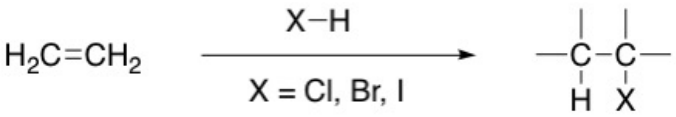
RECALL: Addition Reaction of Alkenes

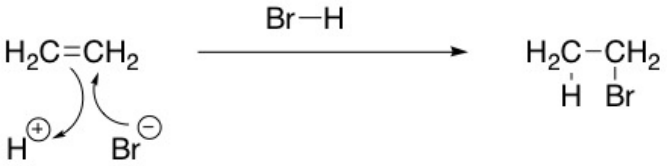
Addition Reactions

Hydrogen Halide (H-X)

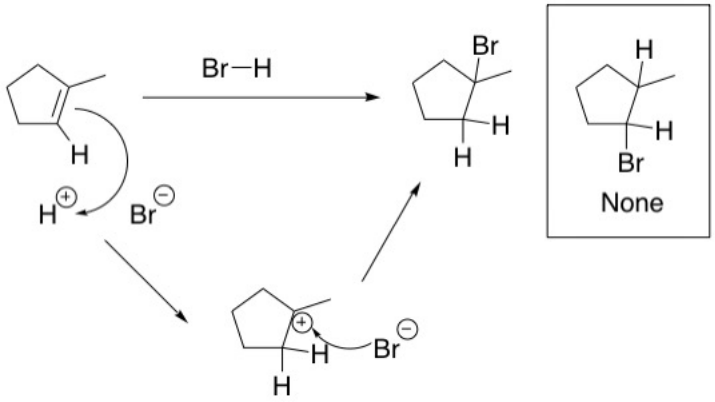


Reaction generally leads to syn/cis addition

Example 1: Ethylene



Example 2: 1-Methylcyclopent-1-ene



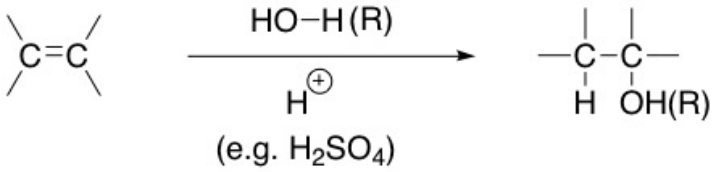
-Markovnikov addition

RECALL: Carbocation stability $3^o > 2^o > 1^o > CH_3^+$

Hydration and ether formation

