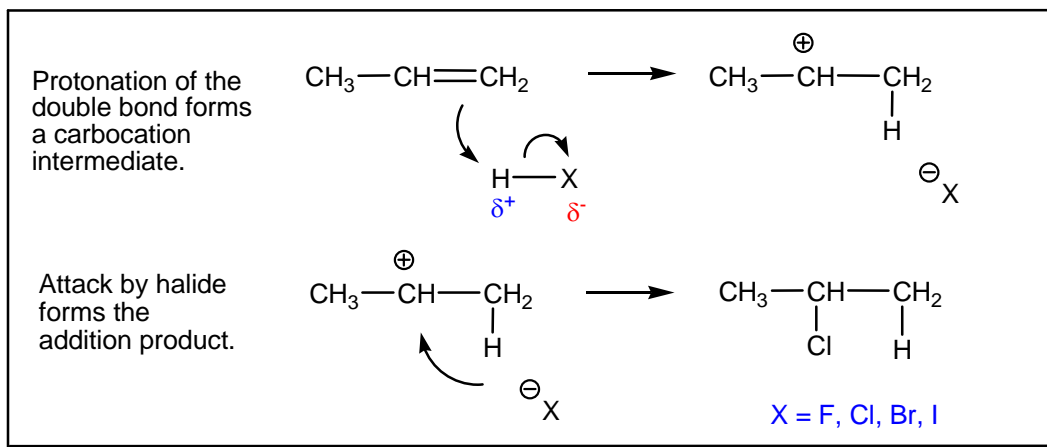
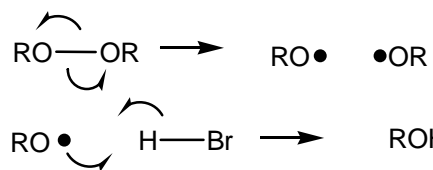


Ionic Addition of HX to Alkenes

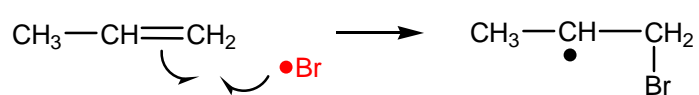


Free Radical Addition of HBr to Alkenes

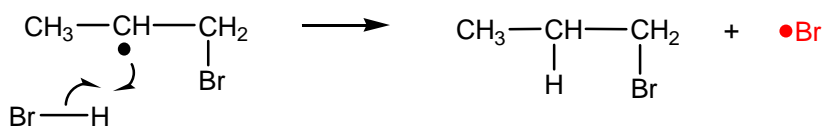
Initiation steps: peroxides cleave HBr to form bromine radical.



