

ACIDS, BASES AND SALTS

Before we discuss the ways in which chemists manage to classify all of the various substances in the universe, we should spend some time looking at three words which cover a lot of substances. These words are used in everyday speech but we need to define them clearly so that everybody uses them to mean the same thing.

An **ACID** is a substance that:-

- a) Reacts with a base to make a salt and water only.
- b) Reacts with many metals to produce a salt and hydrogen gas only.
- c) Reacts with a carbonate to make a salt, water and carbon dioxide only.
- d) Turns litmus indicator red.
- e) Has a low pH number (0 to 6).

A **BASE** is a substance that:-

- a) Reacts with an acid to make a salt and water only.
- b) Turns litmus indicator blue.
- c) Has a high pH number (8 to 14).

A **SALT**:-

- a) Is the product, together with water, of a reaction between a base and an acid.
- b) Has a pH number of 7.

These definitions may not seem particularly helpful at this stage but it does give us some foothold in a topic that we shall pay several visits to. The pH scale, as you can see, is just a guide to how acidic or basic a substance is - very strong acids are pH 1, weak acids are pH 4 or 5, a neutral substance has a pH of 7, a weak base pH 9 or 10 and a strong base is pH 14. If you know, for instance, that the pH of gastric juice from the human stomach is pH 1, it immediately tells you that this is a very acidic substance, and that blood at pH 7.4 is very slightly basic.

Some substances, like the litmus mentioned above, are indicators. An indicator is a substance that changes its color if it goes from an acidic to a basic environment and vice versa. A few indicators have a whole range of colors (the universal indicator follows the colors of the spectrum), but others have just two. In the case of litmus, it is reddish under acidic conditions and blueish under basic conditions, whereas neutral litmus is midway between blue and red. Many substances from nature are indicators, such as red cabbage, beetroot and many colored flowers.

You may like to learn these following 'word equations' that summarize the reactions of acids. In equation 2, we use the word **ALKALI**. This is just a word that describes bases which are soluble in water; so all alkalis are bases but only some bases are alkalis,

- 1) Acid + Base ==> Salt + Water
- 2) Acid + Alkali ==> Salt + Water
- 3) Acid + Carbonate ==> Salt + Water + Carbon Dioxide
- 4) Acid + Metal ==> Salt + Hydrogen

Now for the names and formulas of three very well known acids; SULPHURIC ACID is H_2SO_4 , NITRIC ACID is HNO_3 , HYDROCHLORIC ACID is HCl . And three common bases (all of which are alkalis); SODIUM HYDROXIDE is $NaOH$, POTASSIUM HYDROXIDE is KOH , and LITHIUM HYDROXIDE is $LiOH$. Salts are named after the acid they are made from, therefore; Sulphuric acid produces- SULPHATES, Nitric acid produces NITRATES and Hydrochloric acid produces CHLORIDES.

Using equation 1 (from above) we can substitute a few specific names:-
sulphuric acid + sodium hydroxide ==> sodium sulphate + water.

Note - if you were reading this equation out loud, you would say 'sulphuric acid plus sodium hydroxide gives sodium sulphate plus water'. Note that the "==" should never be written as simply "=", nor should it be referred to as "equals", but always "gives".

Looking at a few more equations, all of the substances that are before the "==" sign are called **REACTANTS**, and all of the substances that come after the "==" sign are

called **PRODUCTS**.

Hydrochloric acid + Lithium Hydroxide ==> Lithium Chloride + Water

Nitric Acid + Potassium Hydroxide ==> Potassium Nitrate + Water

Sulphuric Acid + Copper Carbonate ==> Copper Sulphate + Carbon dioxide + Water

In all of the word equations as above, these substances are being changed into other substances. That is what chemistry is all about, and our progress through this chemistry course will help us to understand why and how these reactions take place.

Source : <http://www.peoi.org/Courses/Coursesen/chem/fram1.html>