General Properties of Aqueous Solutions

Aqueous medium (water medium) is a very powerful medium; most of the chemical reactions and nearly all the biochemical reactions take place in this medium. It is important to understand how different substances behave in solutions made with water. Let us start with the definition of a solution and its components. A ***solution*** *is a homogeneous mixture of substances.* Simple solutions have two components, one is a dissolved substance and another one is a dissolving medium. *The dissolved substance is usually present in a smaller ratio (proportion) and termed as a* ***solute****. The dissolving medium is usually present in a larger proportion and known as a solvent****.*** The solvent is a liquid and in aqueous solution it is a water. The solute can be either solid or liquid or a gas.

Electrolytes and Non-electrolytes

All solutes dissolved in water can be classified as electrolytes or non-electrolytes. *An* ***electrolyte*** *is a substance that breaks up into ions when dissolved in water.* Since it breaks up into ions, it can conduct electricity. On the other hand, ***non-electrolyte*** *is a substance that does not break up into ions when dissolved in water.* Among the electrolytes, there are two kinds; (a) strong electrolyte and (b) weak electrolyte. The **strong electrolyte** dissociates completely (100%) into ions in solution, where as, **weak electrolyte** does not dissociate completely into ions in solution. The chemical reaction for the dissociation of strong electrolyte is written with a single arrow going from reactants to products like (think this is one-way street – traffic going in only direction),

$$NaCl(s) \rightarrow Na^{+}(aq) + Cl^{-}(aq)$$

The chemical reaction for the dissociation of weak electrolyte is written with double arrows going in opposite directions like (think this is two-way street – traffic going in both directions),

$$CH_3COOH(aq) \rightleftharpoons CH_3COO^{-}(aq) + H^{+}(aq)$$

Generally, ionic compounds are strong electrolytes. However, there are few acids and bases are strong electrolytes. See the following table.

Strong Electrolytes	**Weak Electrolytes**	**Nonelectrolytes**
Ionic compounds		
HCl (hydrochloric acid)	CH_3COOH (acetic acid)	CH_3OH (methyl alcohol)
HNO_3 (nitric acid)	HF (hydrofluoric acid)	C_2H_5OH (ethyl alcohol)
$HClO_4$(perchloric acid)	HNO_2 (nitrous acid)	$C_6H_{12}O_6$ (glucose)
H_2SO_4 (sulfuric acid)	NH_3(ammonia)	$C_{12}H_{22}O_{11}$ (sucrose/table sugar)
NaOH (sodium		NH_2-CO-NH_2 (urea)

hydroxide)		
$Ba(OH)_2$ (barium hydroxide)		