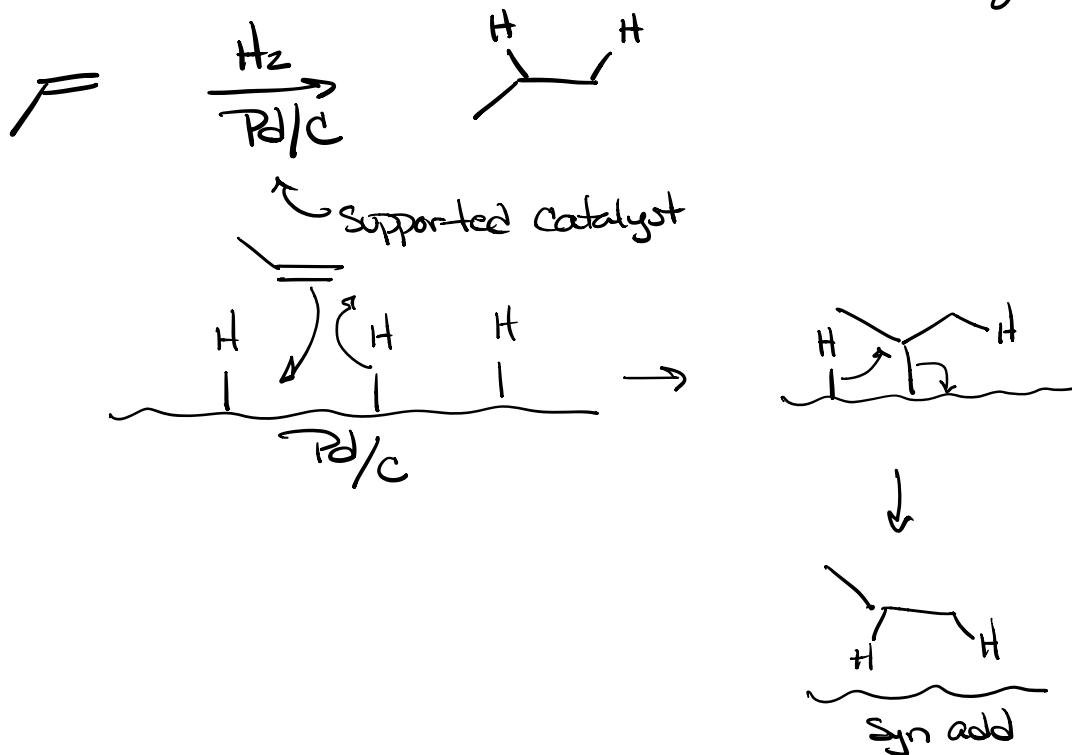


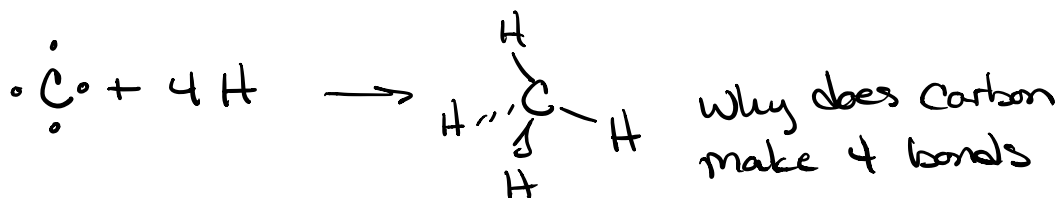
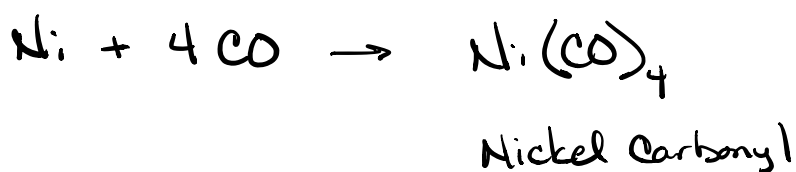
# Transition Metal Compound (Homogeneous Catalysis)

