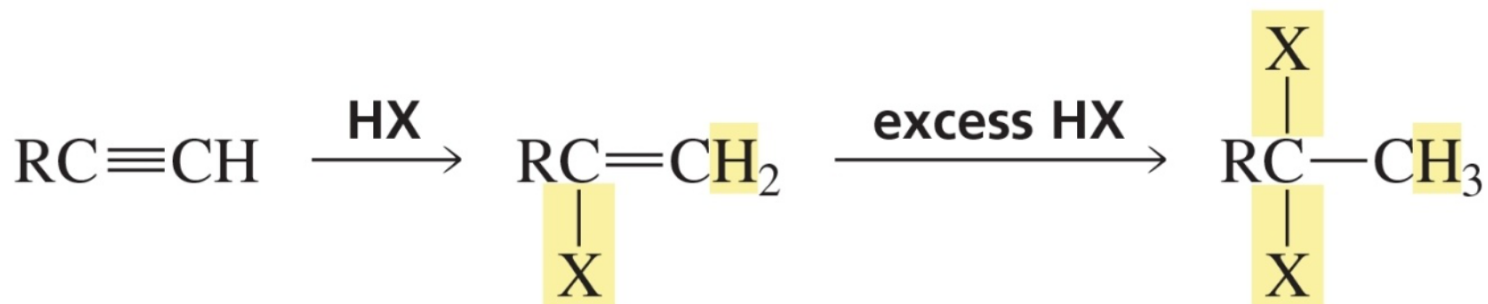


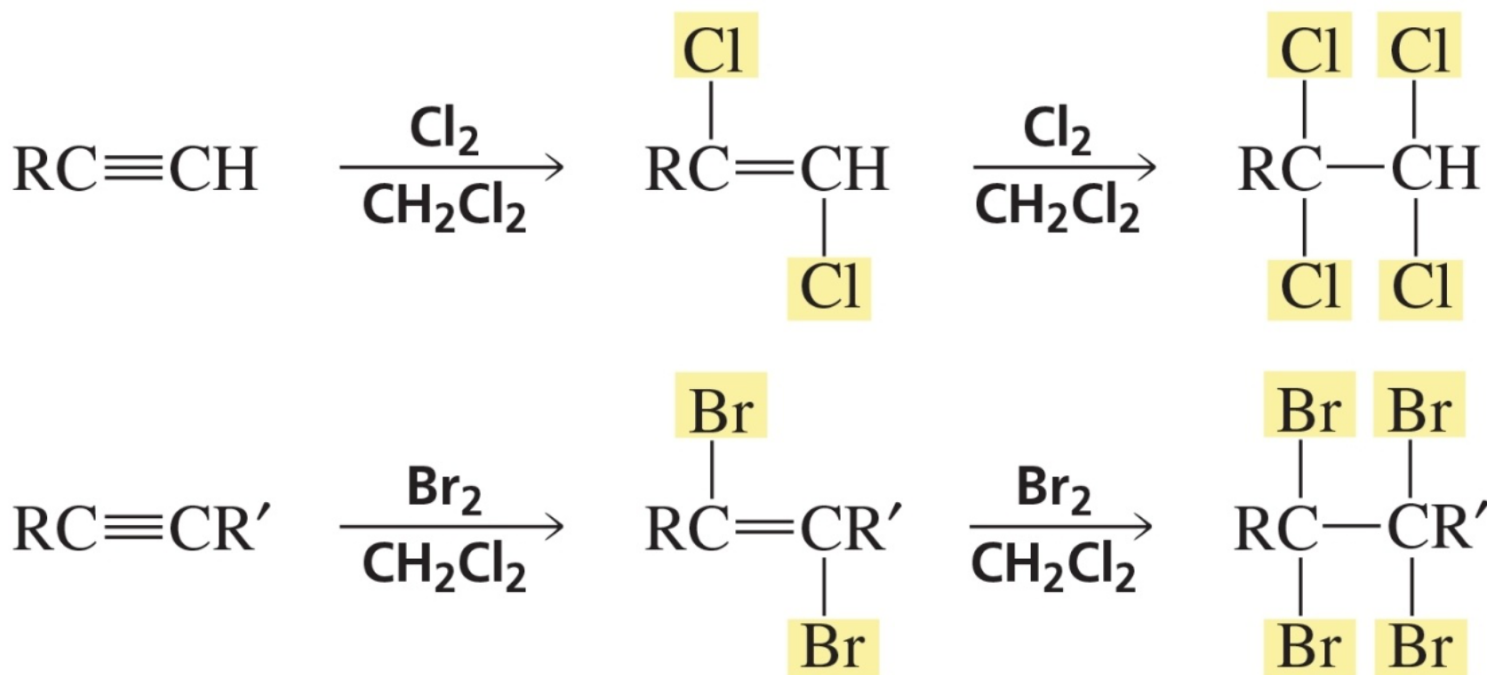
List of reactions

Addition of a halide either with one step or with a excess amount.



$\text{HX} = \text{HF}, \text{HCl}, \text{HBr}, \text{HI}$

