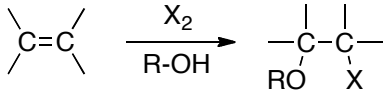
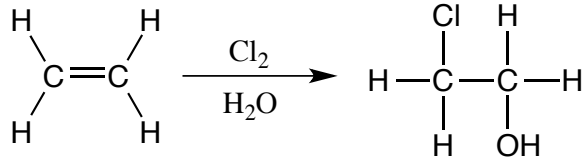
Reaction of Alkenes with Halogen and Water/Alcohol

General reaction



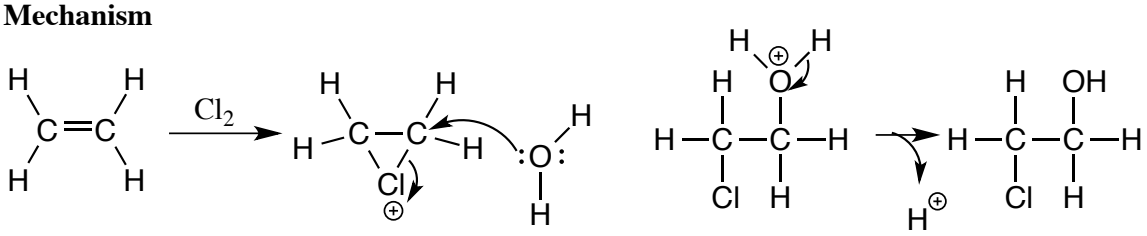
X = Cl, Br, F R = alkyl/H

Example 1



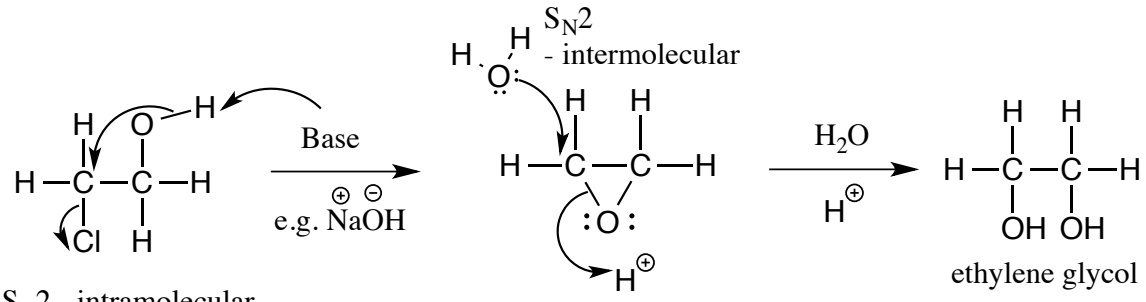
a chlorohydrin

Mechanism



Halohydrins are useful compounds for further reactions. The chlorohydrin below can be converted into an epoxide by an intramolecular (within a molecule) S_N2 reaction. The epoxide may then be converted into a 1,2-diol (intermolecular S_N2).