Hydrogenation Rxn  $\rightarrow$  Heterogeneous (multiple phases  
Solid & liquid)

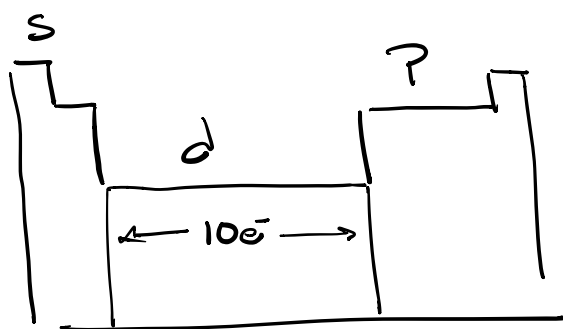


# Transition Metal Compounds

Ligand → Any element, compound or ion that donates  $e^-$  density to a metal

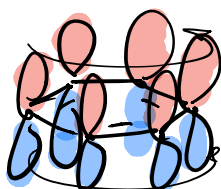
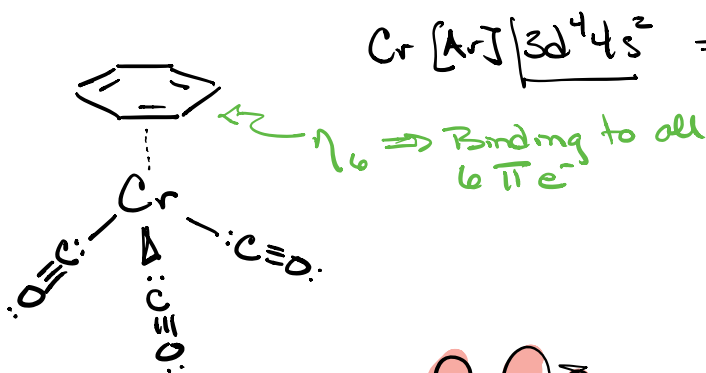
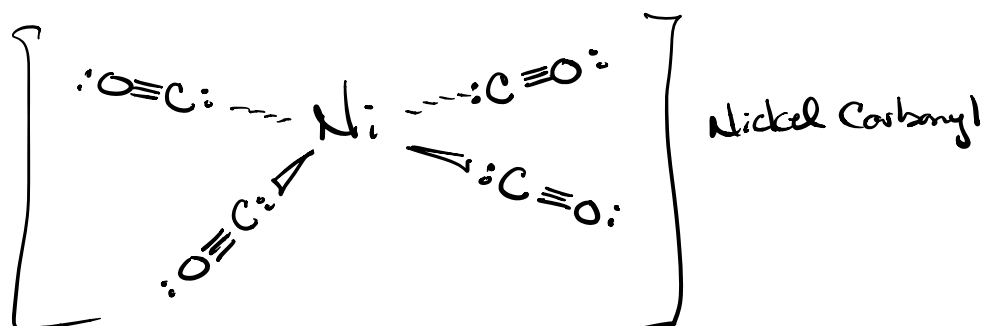
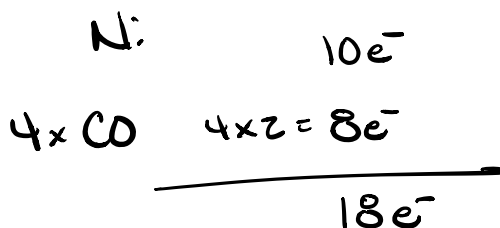
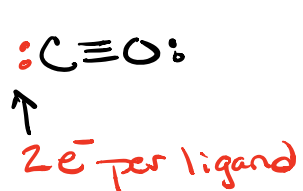
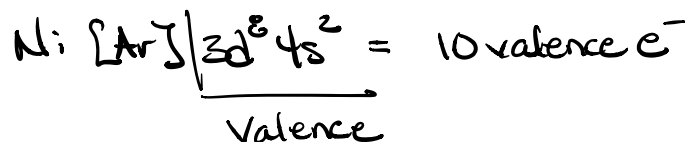
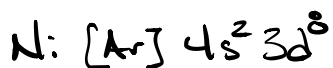


