# Acid , Base and Salts

## 1. Arrhenius

Theory Arrhenius theory is one of the theories defining acids, bases and salt. Arrhenius defined acids and bases on the basis of the ions they produced when in an aqueous solution (dissolved in water). It was proposed that both acids and bases would dissociate when placed in water to form either a hydrogen ion (H+ ) or a hydroxide ion (OH- )

### 1.1Arrhenius Acids

Acid is a substance that dissociates in aqueous solution to give hydrogen ions.

$$HA\,(aq) + H_2O\,(\ell) \rightarrow H_3O^+\,(aq) + A^-\,(aq)$$

### 1.2 Arrhenius Base

Base is a substance which dissociates in aqueous solution to give hydroxide ions.

$$B\,(aq) + H_2O\,(\ell) \rightarrow BH^+\,(aq) + OH^-\,(aq)$$

### 1.2 Salt and Water

According to Arrhenius the chemical reaction between an acid and a base would result in the production of a salt and water. Salts are made up of positive and negative ions.

$$\text{Acid} + \text{Base} \longrightarrow \text{Salt} + \text{Water}$$

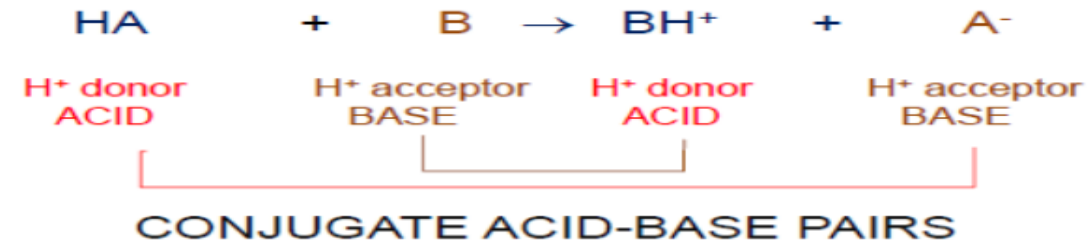
$$HCl + NaOH \longrightarrow NaCl + H_2O$$

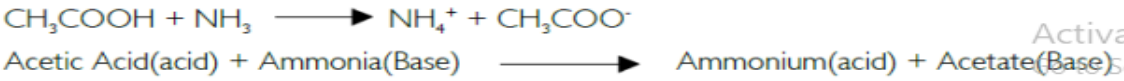
In the above reaction, hydrochloric acid (HCl) reacts with sodium hydroxide (NaOH) to produce sodium chloride (NaCl) and water (H2O). This reaction that occurs supports the Arrhenius theory of acid-base reactions.

## 2. Brønsted-Lowry theory

**An Acid** is a substance (molecule or ion) that can donate Proton ($H^+$) to another substance.

**Base** is a substance that can accept ($H^+$) from another substance.



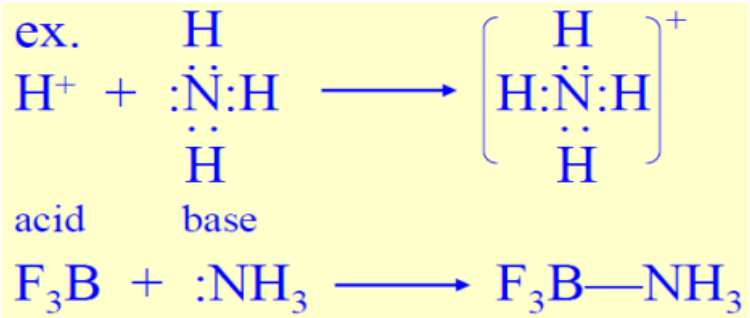






## 3. Lewis Theory

**An Acid** is a substance which can accept a pair of electrons

**Base** is a substance (molecule or ion) which can donate a pair of electrons.



## Electrolytes

An electrolyte is a chemical compound capable of conducting an electrical current when dissolved or molten. The reason an electrolyte can conduct an electrical current is that it forms ions when dissolved or molten. Ions, being positively charged or negatively charged species, are capable of conducting electricity. The most common electrolytes are acids, bases and salts, which ionize when they dissociate in polar solvents such as water or, in the case of salts, become molten. Common electrolytes include salts of metals such as sodium chloride.

$$NaCl_{(s)} \xrightarrow{Water} Na^{+}_{(aq)} + Cl^{-}_{(aq)}$$



The above equation shows the dissociation of the chloride salt of sodium to form a sodium ion and a chloride ion when dissolved in water. Pure water tends to be a very weak electrolyte as it does not have very many dissociated ions. Therefore, any ions added to water tend to make it a much better conductor of electricity as a result of the mobility of the positive and negative ions.



## The Power of Hydrogen (pH)

pH is a measure of acidity or alkalinity of solutions. It is approximately equal to the negative logarithm (base 10) of the concentration in moles of hydronium ($H_3O^+$ or $H^+$) in a solution. Conversely, pOH is also a measure of the acidity or alkalinity of solutions; however it is equal to the negative logarithm of the concentration in moles of hydroxide (OH-) ions. pH has been roughly equated to the molar concentration of hydronium in terms of decimal places. Chemical solutions that have a pH below 7 are considered acidic. Those with a pH value above 7 are considered basic, while those at 7 are neutral.

$$pH = -\log[H^+]$$

$$pOH = -\log[OH^-]$$

$$pH + pOH = 14 \rightarrow pH = 14 - pOH$$

$$H_2O \rightleftharpoons H^+ + OH^- \; K_{eq} = [H^+][OH^-] = 10^{-14}$$

$$-\log(10^{-14}) = -\log[H^+] + -\log[OH^-]$$

$$14 = pH + pOH$$

**Ex: What is the pH for a 0.05M solution of hydrochloric acid?**

**pH = - log[$H^+$]**

**pH = - log[0.05]**

**= - log[$5*10^{-2}$]**

**= 2 - log5**

**= 2 - 0.69**

**= 1.31**

**Ex: What is the pH of the solution has a pOH of 2.13 ?**

**pOH + pH = 14**

**pH = 14 - pOH**

**pH = 14 - 2.13**

**pH = 11.87**