

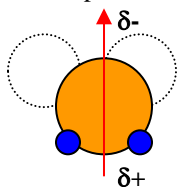
# TYPES OF CHEMICAL REACTIONS AND SOLUTION STOICHIOMETRY

## CHAPTER 4

### 4.1 Water, the Common Solvent

Solution composition consists of a solute (substance which is dissolved, typically in lesser amount than solvent) mixed in a solvent. The universal solvent is water.

Chemical description of water:



H-O-H bond angle of  $105^\circ$ .

Bulky lone pair of electrons and highly electronegative oxygen create a dipole moment which leads to a polar molecule with a partial positive ( $\delta+$ ) and partial negative ( $\delta-$ ) region on the molecule: polar.

Polarity of molecule allows for strong intra and intermolecular attractions.

Water molecules surround solute to “hydrate” with an uncertain nature of the solute (polar or non-polar) describes if it can surround and dissolve “solvolysis” the solute. In general “Like dissolves Like”.

### Conductivity Apparatus

Polar “Water”	Non-Polar “Oil”
soluble ionic salts	fatty acids and lipids
vitamins B and C	vitamins D and E
sugars	gasoline, benzene, terpenes,
Acids and small alcohols	alkanes

### 4.2 The Nature of Aqueous Solutions: “Ionic Theory”

Heath Lecture Series Video

Svante Arrhenius; P. 140, “the conductivity of solutions arose from the presence of ions”

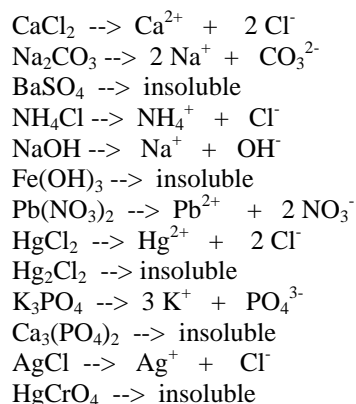
**Strong Electrolytes:** soluble, ionic salts (or strong acids) that dissociate 100% when dissolved in water.

Compound                      A-B  $\rightarrow$                       A<sup>+</sup>                      +                      B<sup>+</sup>  
 For every                      100 AB                      there are                      100 A<sup>+</sup>                      and                      100 B<sup>+</sup>

**Solubility Rules: P. 144 Table 4.1 Memorize!!!**

Slightly soluble and insoluble are interchangeable.

Ex. (From table decide if soluble or not and write the products of dissociation)



**Strong Acids: Memorize!**

Review nomenclature of these acids:

HCl, HBr, HNO<sub>3</sub>, HClO<sub>3</sub>, HClO<sub>4</sub>, H<sub>2</sub>SO<sub>4</sub>,

Compare number of oxygen atoms to hydrogen atoms if there are two or more oxygen atoms than hydrogen atoms, it is probably a strong acid. 100% Dissociation

Ex.  $\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$ ,  $\text{H}_2\text{SO}_4 \rightarrow \text{H}^+ + \text{HSO}_4^-$

**Weak Electrolytes:** less than 100% dissociation, small degree of ionization

Usually weak acids and weak bases.

Ex.  $\text{HC}_2\text{H}_3\text{O}_2 \rightleftharpoons \text{H}^+ + \text{C}_2\text{H}_3\text{O}_2^-$

**Non-Electrolytes:**

Do not produce ions in solution, molecular substances, including pure water, sugars, and alcohols.

Ex.  $\text{C}_6\text{H}_{12}\text{O}_6(\text{aq}) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(\text{aq})$ , no dissociation

**Practice Problems: (In Class) P. 170, Active Learning #2, P. 171 Questions #9, Exercises #17, 18, 19**