

## Solutions

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Each answer shows the steps, then the **result**.

### 2.1

- chlorine at room temperature is a **pale yellow-green gas**

### 2.2

- going down Group VII, **reactivity decreases**

### 2.3

- chlorine: **pale yellow-green gas**
- bromine: **red-brown liquid**
- iodine: **grey-black solid**

### 2.4

- a halogen reacts by **gaining one electron**
- chlorine's outer shell is **closer** to the nucleus and less shielded than iodine's
- chlorine **attracts the incoming electron more strongly**

### 2.5

- $\text{Cl}_2 + 2\text{I}^- \rightarrow 2\text{Cl}^- + \text{I}_2$

### 3.1 A

- **chlorine** is the most reactive (reactivity decreases down the group)
- B and C are lower; D is false

### 3.2

(a)

- $\text{Cl}_2 + 2\text{KI} \rightarrow 2\text{KCl} + \text{I}_2$

(b)

- the solution turns **brown/orange**
- because **iodine** has been displaced

### 3.3

- **no** — bromine will not displace chlorine
- only a **more reactive** halogen can displace a less reactive one

### 3.4

(a)

- chlorine water: **reaction** with both bromide and iodide
- bromine water: **no reaction** with bromide, **reaction** with iodide

- iodine: **no reaction** with either

(b)

- colourless solution turns **brown**
- because **iodine** has been displaced

(c)

- $\text{Cl}_2 + 2\text{KI} \rightarrow 2\text{KCl} + \text{I}_2$
- ionic:  $\text{Cl}_2 + 2\text{I}^- \rightarrow 2\text{Cl}^- + \text{I}_2$

(d)

- each halogen **gains one electron** into its outer shell
- going down, that shell is further from the nucleus and more shielded
- the incoming electron is attracted less strongly, so **reactivity falls**

(e)

- **chlorine is reduced** (gains electrons)
- **iodide is oxidised** (loses electrons)