

6 Oxidation number and redox – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English

Write it 3 times (English)

oxidation numbers

Disproportionation

Recall

From Part 1 you can assign **oxidation numbers** and spot oxidation and reduction. Here we use the numbers to **balance** redox equations and meet a special case.

- Every electron lost by one species is gained by another.
- So the total rise in oxidation number equals the total fall.

New ideas

Read these first, then do the Practice.

■ 1 Balancing with oxidation numbers

1. find the element whose oxidation number **rises** (oxidised) and the one that **falls** (reduced).
2. the total rise must equal the total fall.
3. choose the ratio so they match, then balance the rest.

Fe: $+2 \rightarrow +3$ (rise 1)

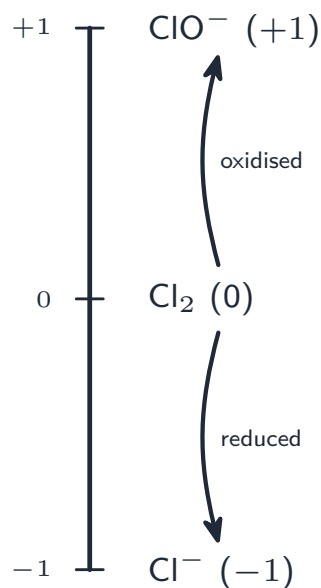
Mn: $+7 \rightarrow +2$ (fall 5)

total rise = total fall $\Rightarrow$ 5 Fe : 1 Mn

Worked example. Fe goes $+2 \rightarrow +3$ (rise 1); Mn goes $+7 \rightarrow +2$ (fall 5). To match, you need **5** Fe for every **1** Mn.

■ 2 Disproportionation

Disproportionation is a redox reaction in which the **same** element is both oxidised **and** reduced at once. For example, chlorine (0) in cold water goes to Cl^- (-1) **and** ClO^- (+1).



Watch out: in disproportionation the *same* element must both rise and fall in oxidation number. If two *different* elements change, it is ordinary redox, not disproportionation.

Practice

Try these in order.

6.1 In a redox reaction, what must be true about the total rise and total fall in oxidation number? [1]

6.2 In a reaction, an element's oxidation number changes from +2 to +3. (a) By how much does it change? (b) Is it oxidised or reduced? [2]

6.3 Manganese falls from +7 to +2, and iron rises from +2 to +3. How many iron atoms are needed for each manganese atom? [2]

6.4 What is meant by *disproportionation*? [2]

6.5 In $\text{Cl}_2 + \text{H}_2\text{O} \rightarrow \text{HCl} + \text{HClO}$, give the oxidation number of chlorine in (a) Cl_2 , (b) HCl , (c) HClO . [3]

6.6 Challenge. When chlorine reacts with cold sodium hydroxide it forms NaCl and NaClO . Use oxidation numbers to explain why this is *disproportionation*. [2]