# 5 Chemical Reactions: An introduction

Indicators that a chemical reaction has occurred, on mixing chemicals, include the following:

- There is a colour change
- A solid forms

## 5.2 Balancing Chemical Equations

In a chemical reaction, atoms are neither created nor destroyed. The total number of each type of atom that is present at the start of the reaction must be there at the end. That is, the number of each type of atom on the reactant side of the chemical equation must equal the number of each type of atom on the product side of the equation. A balanced chemical equation reflects this condition. The act of **balancing a chemical equation** is to ensure that the number of each atom type is conserved.

In the above example, we see that the reactant side consists of 2 atoms of hydrogen and 2 atoms of chlorine. So does the right hand (product) side. The difference between the two sides reflects a change in the way the atoms are grouped into different molecules. Notice also that if you are asked for the formula of the compound that is formed when hydrogen atoms are bonded to chlorine, you would say HCl (H wants to obtain the noble gas count of He, which means hanging onto its electron and stealing another from Cl). Likewise, chlorine needs the noble gas count of Ar  thus it must keep all of its own electrons and acquire another. This leads to covalent bond formation (actually, there is a high ionic component to the HCl bond because H is on the metal side and Cl is on the nonmetal side, so on either count, there is only one possible formula for the combination of H and Cl atoms  HCl). Thus

Count up the atoms:

Reactant side: 4 atoms H, 2 atoms O
Product side: 4 atoms H, 2 atoms O

The equation is now balanc

e.g. Ammonia gas reacts with oxygen under the appropriate conditions at 1000°C to form nitrogen monoxide and water. Write the balanced equation.

$$NH_3\,(g) \;+\; O_2\,(g) \;\rightarrow\; NO\,(g) \;+ H_2O\,(g)$$

the LHS so multiply $NH_3$ by factor 2.

$$\boxed{2}\,NH_3\,(g) \;+\; O_2\,(g) \;\rightarrow\; NO\,(g) \;+\; H_2O\,(g)$$