HO–H or RO–H

Addition R = Alkyl

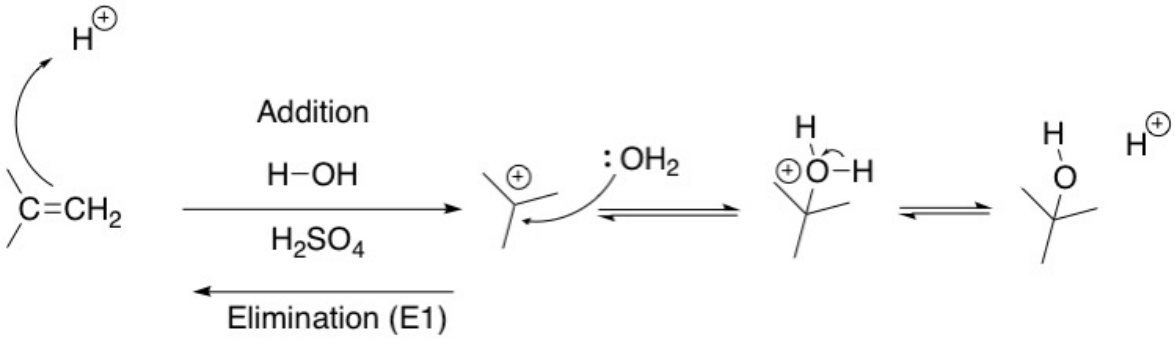


Not Stereospecific

Examples

Hydration formation

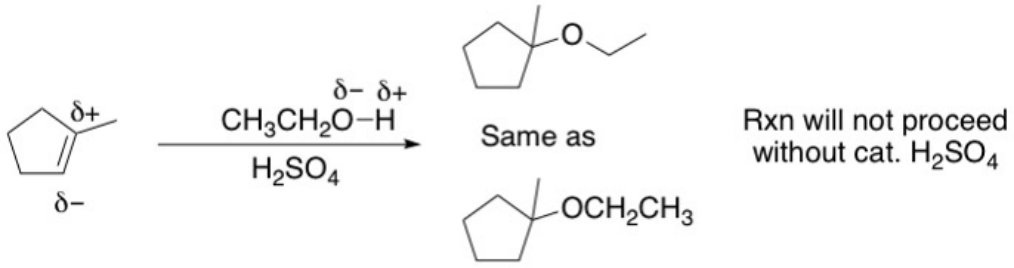
Ex #1)



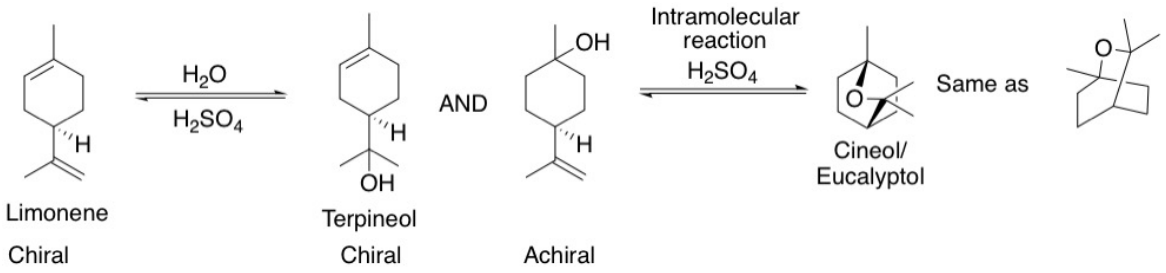
H_2SO_4 (H^+) is a catalyst, meaning that it is not transformed or used up in the reaction but is present to lower the activation energy.

Ether formation

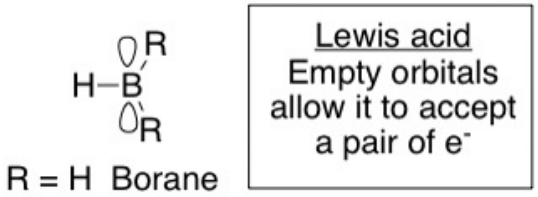
Ex #1)



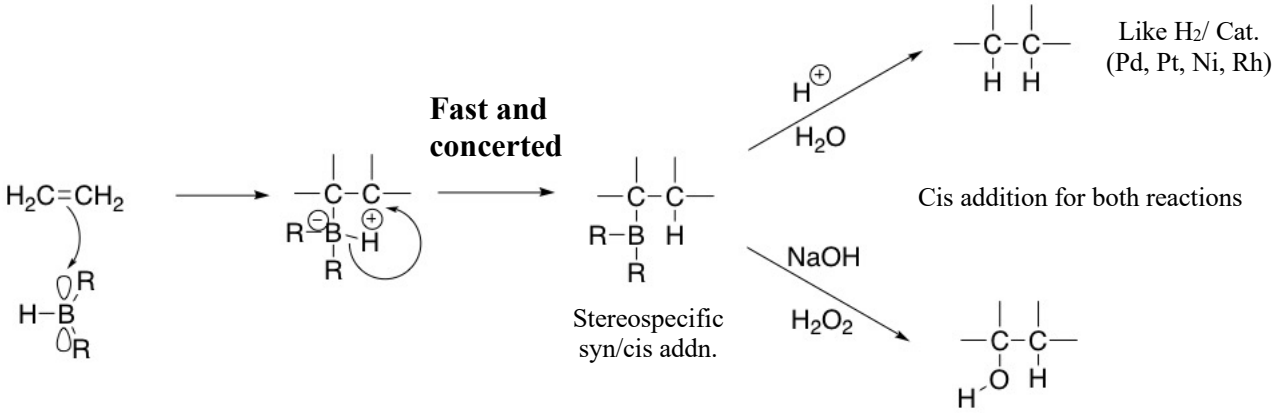
Ex #2)

