

11.1 Physical properties of the Group 17 elements

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS volatility 挥发性 • bond energy 键能 • group 族 • induced dipole 诱导偶极
• instantaneous dipole 瞬时偶极

Objective

Build the skills to answer exam questions on the **physical properties of the halogens** 卤素 — their colours, the trend in **volatility** 挥发性, and the trend in bond strength.

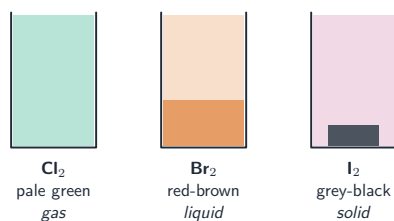
You must be able to:

- describe the colours and the trend in volatility of chlorine, bromine and iodine
- explain volatility in terms of instantaneous dipole–induced dipole forces
- describe and explain the trend in halogen bond strength

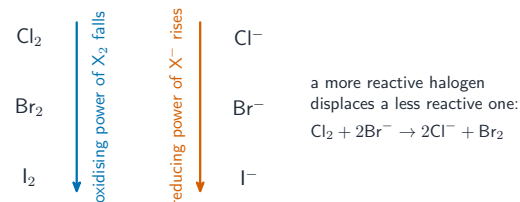
1 Worked examples

■ Colours and volatility

volatility decreases (intermolecular forces get stronger) →



Down Group 17 volatility falls: chlorine (gas) → bromine (liquid) → iodine (solid)



Trends in oxidising power down Group 17

Volatility **decreases** down the group because the molecules get larger with more electrons, so the **instantaneous dipole–induced dipole** forces between them get stronger — harder to overcome, so boiling point rises.

■ Bond strength

The X–X bond energy generally **falls** from Cl₂ to I₂: the shared electrons are further from the nuclei in larger atoms.

2 Practice

2.1 State the colour and physical state of bromine at room temperature. [2]

2.2 State the trend in volatility down Group 17. [1]

3 Exam-style questions

3.1 Why is iodine a solid while chlorine is a gas at room temperature? [1]

- | | |
|---|---|
| A | B |
| C | D |
- A iodine has stronger covalent bonds
 B iodine molecules have more electrons, so stronger id–id forces
 C iodine is ionic
 D chlorine has more electrons

3.2 The type of force broken when iodine sublimates is: [1]

- | | |
|---|---|
| A | B |
| C | D |
- A the I–I covalent bond
 B instantaneous dipole–induced dipole forces
 C ionic bonds
 D hydrogen bonds

3.3 Explain, in terms of intermolecular forces, why the boiling points of the halogens increase down the group. [3]

3.4 Suggest why the bond energy of I_2 is less than that of Cl_2 . [2]
