Normality Encyclopedia Article

Normality

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Normality

Normality is a measure of **concentration** of a chemical species in **solution**. It is defined as the number of **equivalents** of solute per **volume** of solution in liters.

This definition is dependent upon the type of chemical reaction under consideration. For acid-base reactions, one equivalent of acid is the quantity that supplies one **mole** of H^+ ions; whereas one equivalent of base is the amount that reacts with one mole of H^+ ions. In oxidation-reduction reactions, an equivalent is the quantity of substance that either gains (oxidant) or loses (reductant) one mole of electrons. Though not as commonly used, an equivalent in **precipitation** and/or complexation reactions is the amount of the substance that provides or reacts with one mole of reacting **cation** if it is univalent, one-half of a mole if it is divalent, one-third of a mole if it is trivalent, *etc.* At the equivalence point of a titrimetric analysis, irrespective of the reaction type, one equivalent of analyte will have reacted with one equivalent of titrant.

Products formed as the result of acid-base and/or oxidation-reduction reactions often depend upon the experimental conditions. For example, when H_3PO_4 reacts as an acid to form the HPO_4^{2-} **ion** it loses two H^+ ions. Thus, one mole of H_3PO_4 (98.0 grams) will be two equivalents. If one mole of H_3PO_4 is dissolved in sufficient **water** to form 1 liter of solution, its concentration is given as 1 Molar (abbreviated as 1 M) or 2 Normal (abbreviated as 2 N). If only a single H^+ is removed, the concentration is only 1 N. The normality of the H_3PO_4 depends upon the number of H^+ ions that are removed. Similarly, in oxidation- **reduction** reactions, the calculated normality depends upon the number of electrons gained or lost be one formula unit of the substance (*i.e.*, Normality = number of electrons transferred x Molarity). Concentrations expressed as normalities are meaningless unless accompanied by knowledge of how the solution is to be used and the chemical reaction(s) involved.