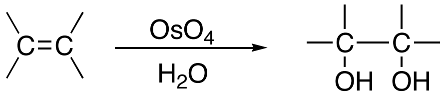
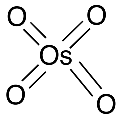
OsO_4, osmium tetroxide.



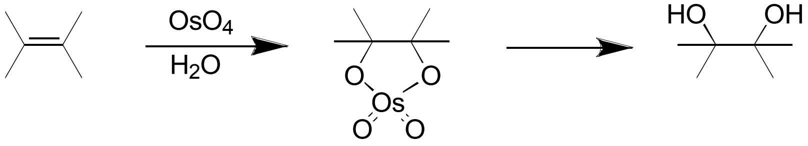
Syn - addition

- stops with diol, does not form carboxylic acid when heated.

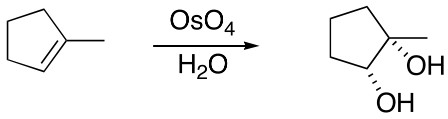


volatile and toxic solid

It goes through this intermediate:



eg.



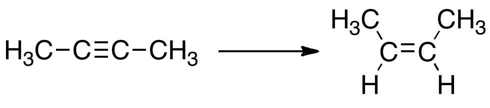
racemic (1:1 mix of enantiomers)

Reactions of alkynes

1. Addition (analogous to alkenes)
2. At terminal carbon bearing H

Addition

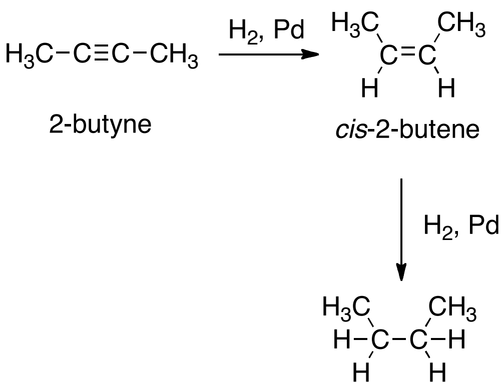
Hydrogenation



1. HBR_2 then $H^+ + H_2O$

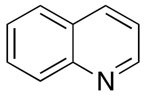
OR

2. H_2 and catalyst. However, need a less reactive catalyst to stop reaction at the cis-2-butene product.



Lindlar's catalyst:

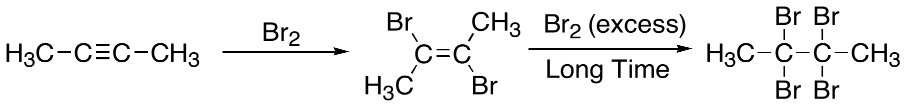
Pd, $BaSO_4$ (or $CaCO_3$ is often used in place of $BaSO_4$), and quinoline (see below):



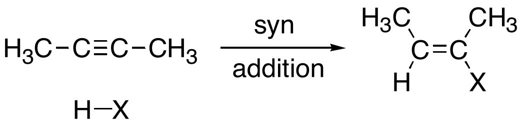
- ➢ These conditions allows for selective hydrogenation of alkynes to alkenes.

<u>Halogenation</u>

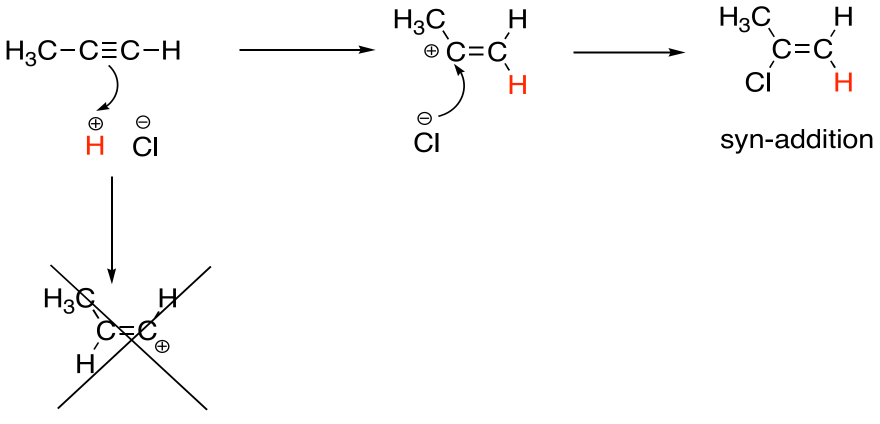
Eg.