⇒ octet rule

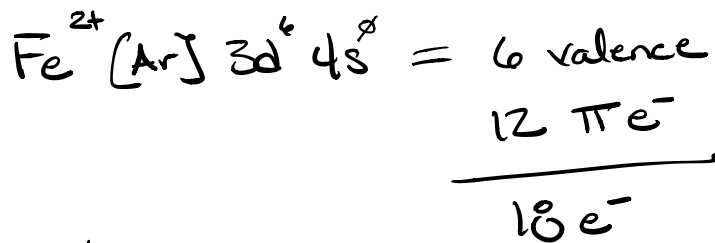
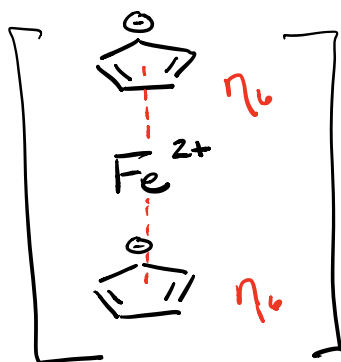
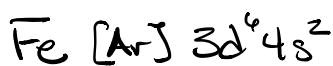


$$\begin{array}{cc} 2 & 6 \\ \text{S} + \text{P} & = 8e^- \end{array}$$

$$\begin{array}{ccc} 2 & 6 & 10 \\ \text{S} + \text{P} + \text{d} & = & 18e^- \end{array}$$



Ferrocene



Complex

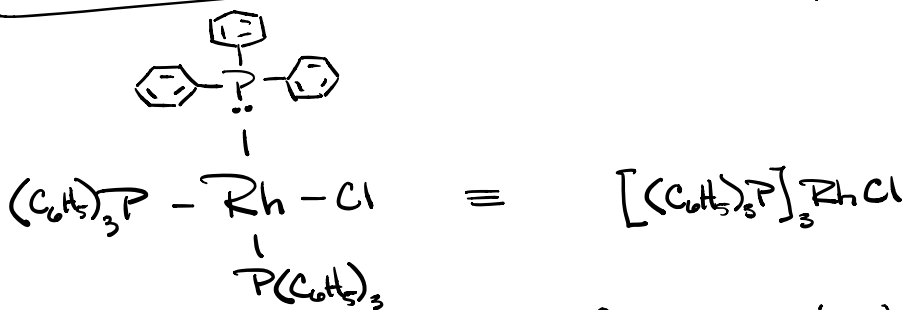
↳ Lewis Acid-Base Complex

When organic ligands are added to a metal the complex becomes soluble in organic solvents.

⇒ Homogeneous Catalysis (all one phase)  
⇒ all soluble

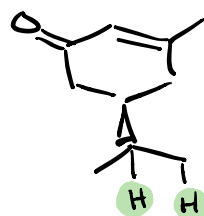
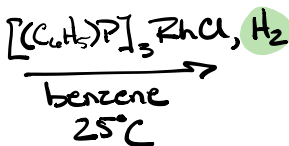
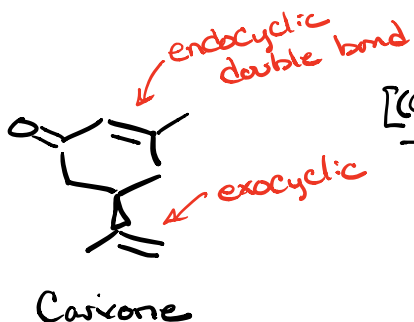
# Wilkinson's Catalyst