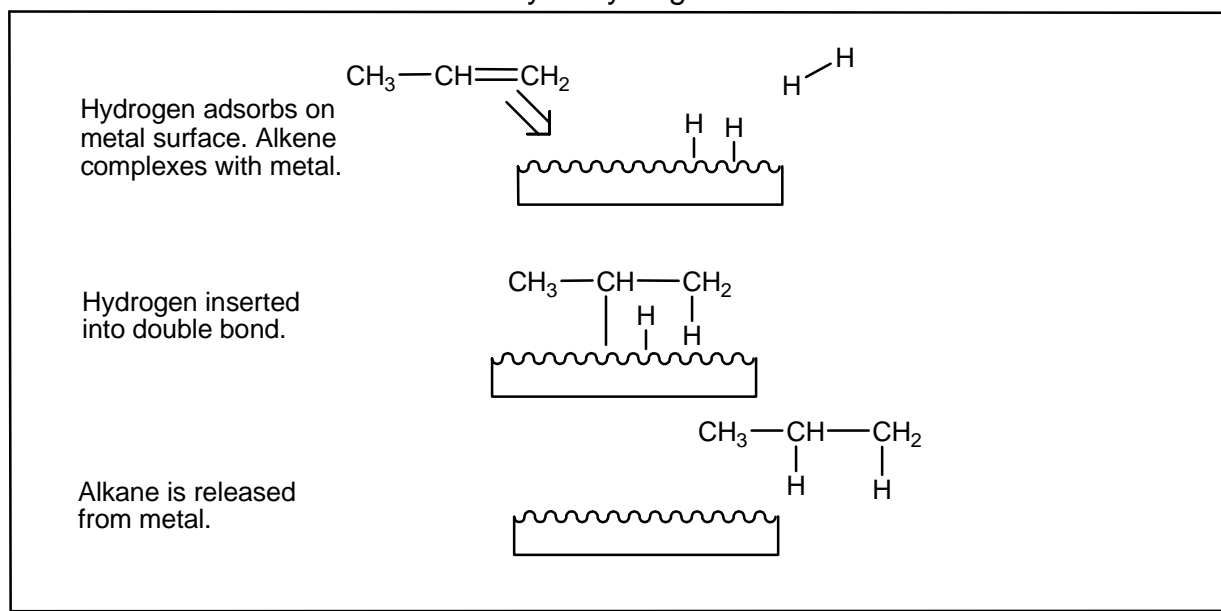
Propagation step: bromine radical adds to alkene to produce alkyl radical.



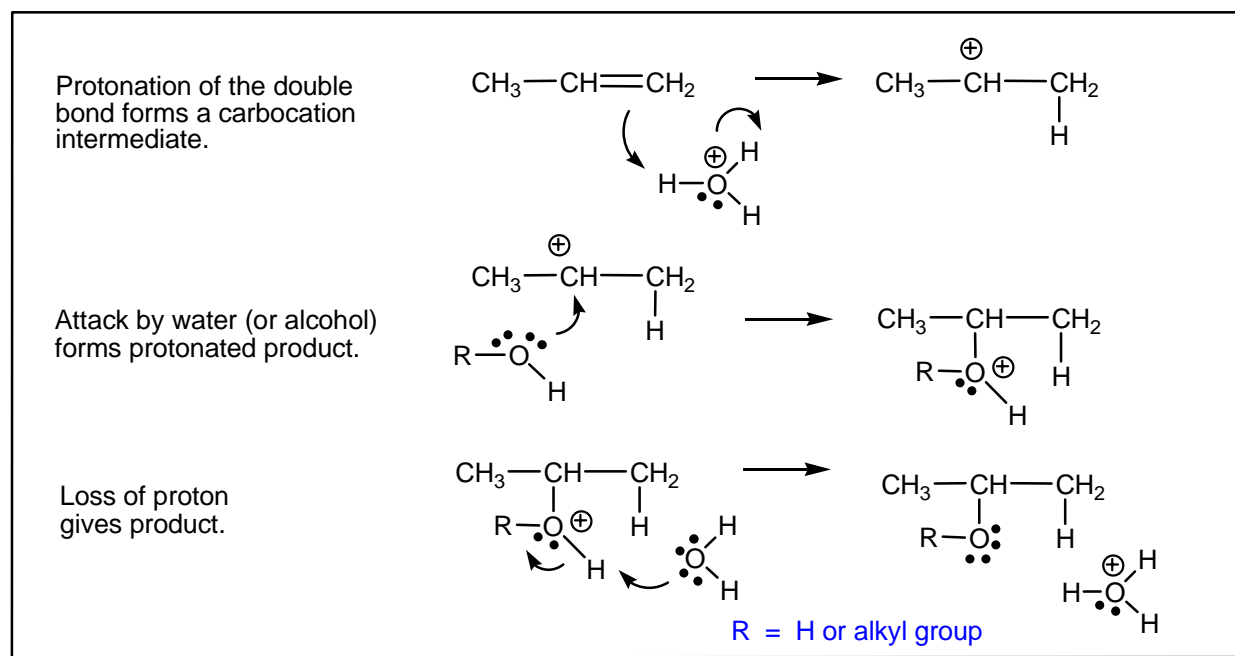
Alkyl radical reacts with HBr to form addition product and new bromine radical.



