

Solutions

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

2.1

(a)

- S: $x + 4(-2) = -2 \Rightarrow x = +6$

(b)

- N: $x + 3(-2) = -1 \Rightarrow x = +5$

2.2

- loss; up

3.1 B

- $2x + 7(-2) = -2 \Rightarrow 2x = 12 \Rightarrow x = +6$

3.2 A

- Zn loses electrons (is oxidised), so it is the reducing agent

3.3

(a)

- $\text{Cl}_2 = 0$; $\text{Cl}^- = -1$; $\text{ClO}^- = +1$

(b)

- the same element (chlorine) is both oxidised (0
- +1) and reduced (0
- -1) in one reaction

3.4

- Mn falls by 5 (+7
- +2); Fe rises by 1 (+2
- +3); so 5 Fe^{2+} are needed per MnO_4^- — ratio 1 : 5

3.5

(a)

- Cl_2 : 0; NaCl : -1; NaClO : +1. In NaClO , Na is +1 and O is -2, so Cl must be +1

(b)

- The **same** element is oxidised and reduced in the one reaction: chlorine goes $0 \rightarrow +1$ in NaClO and $0 \rightarrow -1$ in NaCl

(c)

- $3\text{Cl}_2 + 6\text{NaOH} \rightarrow 5\text{NaCl} + \text{NaClO}_3 + 3\text{H}_2\text{O}$. Five chlorine atoms fall $0 \rightarrow -1$ (gaining 5 electrons in total) while one rises $0 \rightarrow +5$ (losing 5); the electrons balance, and again one element is both oxidised and reduced

(d)

- $\text{Cl}_2 + 2\text{I}^- \rightarrow 2\text{Cl}^- + \text{I}_2$. Chlorine is the oxidising agent: it **gains** electrons ($0 \rightarrow -1$), i.e. it is itself reduced while oxidising the iodide