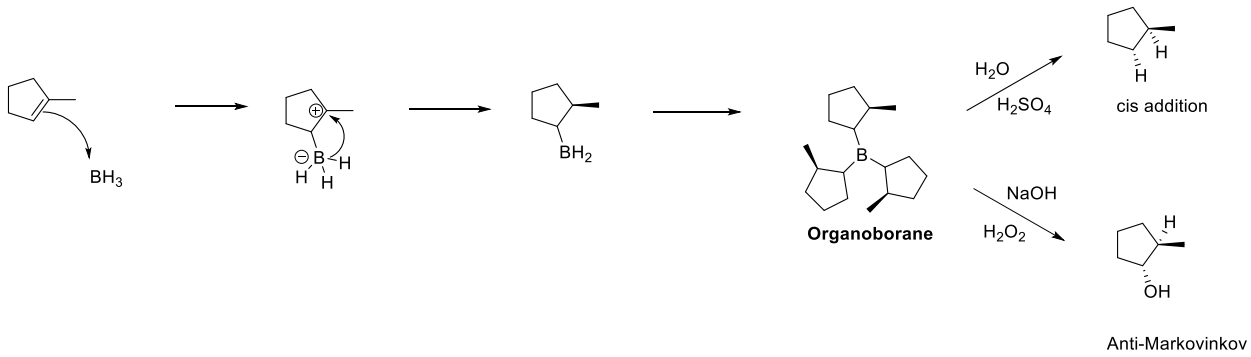


Hydroboration



- B when stable and uncharged has 3 bonds and no lone pairs
- Borane forms partial bonds with another borane molecule to form B_2H_6 (diborane)
- Borane is a hydride (H^-) donor



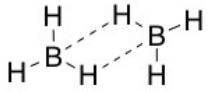


Concerted reaction: bond breaking and bond formation happens in a single step
Anti-Markovnikov: the hydrogen ends up on the more substituted C in a double bond.

