Halogens Map

AQA A-level Chemistry · 3.2.3 Group 7(17), the halogens

1 Physical trends

3.2.3.1 i-ii

- Boiling point **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

3.2.3.1 iii

- 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

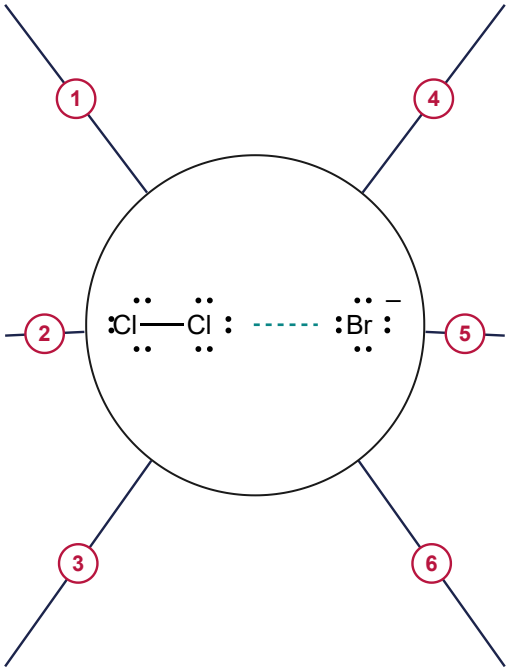


3 Chlorine in water

3.2.3.2 iii-iv

- $Cl_2 + H_2O \rightleftharpoons HCl +$ **HClO**
- Sunlight: $2Cl_2 + 2H_2O \rightarrow 4HCl + O_2$
- Kills bacteria: **benefit** outweighs risk
- Risks: toxic gas; chlorinated organics





4 Chlorine disproportionates

3.2.3.2 i-ii

- Cl 0 → −1 and +1 in one reaction
- Cold dilute NaOH: NaCl + **NaClO**
- $Cl_2 + 2NaOH \rightarrow NaCl + NaClO + H_2O$
- NaClO solution: **bleach**



5 Halides with H_2SO_4

3.2.3.1 iv

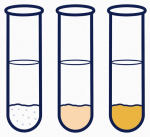
- Cl^-: steamy HCl fumes only
- Br^-: Br_2 + **SO_2** (S +4)
- I^-: I_2, SO_2, S, **H_2S** (S −2)
- Reducing power: **I^- > Br^- > Cl^-**



6 Silver nitrate tests

3.2.3.1 v-vii

- AgCl white, AgBr cream, AgI yellow
- Acidify with **HNO_3** first
- Dilute NH_3: **AgCl** dissolves
- Conc. NH_3: AgBr dissolves; **AgI** does not



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**

Cold alkali

- $Cl_2 + 2OH^-$
- $\rightarrow Cl^- + ClO^- + H_2O$
- Cl 0 → −1 and **+1**

Name the halide

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

Halogens return with halogenoalkanes (3.3.3) and electrode potentials (3.1.11).

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