

11.2 Chemical properties of the halogens and hydrogen halides

Name: _____ Class: _____ Date: _____

Total: 11 marks

KEY WORDS oxidising agent 氧化剂 • hydrogen halide 卤化氢 • thermal stability 热稳定性
 • group 族 • halogen 卤素

Objective

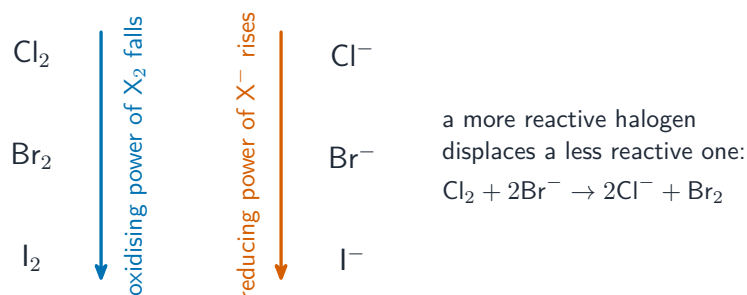
Build the skills to answer exam questions on the **chemical properties of the halogens and hydrogen halides** — the halogens as **oxidising agents** 氧化剂, reactions with hydrogen, and the thermal stability of the **hydrogen halides** 卤化氢.

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 Worked examples

■ Halogens as oxidising agents



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

add $\text{Ag}^+(\text{aq})$,
then $\text{NH}_3(\text{aq})$

Cl^-	Br^-	I^-
AgCl white	AgBr cream	AgI yellow
dissolves in dilute NH_3	needs conc. NH_3	insoluble in NH_3

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: $\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$.

■ Reactions with hydrogen and HX stability

$\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$ — 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	B
C	D

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	B
C	D

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]
