Nucleophile Encyclopedia Article

Nucleophile

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Nucleophile

A nucleophile is any negative **ion** or neutral **molecule** whose electronic configuration consists of at least one unpaired **electron** pair. In chemical reactions, the nucleophile attacks the positive center of some other molecule or positive ion, and then donates a pair of electrons to form a **covalent bond**. Nucleophiles are produced in the formation of **acids and bases**, and in covalent **carbon bonding** in organic compounds.

Thus, reagents that seek a **proton** or some other positive center are called nucleophiles (from **nucleus**, i.e., the positive part of the **atom**, plus *phile* from the Greek word for love). Electrophiles, on the other hand, are reagents that, in their reactions, seek extra electrons to achieve a stable **valence** shell of electrons. For example, in their reactions, nucleophiles consisting of ions with a negatively charged carbon atoms seek a proton or some other positive center to which they can donate their electron pair and thereby achieve electrical neutrality. In a similar way, both hydroxide ions and **water** molecules may act as nucleophiles by reacting with alkyl halides to produce alcohols.

In nucleophilic substitution reactions, the unshared pair of electrons on the nucleophile is used in a new carbon-nucleophile bond. In the case of nucleophilic substitution reactions involving the polar carbon-halogen bond of an alkyl **halide** and a negative nucleophile, the nucleophile seeks the carbon atom that bears the halogen atom. This carbon has a partial positive charge because the halogen atom pulls the electrons in the carbon-halogen bond toward itself. The halide retains the electron pair of the carbon-halogen bond when it leaves. Such leaving groups are usually less nucleophilic than the reacting nucleophile, so these reactions usually do not immediately reverse themselves.