epoxide = oxirane = cyclic 3-membered ether

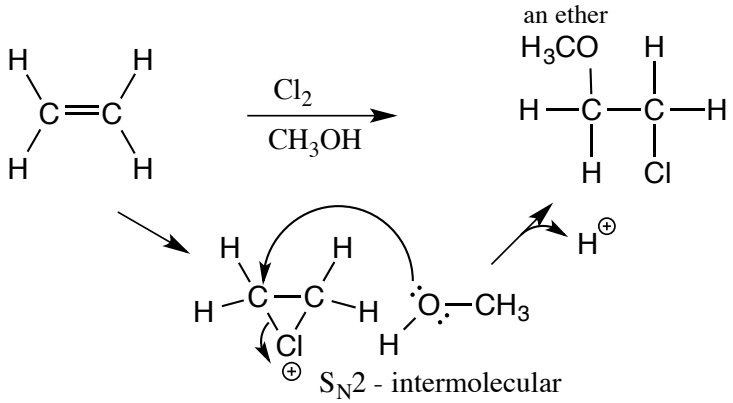


S_N2 - intramolecular
intramolecular rxns are FAST

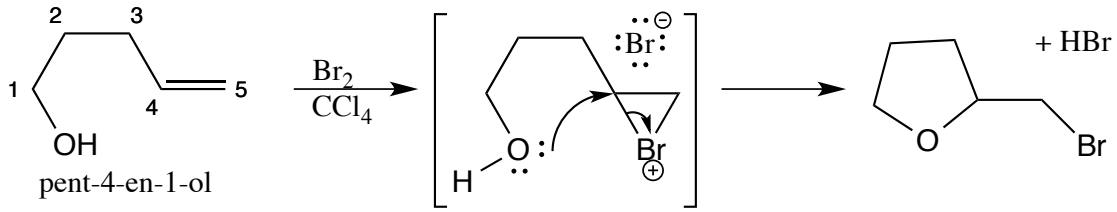
ethylene oxide
- reactive

ethylene glycol

Example 2



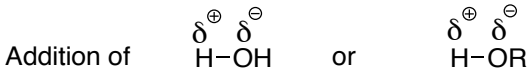
Example 3



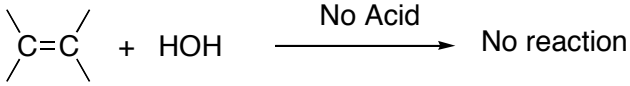
Oxygen is a better nucleophile than bromide and intramolecular cyclization is FAST.

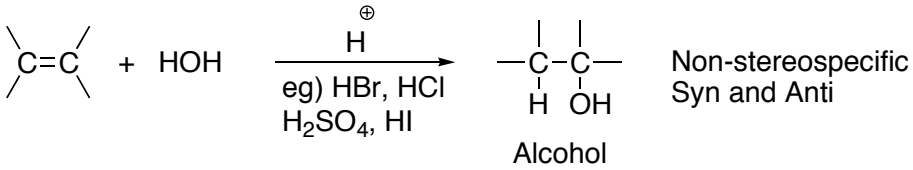
5-membered ring formation is favored → FAST
6-membered ring formation → OK, but much slower

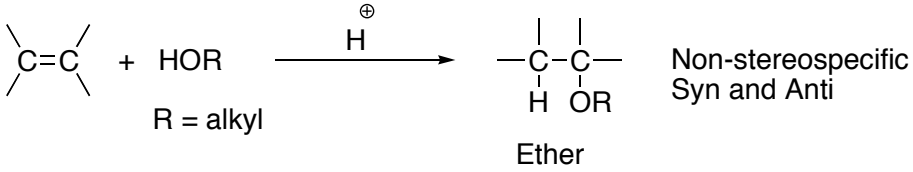
Hydration and Ether Formation



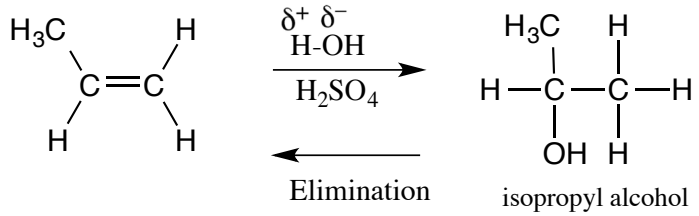
General Reactions:



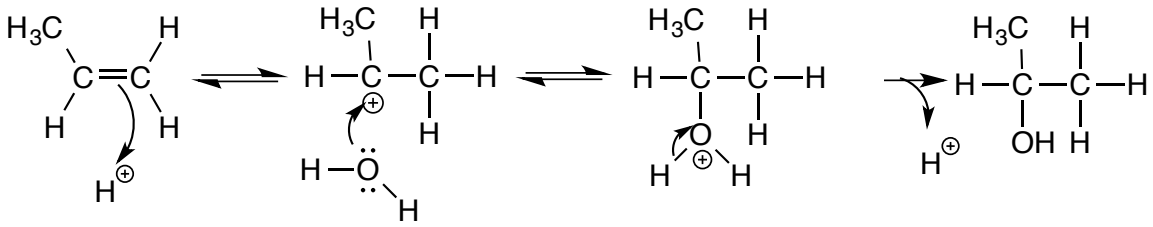




Example 1 (follows Markvnikov Rule)

