

Exercise walk-through

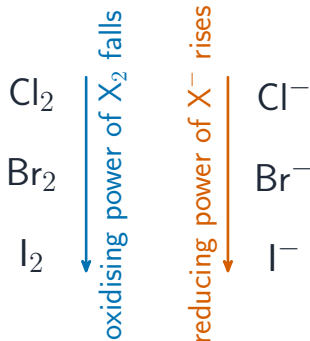
Some reactions of the halide ions ■ 11.3

eXercise

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

Method — Halides as reducing agents



a more reactive halogen
displaces a less reactive one:



Reducing power of the halide ions rising down the group

Method — 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)



Cl^-

AgCl white
dissolves in
dilute NH_3



Br^-

AgBr cream
needs conc.
 NH_3



I^-

AgI yellow
insoluble
in NH_3

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

Three test tubes: white AgCl , cream AgBr , yellow AgI precipitates

Method — With concentrated sulfuric acid

- Cl : only HCl (no redox): $\text{NaCl} + \text{H}_2\text{SO}_4 \rightarrow \text{NaHSO}_4 + \text{HCl}$.
- Br : $\text{HBr} + \text{brown Br} + \text{SO}_2$. I : $\text{HI} + \text{I}_2 + \text{H}_2\text{S} + \text{SO}_2$ (I is the strongest reducing agent).

Method — With concentrated sulfuric acid

reducing power increases



Chloride gives only HCl; bromide also gives Br + SO ; iodide gives I , H S and SO

Practice 2.1 ■ 2 marks

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

Solution 2.1

Method: With concentrated sulfuric acid

Worked steps

(a) white; (b) yellow **B1** *each*.

Practice 2.2 ■ 1 mark

State the trend in reducing power of the halide ions down the group.

Solution 2.2

Method: Halides as reducing agents

Worked steps

reducing power increases down the group **B1**.

Exam-style 3.1 ■ 1 mark

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

A chloride

B bromide

C iodide

D fluoride

Solution 3.1

Method: The silver halide test

A chloride

B bromide



C iodide

D fluoride

Worked steps

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

Exam-style 3.2 ■ 1 mark

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

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

Solution 3.2

Method: With concentrated sulfuric acid

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



Worked steps

C. Iodide is the strongest reducing agent, reducing the acid to H₂S.

Exam-style 3.3 ■ 3 marks

- (a) Describe how you would use silver nitrate and ammonia to distinguish between solutions of sodium chloride and sodium iodide.
- (b) Explain why iodide ions are oxidised by concentrated sulfuric acid but chloride ions are not.

Solution 3.3

Method: With concentrated sulfuric acid

Worked steps

- (a) add silver nitrate to each — both give a precipitate **M1**; chloride gives white, iodide gives yellow **M1**; add ammonia — the chloride (white) dissolves in dilute ammonia, the iodide (yellow) is insoluble **A1**.
- (b) iodide ions are stronger reducing agents (lose their electron more easily) **M1**, so they reduce the sulfuric acid; chloride ions are too weak a reducing agent **A1**.

Exam-style 3.4 ■ 1 mark

Write the equation for the reaction of solid sodium chloride with concentrated sulfuric acid.

Solution 3.4

Method: With concentrated sulfuric acid

Worked steps

