Acids, Bases and Salts



Acids

You've probably heard about acids before. They occur in many foods we eat: apples, lemons, vinegar, even milk. Almost always, we find them dissolved in water.

Acids are almost always composed of some hydrogen atoms and another part involving non-metals. For instance, hydrochloric acid, HCl, is hydrogen + chlorine.

Apart from knowing the chemical formula for an acid, acid solutions have the following main properties of identification.

Acids:

- have a sour taste
- change the colour of a dye called *litmus* from blue to red
- conduct electricity.

We then make a distinction between the properties of strong and weak acids.

Strong Acids are:

- Poisonous
- Burn the skin painfully
- Corrode metal

Weak Acids are:

- Not poisonous in small quantities
- Cause the sting of many insect bites
- Give fruits and drinks a pleasant taste

Some Common Acids

Acid	Form.	Common Name	Location/Usage
Strong			
Hydrochloric Acid	HCl	Spirit of salts	Found in human stomach
Nitric	HNO_3	Sprit of nitre	Used in the making of explosives and fertilisers
Sulphuric	H_2SO_4	Oil of vitriol	Found in car batteries
Weak			
Acetic	Vinegar		Used to pickle food, salad dressing
Carbonic	Food Acid		Added to soft drinks
Citric	Citrus		Found in lemons and oranges
Formic	Ant Sting		Causes the sting
Lactic	Milk Acid		Found in sour milk and tired muscles

Bases

We are less familiar with bases in our everyday lives. They turn up particularly in household cleaners. Like acids, we usually find them dissolved in water.

Bases are usually composed of a metal and a non-metal. Technically, a base is a substance that neutralises an acid.

Bases:
- have a bitter taste
- change the colour of a dye called *litmus* from red to blue
- have a soapy, slippery feeling

Strong Bases are:
- poisonous
- caustic to the skin
- destructive to clothing

Weak Bases are:
- not poisonous in small quantities
- used in antacid tablets to relieve upset stomachs
- sometimes used to relieve insect stings
- an ingredient in many cleaning agents because it dissolves grease and oil

Some Common Bases

Base	Common Name	Location/Usage
Strong		
Potassium hydroxide	Ly or potash	Used in industry
Sodium hydroxide	Soda lye or soda	Used to unclog drains
Weak		
Ammonia solution	Ammonia water	Household cleaner
Sodium carbonate	Washing soda	
Sodium tetraborate	Borax	
Calcium hydroxide	Lime water	A test for CO_2
Magnesium hydroxide	Milk of magnesia	Stomach antacid – indigestion tablets

Salts

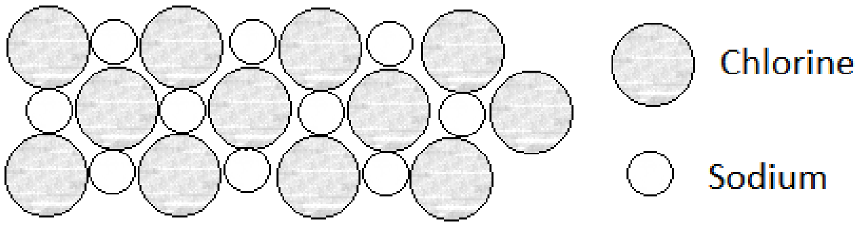
What we mean by 'salt' is much broader than just ordinary table salt. Table salt is just one type, NaCl. Salts are particular molecules formed when a metal bonds to a non-metal molecule. NaCl is a salt, because sodium is a metal, chlorine is a non-metal, and both are bonded together.

The proper definition of a salt is:

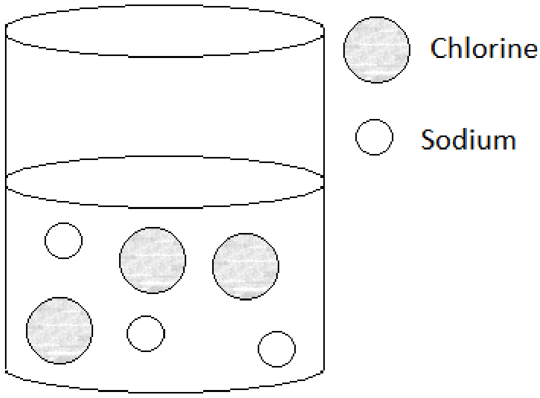
A salt is a substance that forms when an acid solution and a base solution react.

Note that bases are often types of salts themselves, composed of a metal and non-metal part that can be formed in an acid-base reaction.

Salts form crystals. Salt molecules join together, when not dissolved, to form a large structure, called a crystal. For example, NaCl, sodium chloride, looks like this.



When stirred in water, however, the metal and non-metal parts are separated by the water molecules.

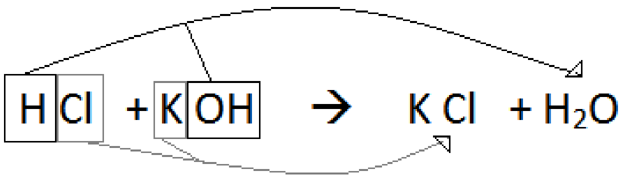


This also happens to acids and bases mixed into water too.

Neutralisation – Producing Salts

When we mix acid and base solutions together, the acid and base react. The hydrogen atoms of the acid join together with the non-metal part of the base to form a fluid, usually water. The other parts form a salt.

For instance, what would happen if we mix hydrochloric acid, HCl, and potassium hydroxide, KOH? The hydrogen atom from HCl joins with the OH from the KOH. But we know that H + OH gives you H_2O, water. The K and Cl also join to form a salt, potassium chloride.



This type of reaction is called a neutralisation reaction, because, both the acid and base are reactive, but once the reaction has occurred the acid and base solutions have lost their acid and base properties. They have been neutralised.

Once dissolved, the oxygen and hydrogen seek each other out, and add to the water in the beaker. The salt remains dissolved, unless it is insoluble.

Indicators

To tell if a solution is acidic, basic or neutral, the scientist will often use an indicator. An indicator is a dye that is coloured differently in an acid from its colour in a base.

Litmus is an indicator that is blue in a basic solution and red in an acidic solution. It will not change colour when anything neutral is added. Litmus is actually made from certain lichens (types of plants).

Another indicator is **phenolphthalein**, which is pink in very basic solutions. It goes clear in *slightly basic* solutions, and remains that way in neutral and acid solutions. Another indicator, **methyl orange**, is yellow in basic, neutral and slightly acidic solutions. It goes salmon pink in more acidic solutions.

The mostly used indicator, **universal indicator**, goes through the rainbow, from red meaning acidic, green meaning neutral and purple meaning basic.

pH Scale

Scientists would become very confused if they spoke about solutions being 'very or slightly basic' or 'very or slightly acidic' all the time. To describe how acidic or basic a solution is, the scientists use a numbering scale, the pH scale.

Very Acidic			Slightly Acidic			Neutral		Slightly Basic				Very Basic	
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Identifying the Presence of Oxygen, Carbon Dioxide and Hydrogen

Oxygen is identified through a **glowing splint relighting**. Carbon Dioxide is identified through blowing against limewater, and seeing it becoming cloudy, and Hydrogen is identified by a popping sound in contact with a lighted taper.