Tris-(triphenylphosphine)Rhodium Chloride

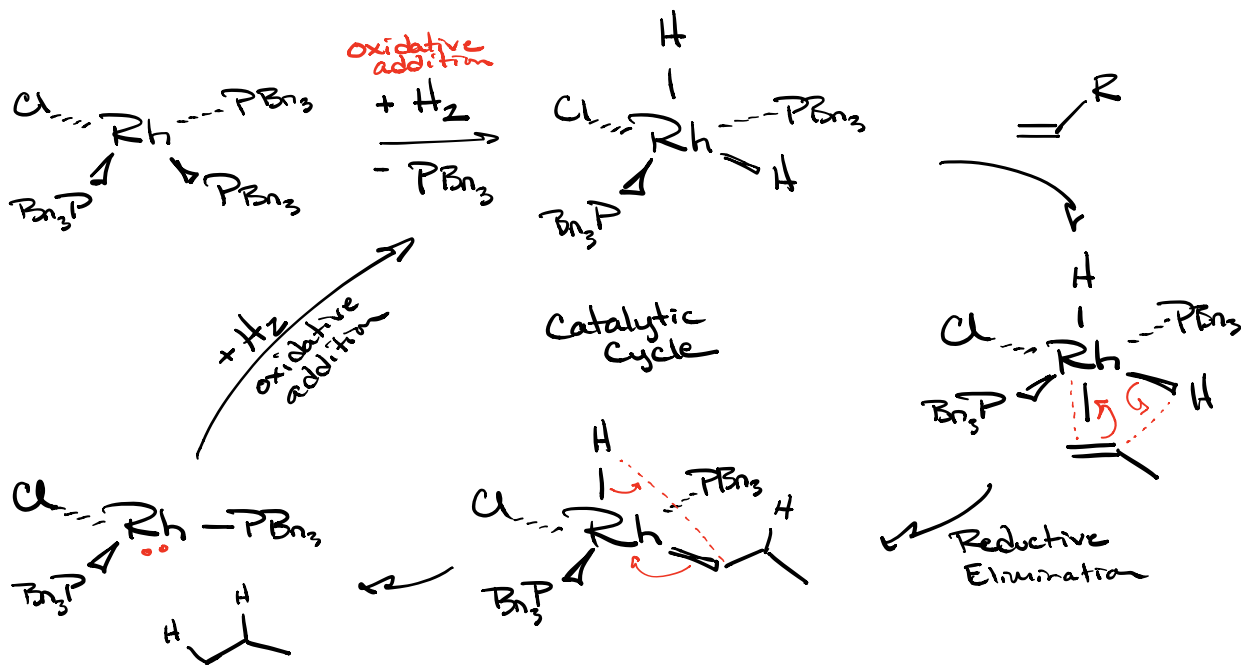


used for Alkene hydrogenation

⇒ selective for less substituted double bonds

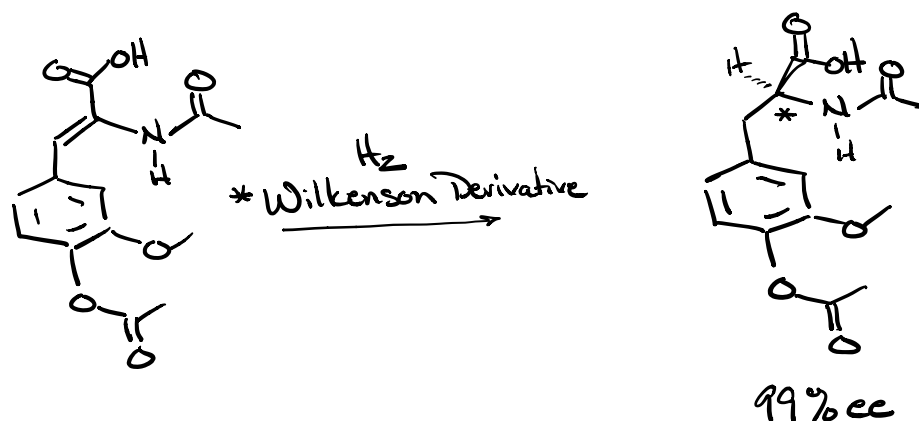
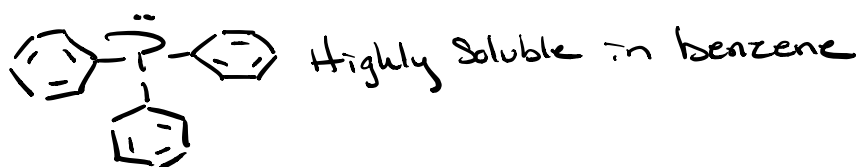