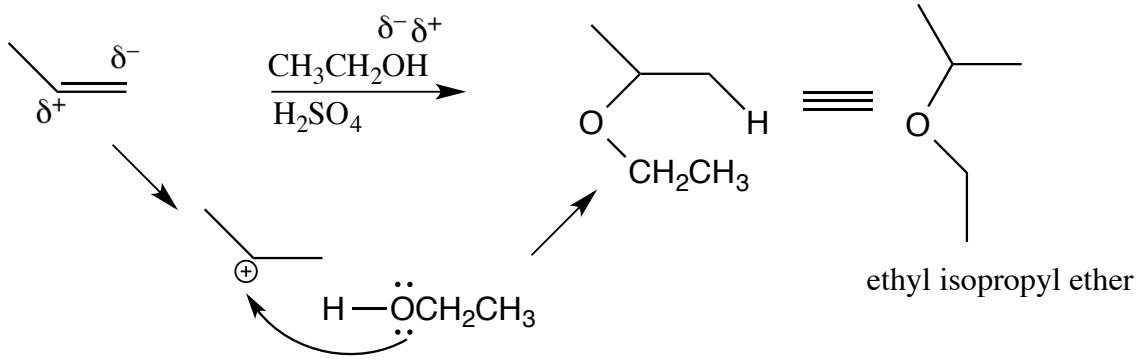


Mechanism



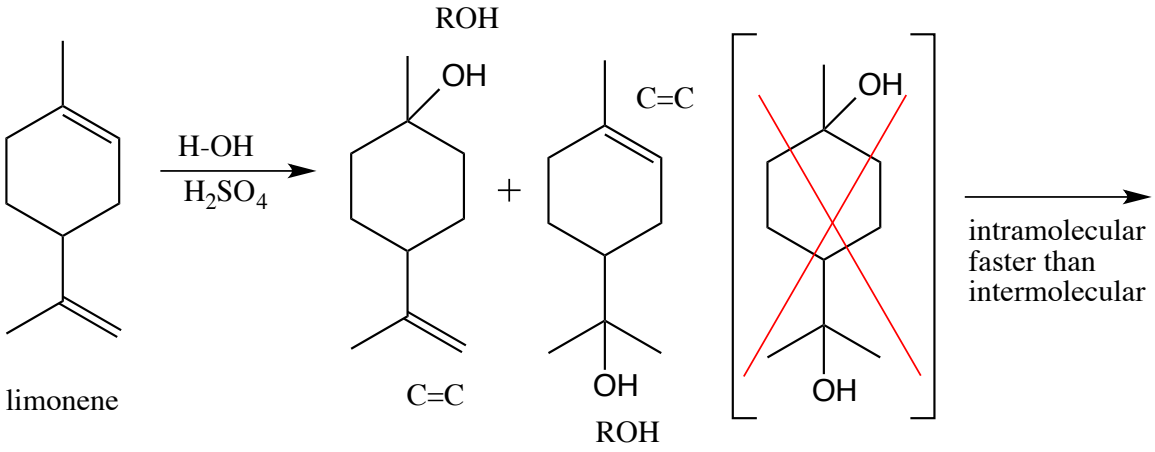
Example 2

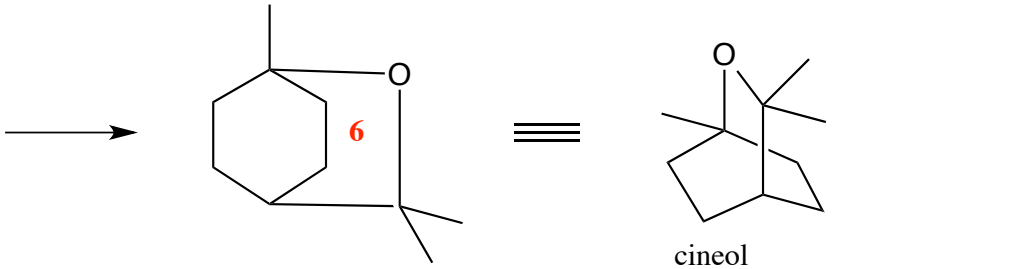
Ether formation: alkene + alcohol + acid catalyst



A secondary carbon is better at stabilizing positive charge than a primary carbon. The oxygen from the alcohol (partially negative) ends up attaching to the secondary carbon (partially positive) after protonation of the alkene creates the carbocation.

Example 3





cineol
eucalyptol
- seed germination inhibitor

Eucalyptol is made by the intramolecular formation of a 6-membered ring. The product that would have both alkenes hydrated is not formed.