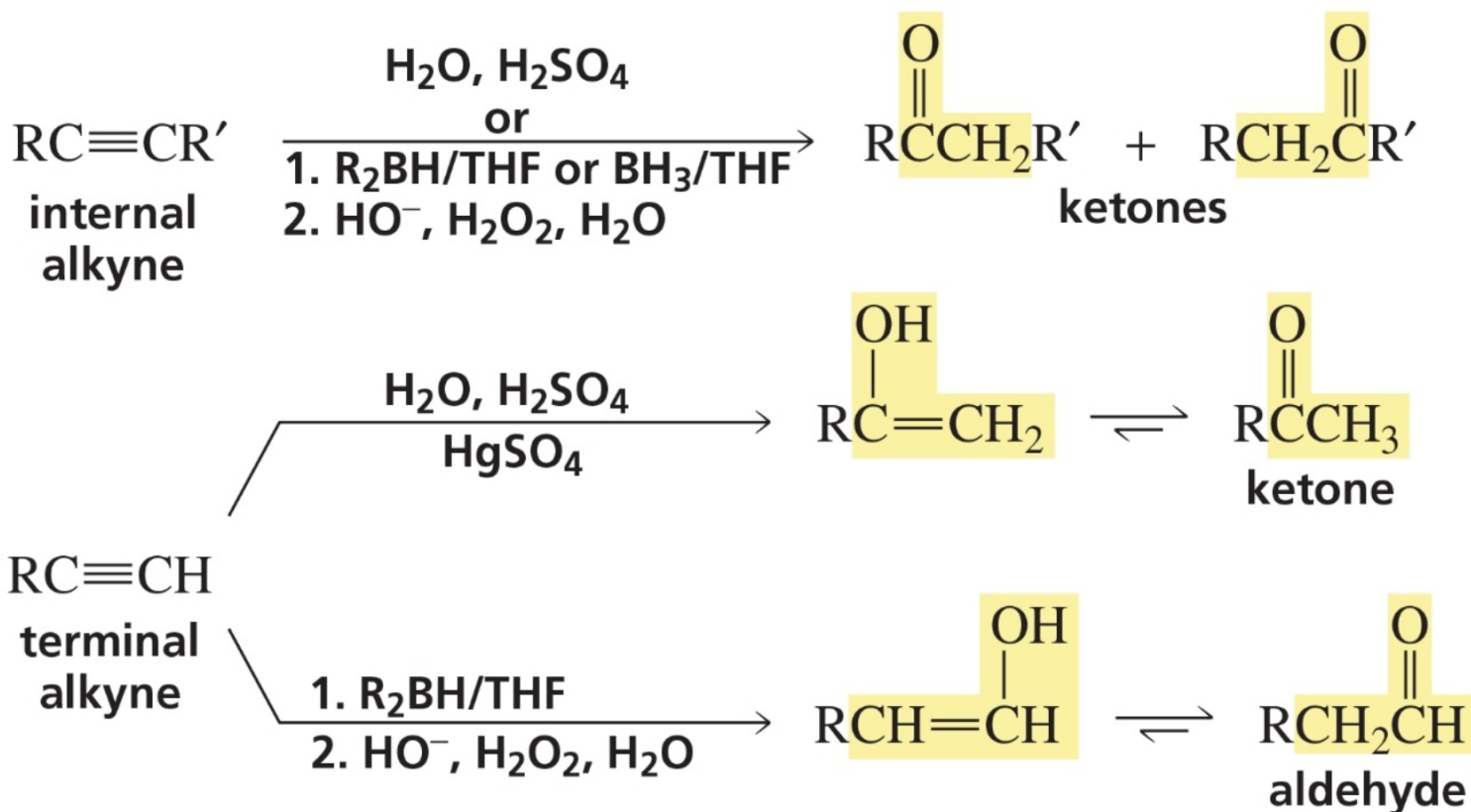
Addition of chlorine or bromine without any hydrogen being added to the molecule. The dichloromethane at the bottom is a solvent.