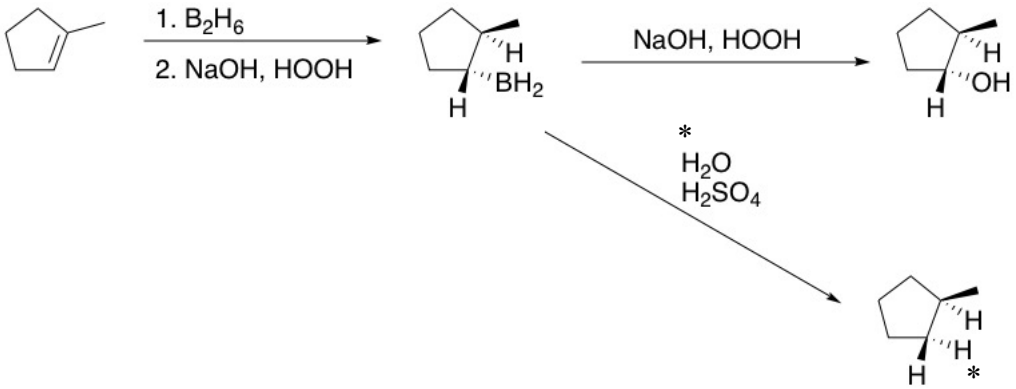
Structure of borane

Exists as Diborane (B_2H_6), but behaves like BH_3

Borane BH_3

Diborane 

Example

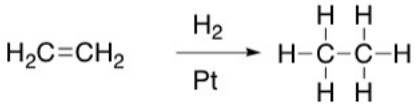


Syn addition, but anti-Markovnikov add'n of OH

Oxidation and reduction reactions

Reduction adds electrons
Oxidation removes electrons

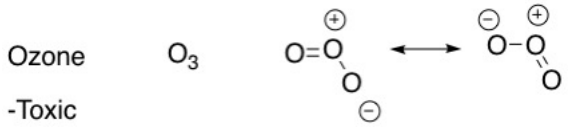
Reduction Reaction



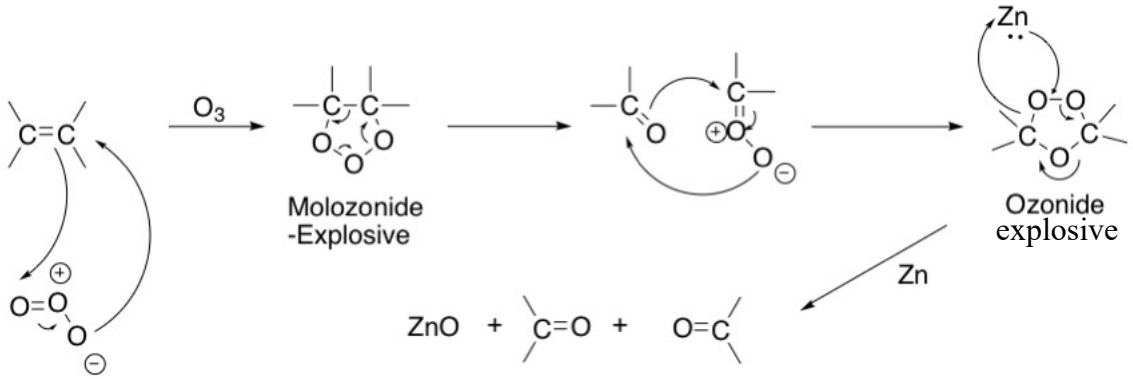
12 e^- outer shell 14 e^- outer shell

As there is an increase in the electron count in the outer shell, this is a reduction of ethylene.

Ozonolysis (lysis = cleavage) – cleavage by ozone (O_3)

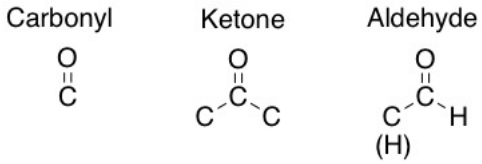


- Use double-headed arrow to indicate resonance (↔)
- Highly reactive (always looking for negative charge such as the negative charge in a double bond)

