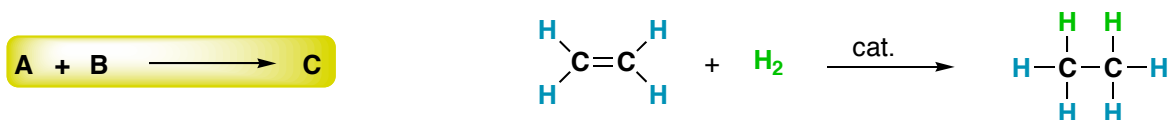


Chapter 5 - Overview of Organic Reactions

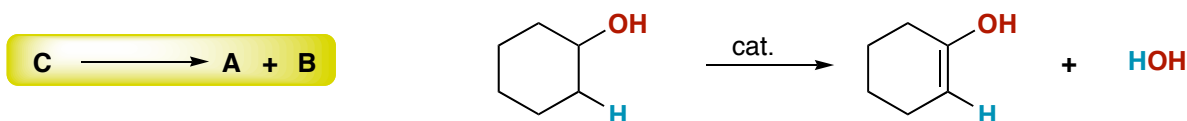
General Reaction Classes

All reaction steps can be classified as one of the following four general reactions.

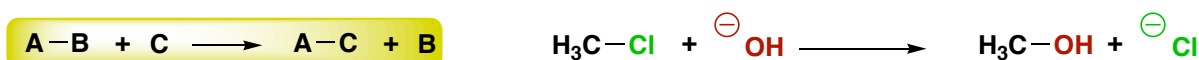
Additions Reactions - two or more molecules combine to form a new product



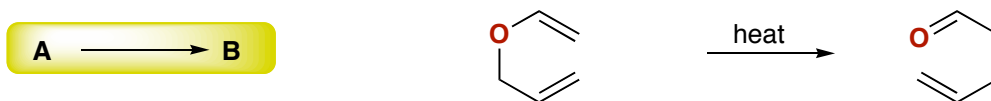
Elimination Reactions - a molecule breaks apart into two or more molecules



Substitution Reactions - part of a molecule is substituted for another group



Rearrangement Reactions - A molecule does not gain or lose atoms, but reorganizes its bonds or groups. Also called isomerization.



Reaction Mechanisms

A mechanism is a detailed step by step description of a chemical transformation. Chemical reactions involve bond breaking and bond making. Bonds can break in two different ways.

Homolytic Bond Cleavage - the atoms separate and each takes one electron from the bond to form free radicals. Note that radicals are neutral and have one unpaired electron.



Heterolytic Bond Cleavage - the atoms separate and the more electronegative atom takes both electrons from the bond. This usually leaves one atom electron deficient and positive and one atom electron rich and negatively charged. Most organic reactions occur via heterolytic bond cleavages.



Note that there could be other propagation and termination reactions that occur. For example, CH_2Cl_2 could form by reacting chlorine radical with the first product CH_3Cl to make a different radical which grabs chlorine. Ethane could be formed if two methyl radicals combine in a termination process. Generally free radical halogenation of alkanes is not a very useful reaction as there are many products that result and it is not clean or selective.

Polar Reactions

Most reactions occur through polar heterolytic bond breaking and making. They occur due to the attraction between positive and negatively charged parts of a molecule. Thus, it is important to remember how electronegative atoms influence the polarization of bonds. In any polar reaction there is an electron deficient species and an electron rich species. We have special terms to refer to their role in a reaction.

Nucleophile (loves the nucleus) - these are electron rich and seek out positive charges.

Electrophile (loves electrons) - these are electron deficient and are seeking electrons.

A nucleophile will attack (push its electron density or electron pair towards) an electrophile.