Catalytic Hydrogenation

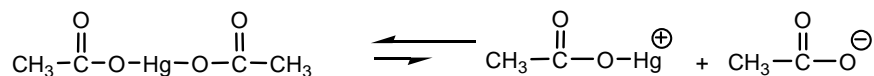


Acid-Catalyzed Addition of Water and Alcohols to Alkenes

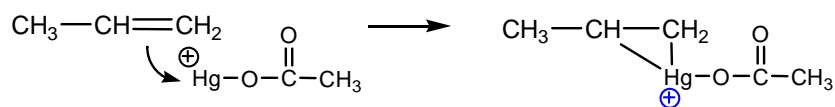


Hydration via Oxymercuration-Demercuration

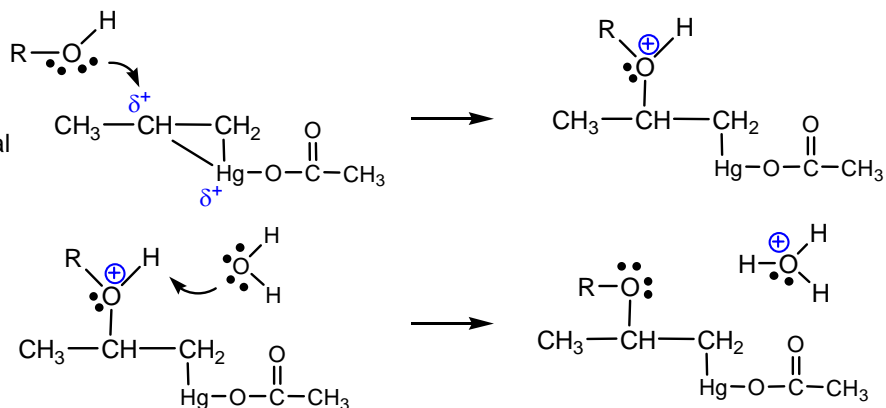
Mercury(II) acetate dissociates to form an electrophilic mercury species.



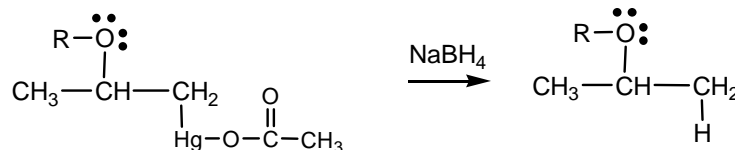
Oxymercuration involves attack by the double bond to form a mercurinium ion.



Water or alcohol attacks the intermediate in an anti-fashion to give a protonated organomercurial alcohol or ether.

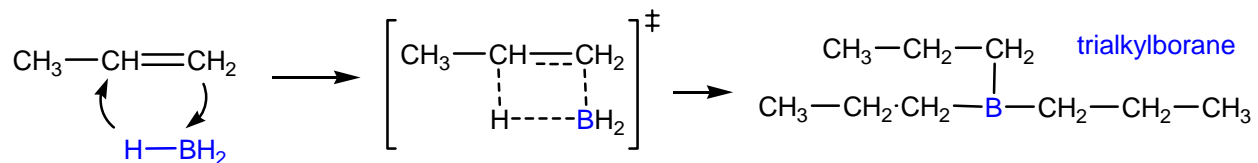


After the deprotonation step, NaBH_4 delivers a hydride to replace the mercury with retention of stereochemistry.

