3.2.3 Group 7(17), the Halogens

3.2.3.1 *Halogen trends: electronegativity, boiling point, oxidising ability, reducing ability of halides. Tests for halide ions.*

Electronegativity decreases down Group 7 (larger atoms, more shielding).

Boiling point increases (more electrons → stronger London forces).

Oxidising ability decreases: Cl■ > Br■ > I■. Cl■ displaces Br■ and I■; Br■ displaces I■.

Reducing ability of halides increases down the group.

Solid NaX + conc. H■SO■: NaCl → steamy HCl (white fumes). NaBr → HBr + Br■ (orange fumes). NaI → HI + I■ (purple) + S (yellow) + H■S (rotten eggs).

Halide test: dilute HNO■ + AgNO■. AgCl = white (dissolves in dilute NH■). AgBr = cream (dissolves in conc. NH■). AgI = yellow (insoluble in NH■).

3.2.3.2 *Chlorine with water and with NaOH. Disproportionation. Water treatment. Benefits vs risks.*

Cl■ + H■O ■ HCl + HOCl (disproportionation: Cl: 0 → –1 and +1). HOCl kills bacteria — used in water treatment.

Cl■ + 2NaOH → NaCl + NaClO + H■O (cold dilute NaOH). NaClO = bleach.

Benefits of chlorination: kills bacteria, prevents waterborne diseases.

Risks: chlorine is toxic; forms potentially harmful chlorinated by-products.

Society judges benefits outweigh risks.

★ REQUIRED PRACTICAL RP4 — Test-Tube Reactions to Identify Cations and Anions

Cation tests — Flame tests (clean nichrome wire in conc. HCl): Ca = orange-red, Sr = red, Ba = green. NH■■: add NaOH and warm — NH■ turns damp red litmus blue.

Anion tests — Halides: dilute HNO■ then AgNO■. AgCl = white (soluble dilute NH■), AgBr = cream (soluble conc. NH■), AgI = yellow (insoluble). CO■²■: dilute acid → CO■ turns limewater milky. SO■²■: dilute HCl then BaCl■ → white ppt BaSO■.

Common errors: cross-contamination; not acidifying before AgNO■ (gives false positives); not acidifying before BaCl■ (BaCO■ false positive); dirty nichrome wire.

Improvements: clean wire until no colour; acid HNO■ before AgNO■ test; acid HCl before BaCl■ test; white tile for colour observation.