<u>HX Addition (syn)</u>



Eg. Propyne (follows Markovnikov's rule):



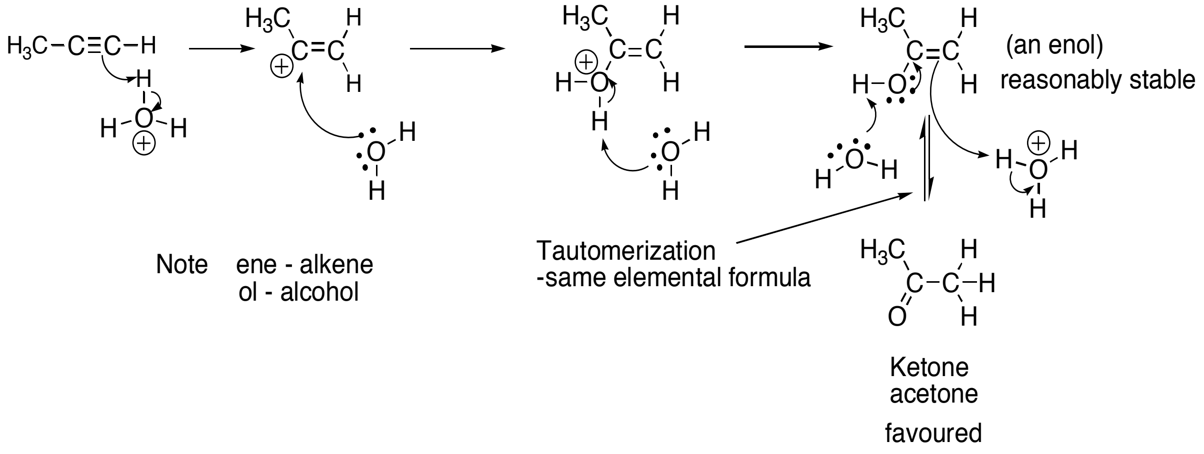
Not formed

Addition of water (requires acid)

Remember

$$H_2O + H_2SO_4 \rightleftharpoons H_3O^{\oplus} + HSO_4^{\ominus}$$

Mechanism:



(an enol)
reasonably stable

Note ene - alkene
ol - alcohol

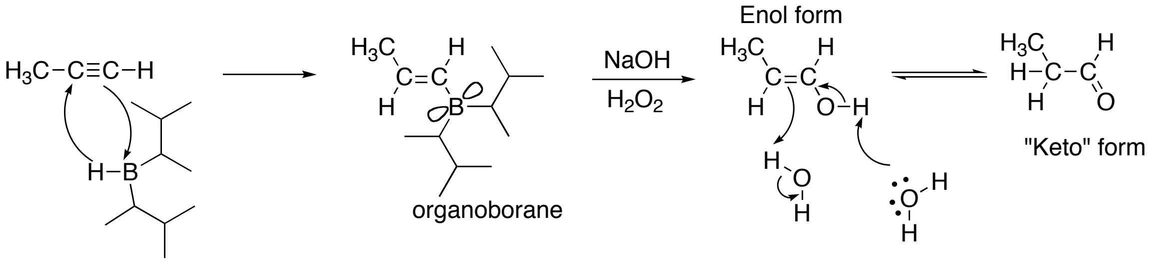
Tautomerization
-same elemental formula

Ketone
acetone

favoured

Tautomers (eg. keto/enol) are rapidly equilibrating structural isomers. The process is called **tautomerisation**.

Anti-Markovnikov Water Addition – Hydroboration-Oxidation



- Two possibilities for reaction of Organoboranes:

water and acid to add H and give alkene or NaOH and H_2O_2 to give enol tautomer that converts (equilibrium) primarily to keto tautomer (aldehyde shown below)