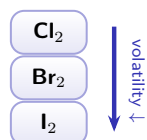


Group 17

A-Level Chemistry ■ Topic 11

A-Level Chemistry



Group 17

What we will cover

- 1 States & volatility
- 2 Oxidising power & displacement
- 3 The silver halide test
- 4 Halides & sulfuric acid
- 5 Reactions of chlorine



chlorine kills microbes

1

The halogens

States and volatility

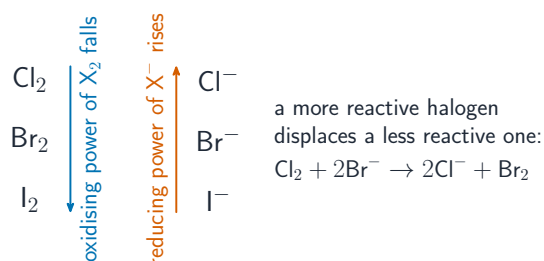
Down Group 17 the molecules get larger, so instantaneous dipole-induced dipole forces get stronger. Melting and boiling points **rise**.

F₂ pale yellow gas	Cl₂ green gas	Br₂ red-brown liquid	I₂ grey-black solid
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Oxidising power and displacement

- halogens gain an electron – **oxidising power** 氧化能力 **falls** down
- halide ions** 卤离子 lose an electron – **reducing power** 还原能力 **rises** down

A more reactive halogen **displaces** a less reactive one: $\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$.



The silver halide test



Add Ag^+ , then **ammonia** 氨, to identify the halide:

- Cl^- – **white**, dissolves in dilute NH_3
- Br^- – **cream**, only in conc. NH_3
- I^- – **yellow**, insoluble

Halides with concentrated sulfuric acid

reducing power increases
↓

$\text{Cl}^- \rightarrow \text{HCl}$ only (no redox)

$\text{Br}^- \rightarrow \text{HBr}$, then $\text{Br}_2 + \text{SO}_2$

$\text{I}^- \rightarrow \text{HI}$, then $\text{I}_2 + \text{H}_2\text{S} + \text{SO}_2$

The stronger reducing agents are oxidised by the acid:

- Cl^- – only HCl (no redox)
- Br^- – also Br_2 & SO_2
- I^- – I_2 , H_2S & SO_2 (strongest reducer)

2 Chlorine

Reactions of chlorine

cold dilute NaOH : $\text{Cl}_2 + 2\text{NaOH} \rightarrow \text{NaCl} + \text{NaClO} + \text{H}_2\text{O}$

hot conc. NaOH : $3\text{Cl}_2 + 6\text{NaOH} \rightarrow 5\text{NaCl} + \text{NaClO}_3 + 3\text{H}_2\text{O}$

Both are **disproportionation** 歧化 (Cl goes up *and* down from 0). In water, $\text{Cl}_2 + \text{H}_2\text{O} \rightleftharpoons \text{HOCl} + \text{HCl}$ – HOCl kills **bacteria** 细菌.

3

Recap

Group 17
└ Recap

Worked example – halogen displacement

Chlorine water is added to potassium bromide solution. State what is seen and give the ionic equation.

- Cl_2 is a **stronger oxidising agent** than Br_2 , so it takes the electrons.
- $\text{Cl}_2 + 2\text{Br}^- \rightarrow 2\text{Cl}^- + \text{Br}_2$
- Seen: the solution turns **orange** as Br_2 forms.
- Cl_2 is **reduced** ($0 \rightarrow -1$); Br^- is **oxidised** ($-1 \rightarrow 0$).

A halogen displaces any halide **below** it. Oxidising power falls down the group: $\text{Cl}_2 > \text{Br}_2 > \text{I}_2$.

Group 17
└ Recap

Topic 11 – key takeaways

1 Volatility

falls down; gas to liquid to solid

2 Redox trends

oxidising power down; reducing power up

3 Halide test

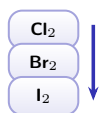
AgCl white, AgBr cream, AgI yellow

4 Chlorine

disproportionation with NaOH ; purifies water

Check yourself

- 1 Which way does oxidising power change down Group 17?
- 2 Colour of the AgI precipitate?
- 3 Which halide is oxidised to I_2 by conc. H_2SO_4 ?
- 4 What type of reaction is Cl_2 with NaOH?



Answers 1. decreases 2. yellow 3. iodide (I^-) 4. disproportionation