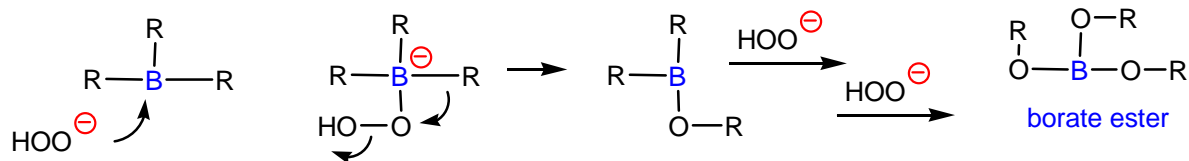


Hydroboration/Oxidation

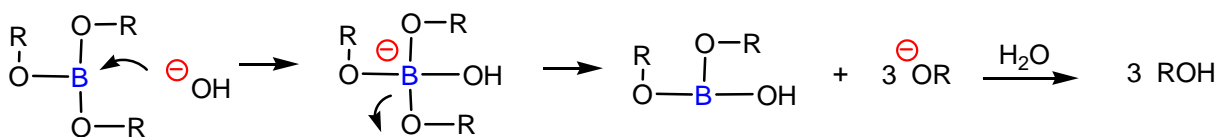
Hydroboration: Borane adds syn to the double bond. Three equivalents of alkene react with one equivalent of BH_3 to form the trialkylborane.



Oxidation: Three equivalents of peroxide ion give the trialkylborate ester via rearrangement.



Hydrolysis of borate ester release three equivalents of alkoxide which is protonated.

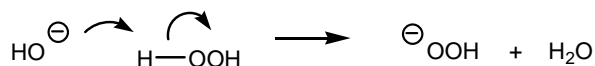


[Click here to see complete mechanism for hydroboration](#)

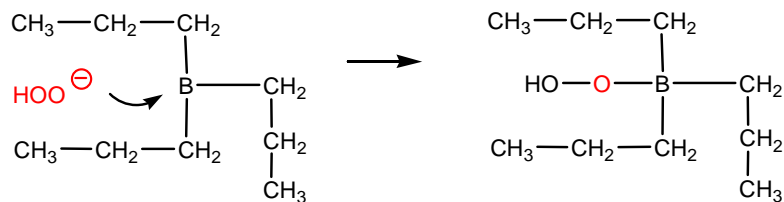
[Click here to see complete mechanism for oxidation of trialkylborate](#)

Oxidation of Trialkyl Borane Followed by Hydrolysis of Borate Ester to the Alcohol

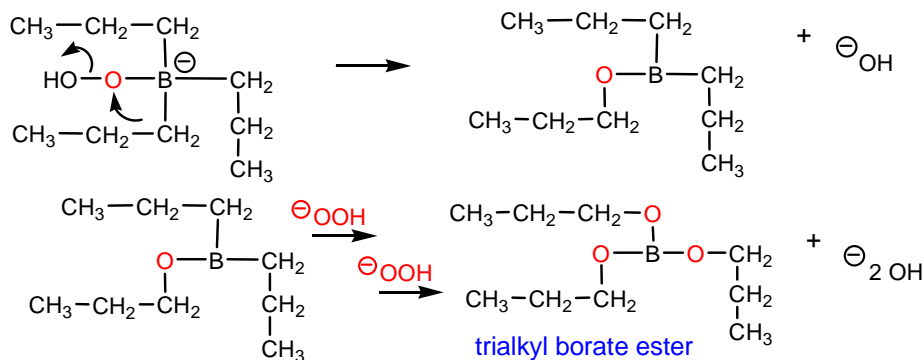
Formation of hydroperoxide ion.



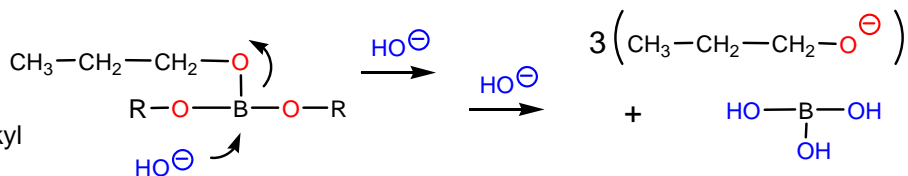
Hydroperoxide adds to the boron atom.