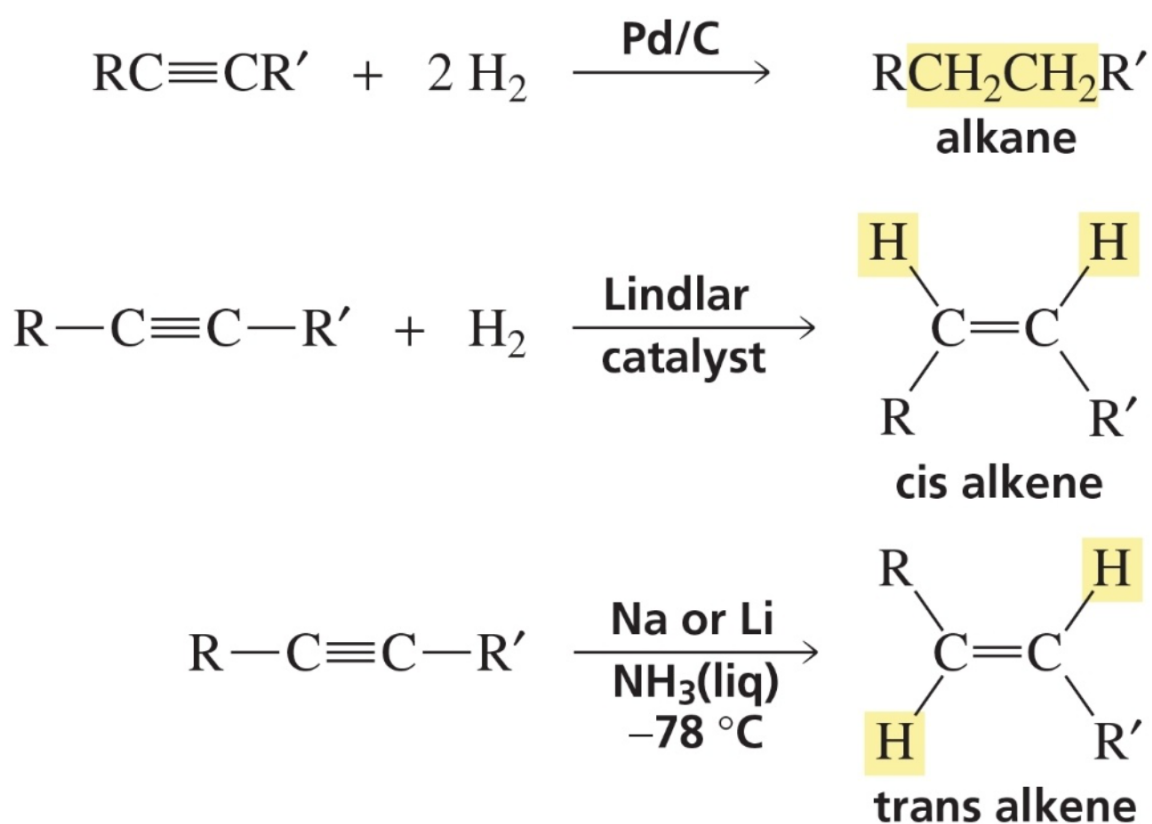
Addition of any hydrocarbon groups to a molecule of acetylene. If you want to add two different groups to both sides of the acetylene molecule you do them as two different steps.



