# Halogens Map

OCR A Level Chemistry A · 3.1.3 The halogens

## 1 Physical trends

3.1.3(a), (d)

- Boiling point **rises**: more electrons
- $Cl_2$ gas, $Br_2$ liquid, $I_2$ solid
- Reactivity **falls** down the group
- More shells, more shielding



## 2 Displacement

3.1.3(c)

- 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

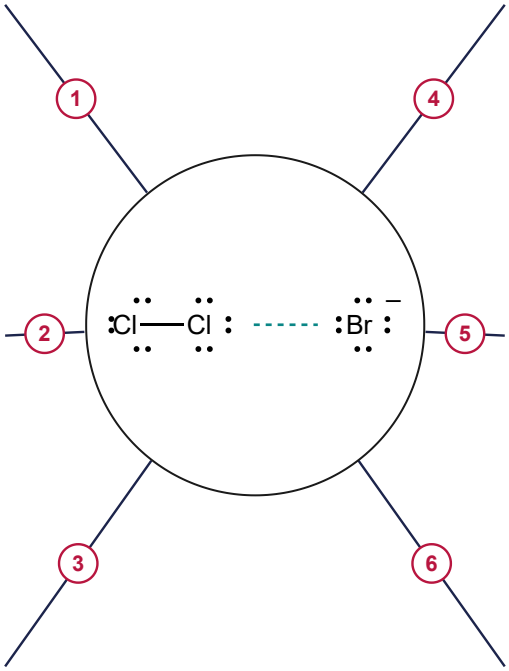


## 3 Chlorine in water

3.1.3(e)(i), (f)

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






## 4 Chlorine disproportionates

3.1.3(e)(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 Halogens as oxidising agents

3.1.3(b)

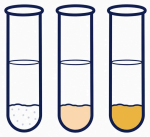
- Outer shell **$s^2p^5$**
- $X_2 + 2e^- \rightarrow 2X^-$
- $Mg + Cl_2 \rightarrow MgCl_2$: halogen **reduced**
- Oxidising power **falls** down the group



## 6 Silver nitrate tests

3.1.3(g)

- 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

acidify with dilute nitric acid, add silver nitrate, then ammonia

| Halide | With $AgNO_3$ | Dilute $NH_3$ | Concentrated $NH_3$ |
|---|---|---|---|
| $Cl^-$ | white AgCl | dissolves | dissolves |
| $Br^-$ | cream AgBr | does not dissolve | dissolves |
| $I^-$ | yellow AgI | does not dissolve | does not dissolve |

## 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 haloalkanes (4.2.2), qualitative analysis (3.1.4) and redox titrations (5.2.3).

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