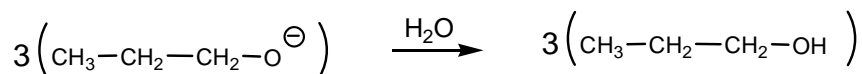
Ultimately, 3 equivalents of peroxide ion are added and all three alkyl groups migrate to give a trialkyl borate ester.



Hydrolysis of the trialkyl borate ester releases three equivalents of the product alcohol.

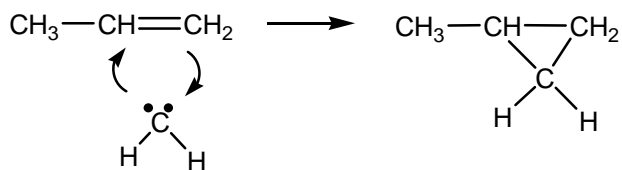


Alkoxide is protonated to give the final product alcohol.

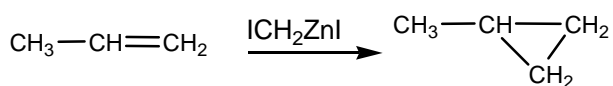


Carbene Insertion

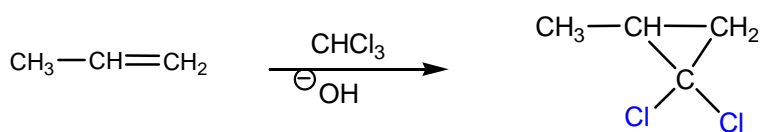
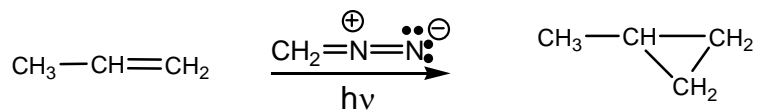
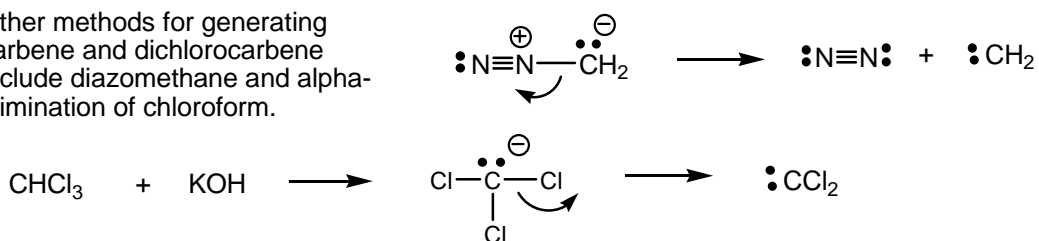
Carbene insertion is a syn addition via a concerted process.



The Simmons-Smith reagent, ICH_2ZnI , works under mild conditions.

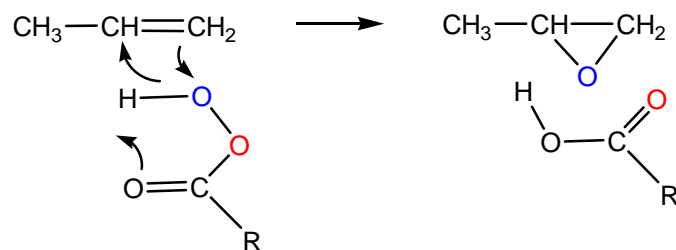


Other methods for generating carbene and dichlorocarbene include diazomethane and alpha-elimination of chloroform.

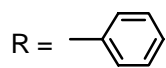


Epoxidation of Alkenes

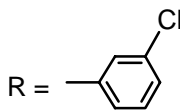
Epoxidation is a concerted syn addition to an alkene.



