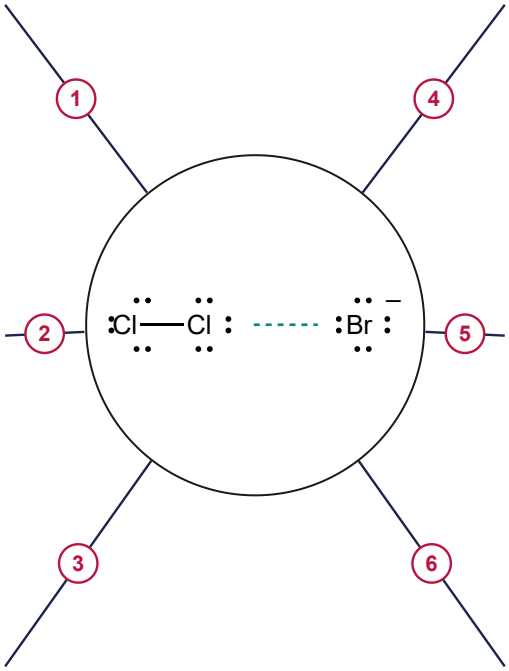


3 Halogens with metals

8.26 i

- $2Na + Cl_2 \rightarrow 2NaCl$
- $Mg + Br_2 \rightarrow MgBr_2$
- Metal **oxidised**; halogen **reduced**
- Halogen 0 → −1





4 Chlorine disproportionates

8.26 ii-iv

- $Cl_2 + H_2O \rightleftharpoons HCl + HClO$
- Cold NaOH: NaCl + **NaClO** (bleach)
- Hot NaOH: 5NaCl + **$NaClO_3$**
- Cl 0 → −1, +1 or +5



5 Halides with H_2SO_4

8.27 i

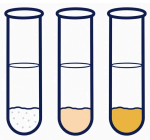
- Cl^-: steamy HCl fumes only
- Br^-: Br_2 + **SO_2** (S +4)
- I^-: I_2, SO_2, S, **H_2S** (S −2)
- Reducing power: **I^- > Br^- > Cl^-**



6 Tests and predictions

8.27 ii-iii, 8.28

- AgCl white, AgBr cream, AgI yellow
- NH_3: dilute, conc., insoluble
- $HX + NH_3 \rightarrow NH_4X$: **white smoke**
- At: black solid; AgF soluble



The halides compared

one larger ion explains most of the rows

Halide	With $AgNO_3$	NH_3	With conc. H_2SO_4
F^-	no precipitate	–	HF only
Cl^-	white AgCl	dissolves in dilute	HCl only: steamy fumes
Br^-	cream AgBr	dissolves in concentrated	HBr, Br_2, SO_2
I^-	yellow AgI	insoluble	HI, I_2, SO_2, S, H_2S

Worked examples

Predict a displacement

- Br_2 + KI: yes
- $Br_2 + 2I^- \rightarrow 2Br^- + I_2$
- hexane layer **purple**

Hot alkali

- $3Cl_2 + 6OH^-$
- $\rightarrow 5Cl^- + ClO_3^- + 3H_2O$
- 5 e^- gained = **5 e^- lost**

Name the halide

- cream precipitate
- dissolves in conc. NH_3 only
- **bromide**

Halogens return with halogenoalkanes (Topic 10), redox titrations and electrode potentials (Topic 14).

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