dihydrocarvone



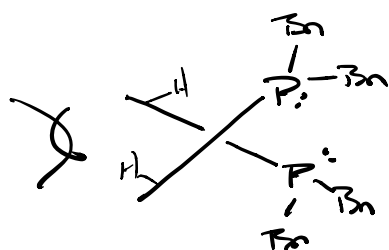
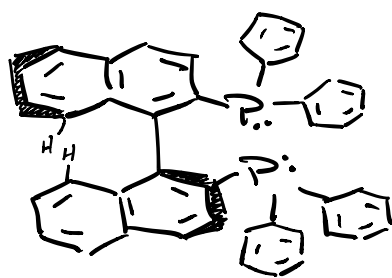
- Why does chloride not leave

$\text{Cl}^-$  not soluble in benzene



Enantioselective Hydrogenation

Noyori's BINAP Chiral Ligand

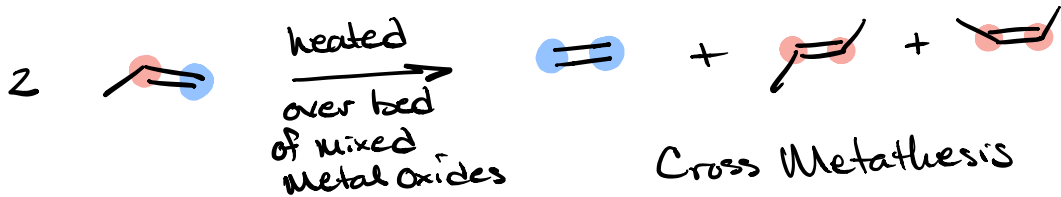


Atropisomers

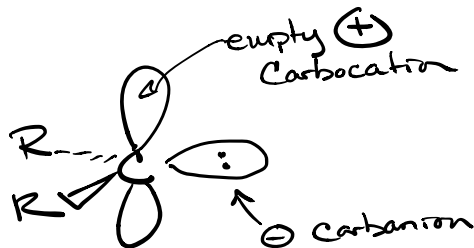
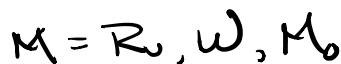
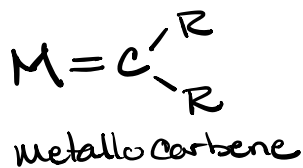
Bidentate Ligand