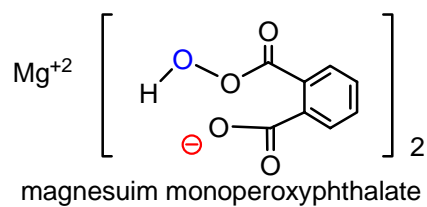
peracids



perbenzoic acid

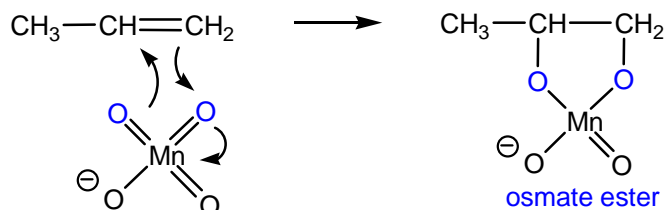


meta-chloroperbenzoic acid also called MCPBA

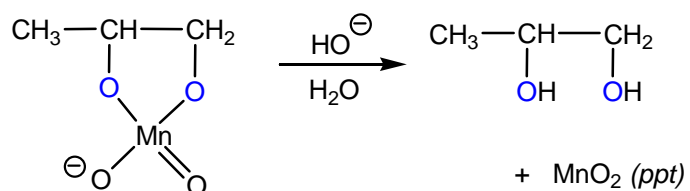


Hydroxylation by Permanganate

MnO_4^- reacts with alkenes in a concerted syn addition to form cyclic ester.



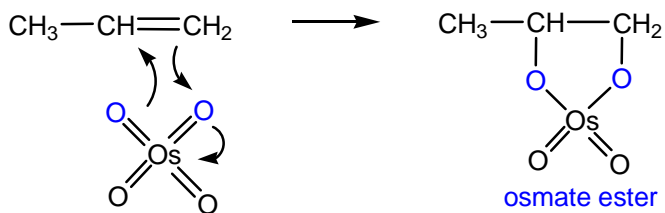
Basic hydrolysis releases the glycol and produces a precipitate of MnO_2 .



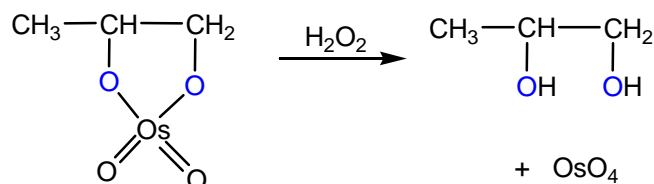
The exact mechanism of hydroxylation by this method is not well characterized.

Osmium Tetroxide Hydroxylation

OsO_4 reacts with alkenes in a concerted syn addition to form an osmate ester.

