A-LEVEL CHEMISTRY • EXERCISE SHEET

11.3 Some reactions of the halide ions

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS reducing agent 还原剂 • precipitate 沉淀 • ammonia 氨 • halide ion 卤离子 • silver halide 卤化银

Objective

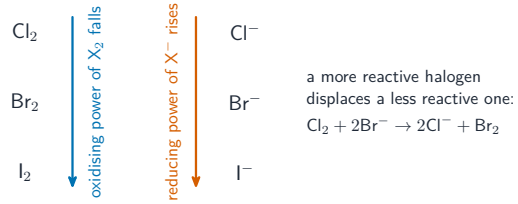
Build the skills to answer exam questions on **reactions of the halide ions** 卤离子 — halides as **reducing agents** 还原剂, the **silver halide** 卤化银 test, and the reaction with concentrated sulfuric acid.

You must be able to:

- describe the relative reactivity of the halide ions as reducing agents
- describe the test with aqueous silver ions followed by ammonia
- describe and write equations for the reactions with concentrated sulfuric acid

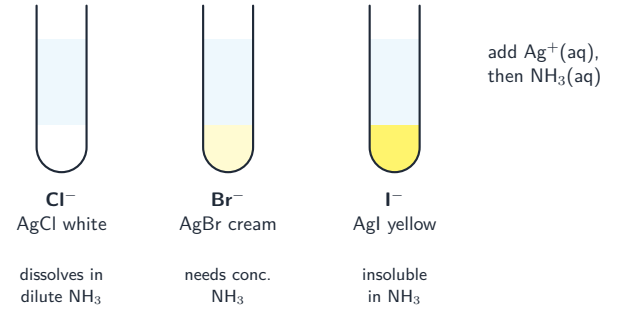
1 Worked examples

Halides as reducing agents



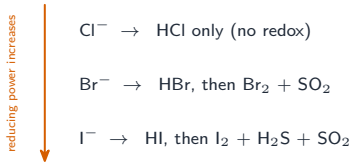
Reducing power of the halide ions increases down the group (a larger ion loses its electron more easily)

The silver halide test



Add $AgNO_3$ then ammonia: AgCl white (dissolves in dilute NH_3), AgBr cream (dissolves in conc. NH_3), AgI yellow (insoluble)

With concentrated sulfuric acid



The stronger reducing agents (Br^-, I^-) are oxidised to the halogen, reducing the sulfur

- Cl^-: only HCl (no redox): $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$.
- Br^-: HBr + brown Br_2 + SO_2. I^-: HI + I_2 + H_2S + SO_2 (I^- is the strongest reducing agent).

2 Practice

2.1 State the colour of the precipitate formed when silver nitrate is added to (a) chloride and (b) iodide ions. [2]

2.2 State the trend in reducing power of the halide ions down the group. [1]

3 Exam-style questions

3.1 A halide gives a cream precipitate with silver nitrate that dissolves only in concentrated ammonia. The halide is: [1]

A B
C D

A chloride
B bromide
C iodide
D fluoride

3.2 Which halide is oxidised to a coloured element by concentrated sulfuric acid, also producing H_2S? [1]

A B
C D

A chloride
B bromide
C iodide
D none of them

3.3 (a) Describe how you would use silver nitrate and ammonia to distinguish between solutions of sodium chloride and sodium iodide. [3]

(b) Explain why iodide ions are oxidised by concentrated sulfuric acid but chloride ions are not. [2]

3.4 Write the equation for the reaction of solid sodium chloride with concentrated sulfuric acid. [1]

3.5 Separate samples of solid NaCl, NaBr and NaI are each warmed with concentrated sulfuric acid.

(a) State what is observed with each solid, naming the sulfur-containing product where one is formed. [5]

(b) Explain the pattern in (a) in terms of the reducing power of the halide ions. [3]

(c) Describe the test that distinguishes chloride, bromide and iodide ions **in solution**, giving the result in each case and the effect of adding aqueous ammonia. [4]

(d) State why dilute nitric acid is added before the silver nitrate. [1]