(S,S)-BINAP

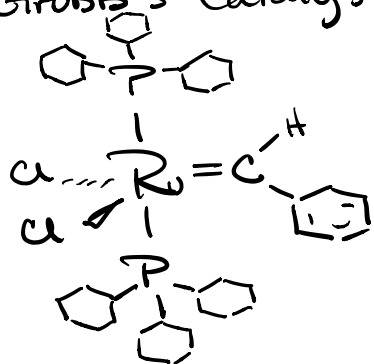
# Olefin Metathesis



Mechanism goes through Metallo Carbene



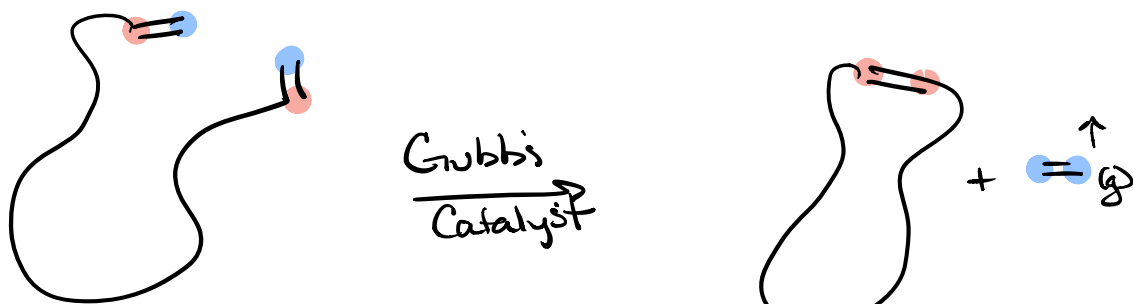
## Grubb's Catalyst



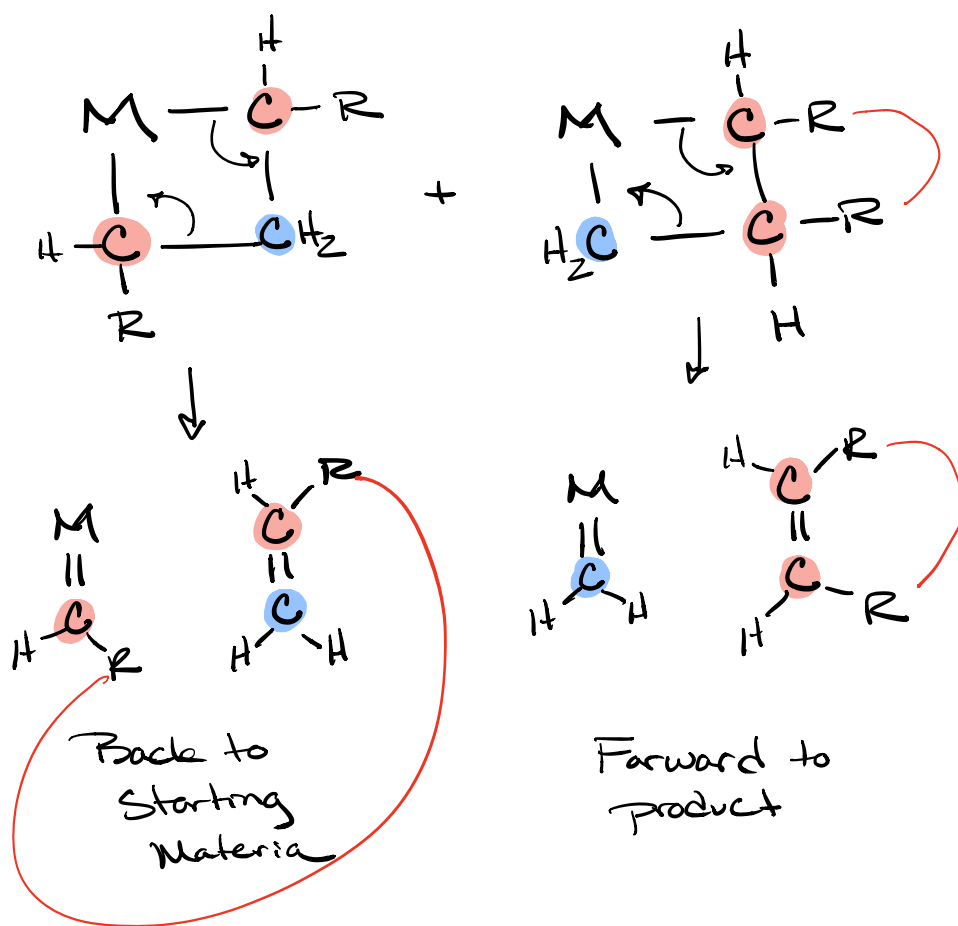
Ring Closing Metathesis

Closing 6 & 5 member rings is easy

Closing big rings is really hard until  