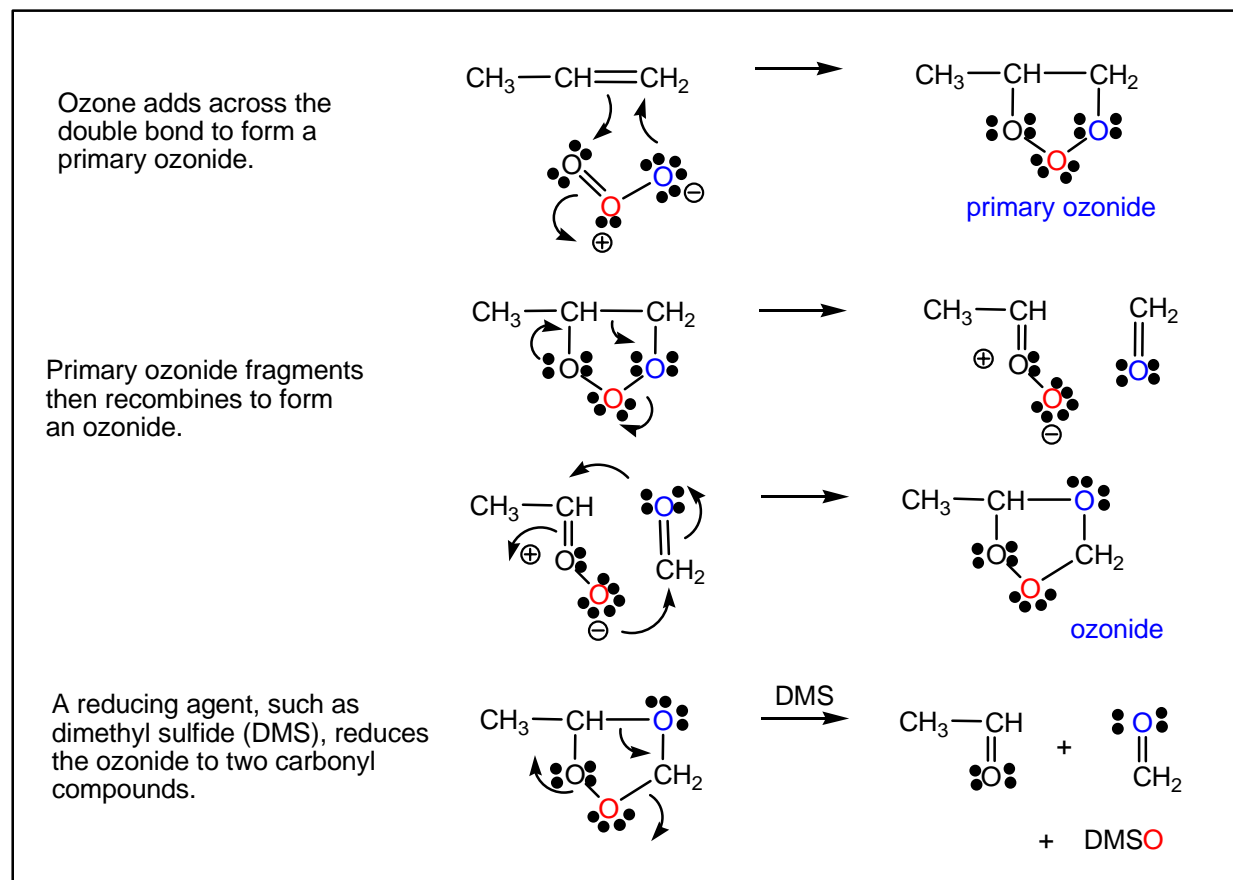


Hydrogen peroxide is used to cleave the ester to form the glycol and oxidize OsO_2 back to OsO_4 .



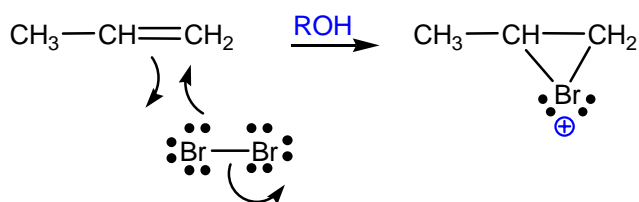
The exact mechanism of glycol formation from the osmate ester is not well characterized.

Ozonolysis- Oxidative Cleavage of Alkenes

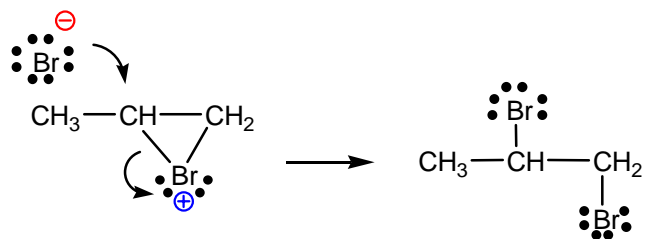


Addition of Halogens

Bromine adds to the double bond to form a bromonium ion.



Bromide ion attacks the back side of bromonium ion.



Chlorine adds in the same fashion although iodine and especially fluorine are sluggish and generally not used for this reaction.



Halohydrin Formation