A terminal alkyne is one where the triple bond is at the end of a chain while an internal is not. Hydroboration can be done either way and will always create a less stable ketone. Whenever an acid catalyzed hydration is done that will create both an enol and a ketone or aldehyde. The ketone or aldehyde will always be the major product.

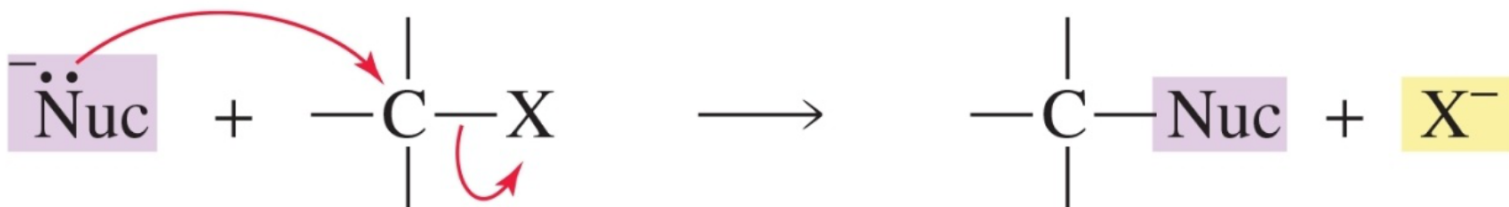


Addition of hydrogen to Alkynes. Palladium on carbon will bring an alkyne to an alkane. Lindlar's catalyst will bring an alkyne to an alkene and it will do a same side addition with the hydrogens. In other words it'll add as CIS or Z. Sodium and liquid ammonia at very cold temperatures does the same thing as a Lindlar's catalyst but it instead adds the hydrogen as TRANS or in other words E.

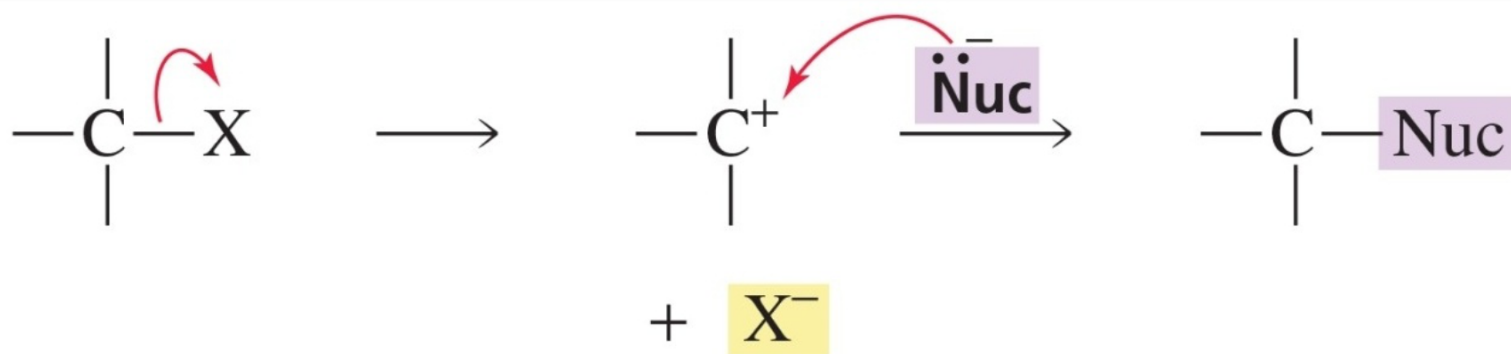


Substitution and Elimination reactions

Sn2 reaction. The S means substitution the N means nucleophilic and 2 means bimolecular. In other words it is a nucleophilic substitution reaction whose rate is dependent upon the nucleophile and the reactant.