Grubbs' Catalyst

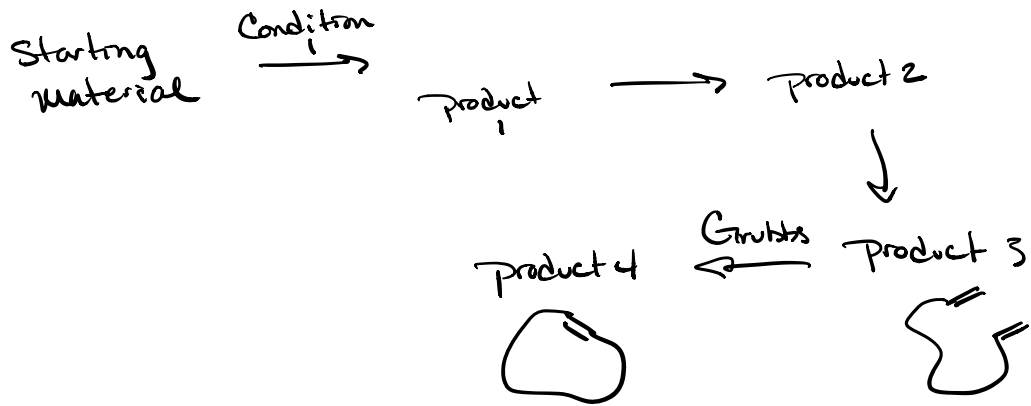
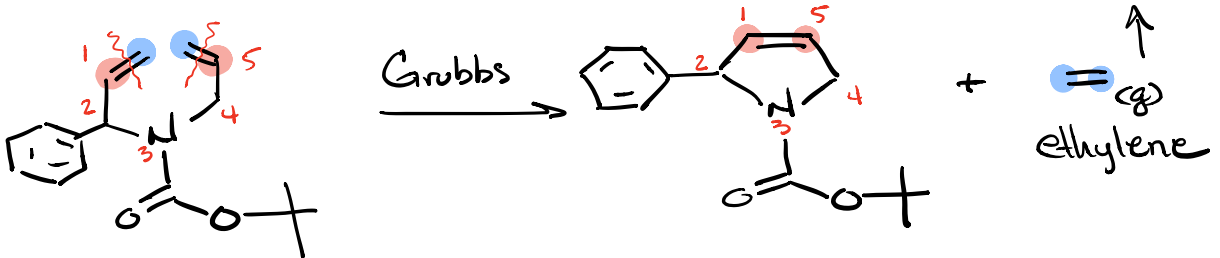


Two Intermediates

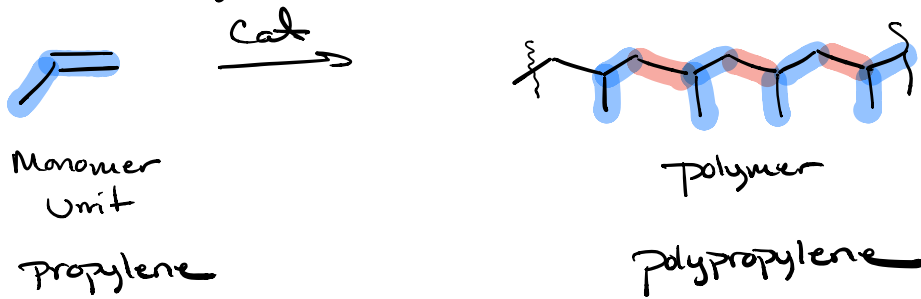


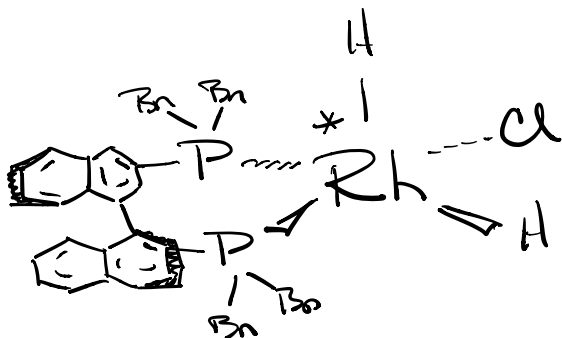


Expectation is:



Ziegler-Natta Catalyst





Whole Rhodium Complex made  
Chiral