

Exercise walk-through

The chemical properties of the halogen elements and the hydrogen halides ■ 11.2

eXercise

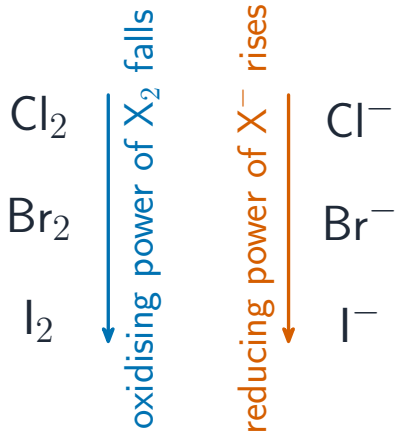
You must be able to

- 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

Method — Halogens as oxidising agents

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

Method — Halogens as oxidising agents

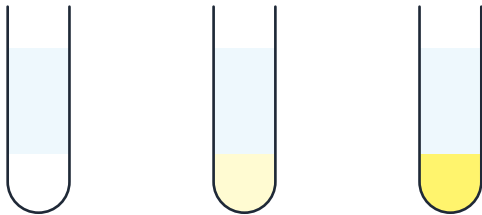


a more reactive halogen
displaces a less reactive one:



Method — Halogens as oxidising agents

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



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

Silver halide tests distinguish the halides

Method — 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 explosive in light; I 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).

Practice 2.1 ■ 2 marks

State the trend in oxidising power down Group 17 and explain it.

Solution 2.1

Method: Halogens as oxidising agents

Worked steps

oxidising power decreases down the group **B1**; the larger atoms attract an extra electron less strongly **B1**.

Practice 2.2 ■ 1 mark

Write the equation for the displacement reaction of chlorine with potassium bromide.

Solution 2.2

Worked steps



Exam-style 3.1 ■ 1 mark

Which is the strongest oxidising agent?

A Cl

B Br

C I

D they are equal

Solution 3.1

Method: Halogens as oxidising agents

A Cl



B Br

C I

D they are equal

Worked steps

A. Chlorine is the strongest oxidising agent.

Exam-style 3.2 ■ 1 mark

Which hydrogen halide is the **least** thermally stable?

A HCl

B HBr

C HI

D HF

Solution 3.2

Method: Reactions with hydrogen and HX stability

A HCl

B HBr

C HI



D HF

Worked steps

C. HI is the least thermally stable (weakest H-X bond).

Exam-style 3.3 ■ 2 marks

- (a) State and explain whether bromine would displace chlorine from sodium chloride.
- (b) Explain why HI is less thermally stable than HCl.

Solution 3.3

Method: Reactions with hydrogen and HX stability

Worked steps

(a) no **M1**; bromine is a weaker oxidising agent than chlorine, so it cannot displace chloride **A1**.

(b) the H-I bond is longer and weaker than H-Cl **M1**, so HI decomposes more easily on heating **A1**.

Exam-style 3.4 ■ 2 marks

Explain why the halogens become less reactive as oxidising agents down the group.

Solution 3.4

Method: Halogens as oxidising agents

Worked steps

down the group the atoms get larger with more shielding (M1), so they attract an extra electron less strongly — weaker oxidising agents (A1).