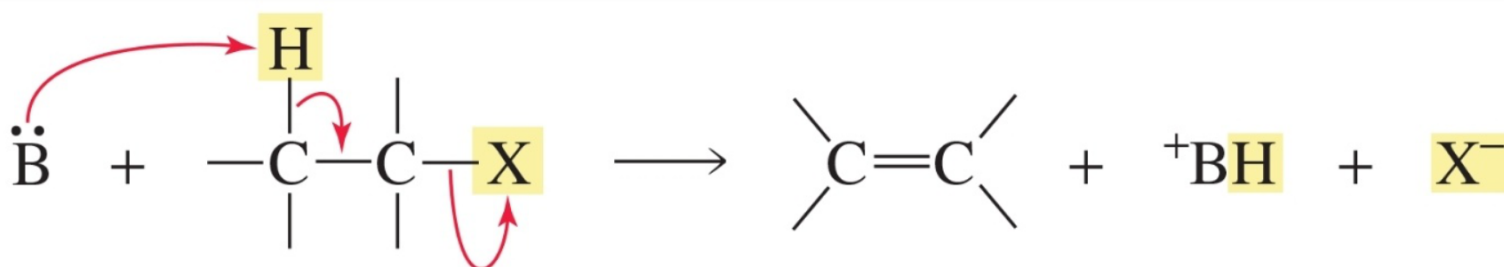


Sn1 reaction. It is the same as a Sn2 reaction the only difference is that the rate of the reaction is determined only by the reactant not the nucleophile, and a carbocation is formed as an intermediate which does not happen in a Sn2 reaction.

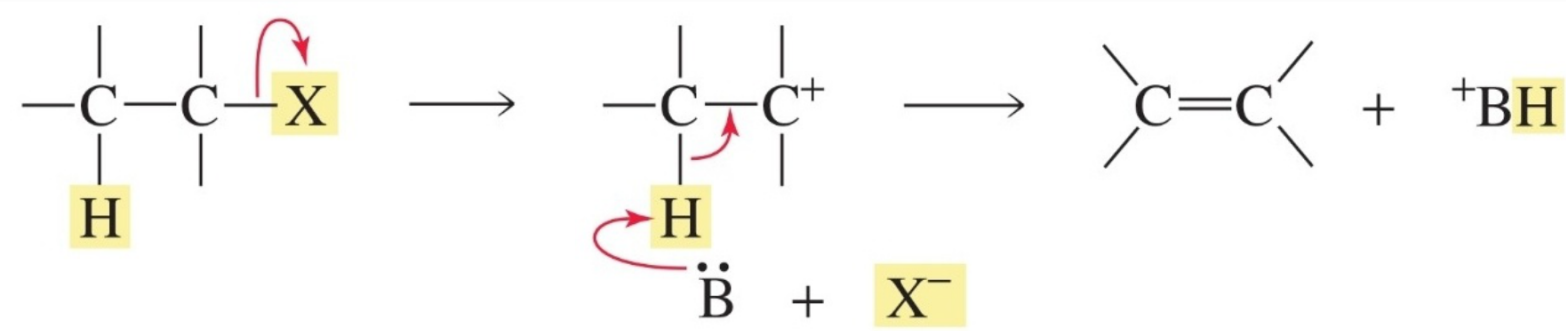


Please note for stereochemistry that Sn1 reactions will create a racemic mixture meaning they will create equal parts of R and S enantiomers. Sn2 reactions will only create the inverted product. So if you start with S you will end with R.

E1 reaction. Both E1 and E2 reactions follow Zaitsev's rule which is: the beta carbon with the least hydrogens will have its hydrogen removed to form the double bond. The only case where this does not happen is when there is an opportunity to form a conjugated double bond. This means that there are double bond, single bond, double bond continuing.



E2 reaction. Concerning stereochemistry, elimination reactions generally prefer TRANS or E additions because there is a more stable transition state if the larger groups are on opposite sides of the double bond.



As for determining whether substitution or elimination here are a couple tips:

When dealing with alkyl halides that can undergo all types of substitution and elimination reactions:

- good nucleophiles or strong bases will favor the S_N2 E2 pathway while poor or weak nucleophiles will favor S_N1 and E1

When talking about competing S_N2 and E2 reactions:

- Primary alkyl halides will undergo substitution
- Secondary alkyl halides will undergo substitution and elimination but note that strong, bulky bases, and high temperatures will always favor elimination over substitution
- Tertiary alkyl halides will only experience elimination

When faced with a tertiary alkyl halide:

- Your major product will be substitution but you will also get elimination as a minor product

Reactivity:

S_N2: Primary > secondary > Tertiary

E2: tertiary > secondary > primary