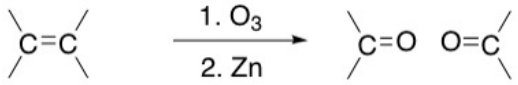


- Reaction is irreversible

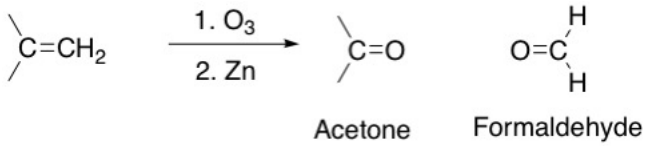
Examples of carbonyl groups



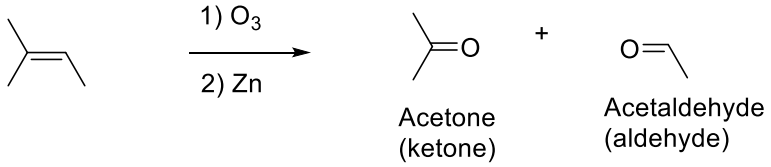
Reaction scheme of ozone

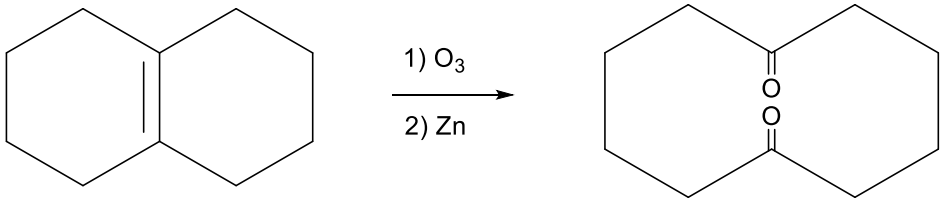


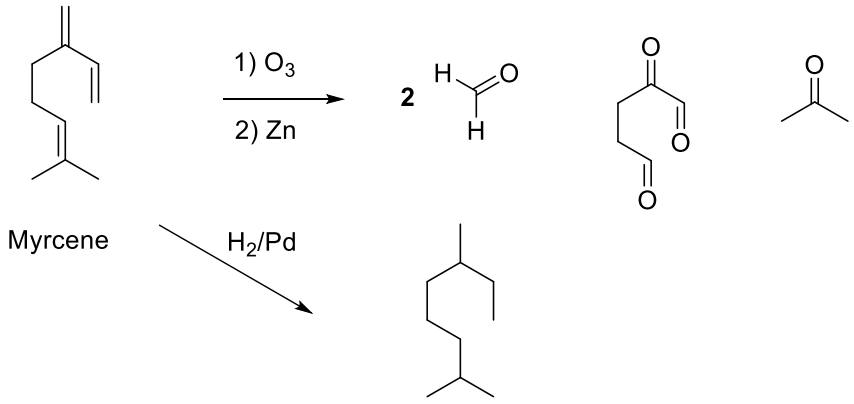
Example



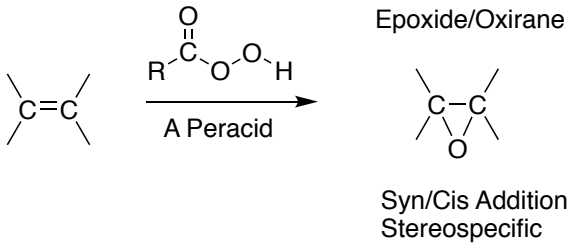
More examples



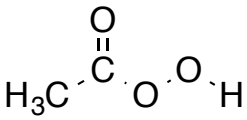




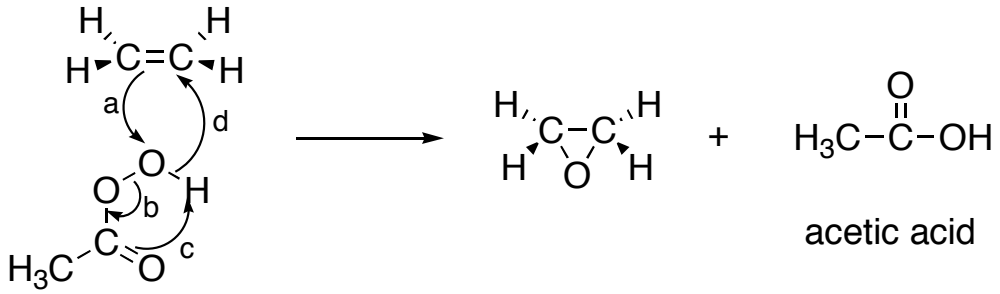
Epoxidation:



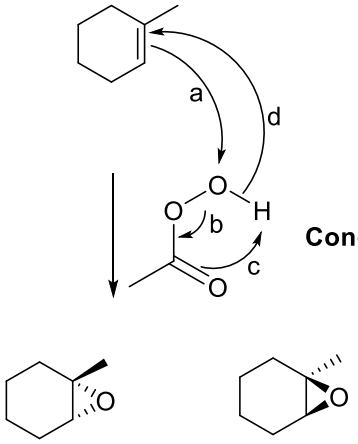
Example of a peracid



Mechanism:



