

11.3 Some reactions of the halide ions

Name: _____ Class: _____ Date: _____

Total: 11 marks**KEY WORDS** reducing agent 还原剂 • ammonia 氨 • precipitate 沉淀 • halide ion 卤离子 • silver halide 卤化银

Objective

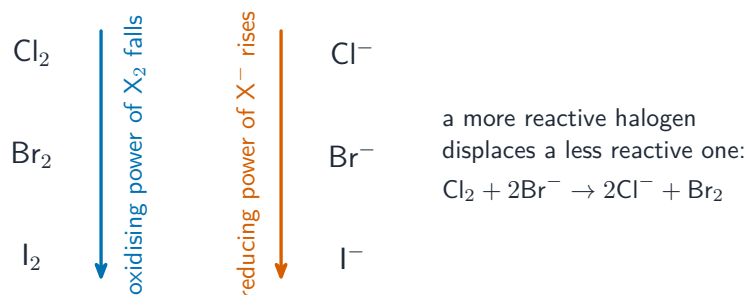
Build the skills to answer exam questions on **reactions of the halide ions** 卤离子 — halides as **reducing agents** 还原剂, the **silver halide** 卤化银 test, and the reaction with concentrated sulfuric acid.

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

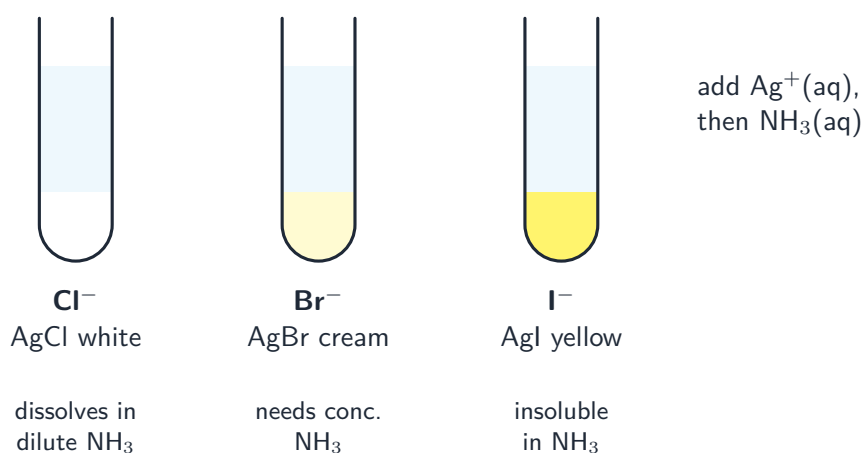
1 Worked examples

■ 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

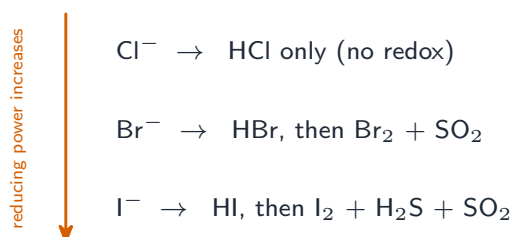


add $\text{Ag}^+(\text{aq})$,
then $\text{NH}_3(\text{aq})$

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

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): $\text{NaCl} + \text{H}_2\text{SO}_4 \rightarrow \text{NaHSO}_4 + \text{HCl}$.
- Br^- : $\text{HBr} + \text{brown Br}_2 + \text{SO}_2$. I^- : $\text{HI} + \text{I}_2 + \text{H}_2\text{S} + \text{SO}_2$ (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** chloride
 - **B** bromide
 - **C** iodide
 - **D** fluoride
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3.2 Which halide is oxidised to a coloured element by concentrated sulfuric acid, also producing H_2S ? [1]

- **A** chloride
 - **B** bromide
 - **C** iodide
 - **D** none of them
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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]

Solutions

2.1 (a) white; (b) yellow.

2.2 reducing power increases down the group.

3.1 B. A cream precipitate dissolving only in concentrated ammonia is bromide.

3.2 C. Iodide is the strongest reducing agent, reducing the acid to H_2S .

3.3 (a) add silver nitrate to each — both give a precipitate; chloride gives white, iodide gives yellow; add ammonia — the chloride (white) dissolves in dilute ammonia, the iodide (yellow) is insoluble.

(b) iodide ions are stronger reducing agents (lose their electron more easily), so they reduce the sulfuric acid; chloride ions are too weak a reducing agent.

3.4 $\text{NaCl} + \text{H}_2\text{SO}_4 \rightarrow \text{NaHSO}_4 + \text{HCl}$.