11.2 Chemical properties of the halogens and hydrogen halides

Name: _____ Class: _____ Date: _____ **Total: 11 marks**

KEY WORDS oxidising agent • hydrogen halide • thermal stability • group • halogen

Objective

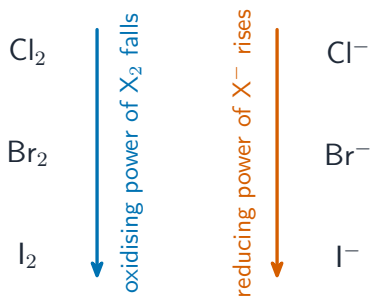
Build the skills to answer exam questions on the **chemical properties of the halogens and hydrogen halides** – the halogens as **oxidising agents**, reactions with hydrogen, and the thermal stability of the **hydrogen halides**.

You must be able to:

- describe the relative reactivity of the halogens as oxidising agents
- describe the reactions with hydrogen and explain the reactivity trend
- explain the thermal stabilities of the hydrogen halides in terms of bond strength

1 Key knowledge and worked examples

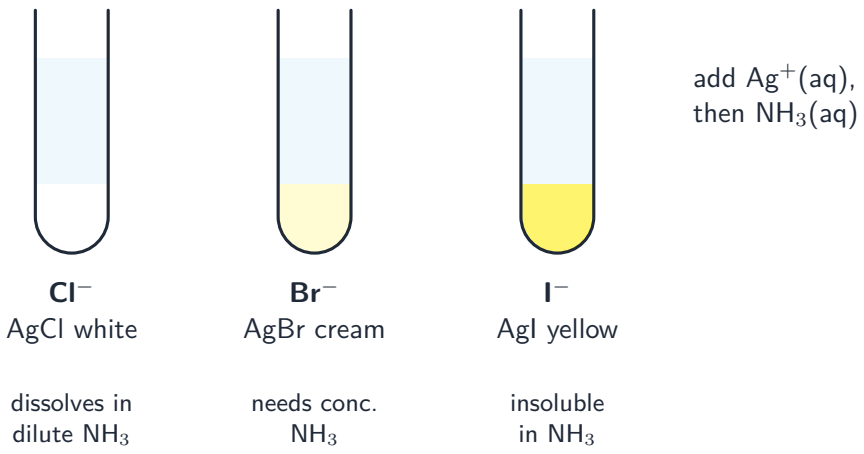
■ Halogens as oxidising agents



a more reactive halogen displaces a less reactive one:

$Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$

Oxidising power of the halogens falls down the group (the larger atom attracts an extra electron less)



Silver halide tests distinguish the halides

Each halogen gains one electron to form X^-, so it is an **oxidising agent**. A more reactive halogen **displaces** a less reactive one: $Cl_2 + 2KBr \rightarrow 2KCl + Br_2$.

■ Reactions with hydrogen and HX stability

$H_2 + Cl_2 \rightarrow 2HCl$ – the reaction gets **less vigorous** down the group (Cl_2 explosive in light; I_2 slow). The thermal stability of HX **decreases** down the group, because the H–X bond weakens as the atom gets larger (HI breaks easily; HCl is stable).

2 Practice

2.1 State the trend in oxidising power down Group 17 and explain it. [2]

2.2 Write the equation for the displacement reaction of chlorine with potassium bromide. [1]

3 Exam-style questions

3.1 Which is the strongest oxidising agent? [1]

- ☐ **A** Cl_2
- **B** Br_2
- **C** I_2
- **D** they are equal

3.2 Which hydrogen halide is the **least** thermally stable? [1]

- ☐ **A** HCl
- **B** HBr
- **C** HI
- **D** HF

3.3 (a) State and explain whether bromine would displace chlorine from sodium chloride. [2]

(b) Explain why HI is less thermally stable than HCl. [2]

3.4 Explain why the halogens become less reactive as oxidising agents down the group. [2]