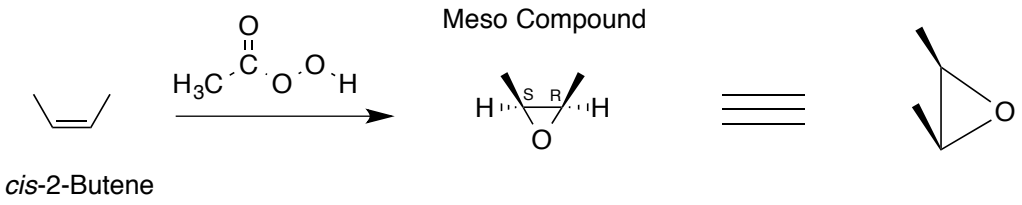
1-methyl-1-cyclohexene

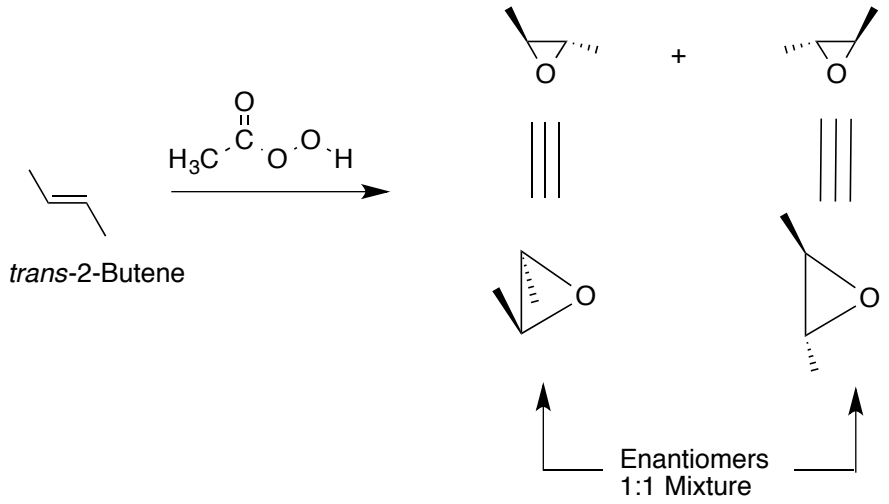


Concerted Stereospecific

Racemic mixture (1:1)
cis/syn addition

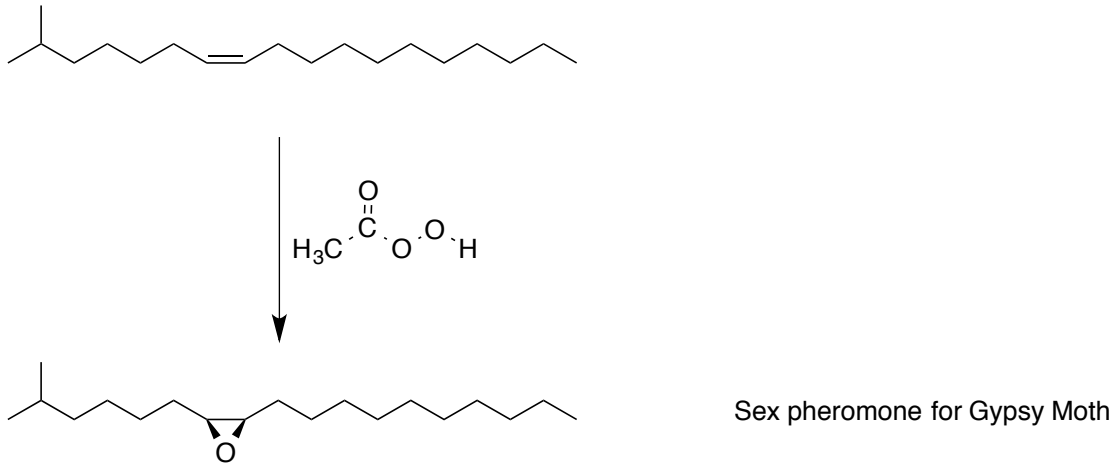
Example 1: *trans*- vs *cis*-Butene





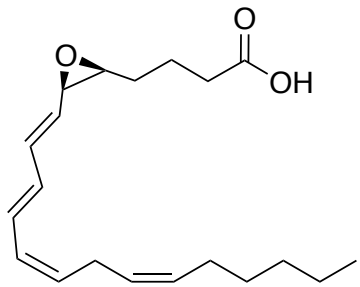
The possibility of epoxidation from the top is 50% and from the bottom is 50% so a 1:1 mixture of enantiomers is form (racemic mixture).

Example 2: 2-Methyl-7-octadecene



biologically, only one enantiomer is active (one shown) – racemate produced by peracetic acid

Example 3:



Leukotriene A_4