

Print Name: _____

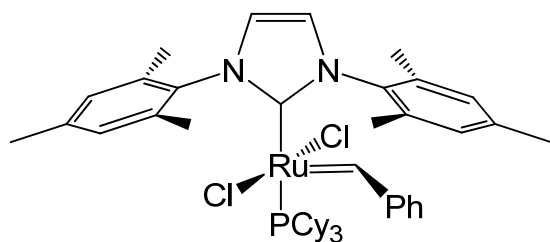
1. (7 x 1 pts)*N*-Heterocyclic carbenes, true or false;

- | | | |
|------|---|-------|
| i) | are prone to electrophilic attack when complexed | false |
| ii) | are prone to nucleophilic attack when complexed | false |
| iii) | are σ -basic | true |
| iv) | are π -acidic | false |
| v) | have steric and electronic influence on catalysis | true |
| vi) | have electronic influence only | false |
| vii) | are Fischer type carbenes | true |

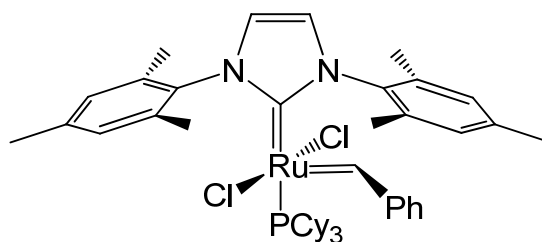
2. (1 + 2 pts)

Which of the following structures represents the true structure of Grubbs catalyst (a) or (b)?

Briefly explain why?



(a)



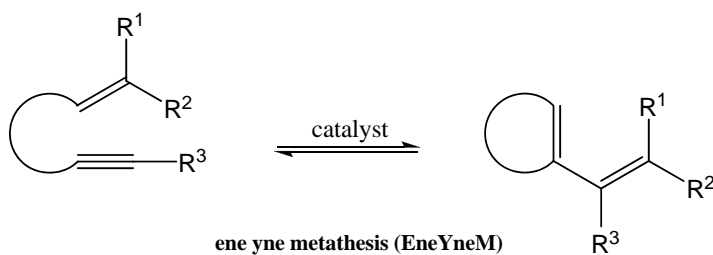
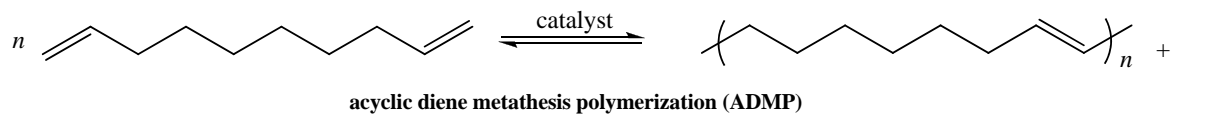
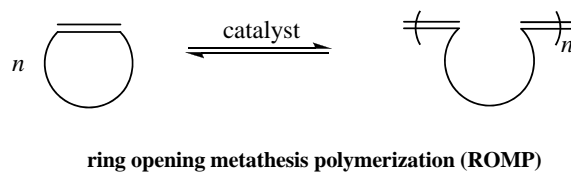
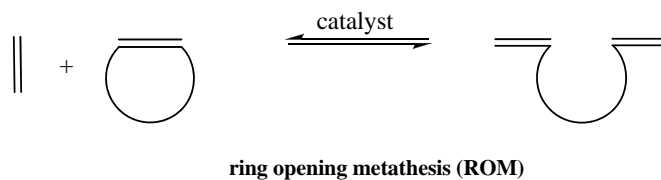
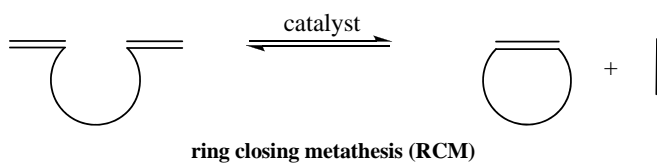
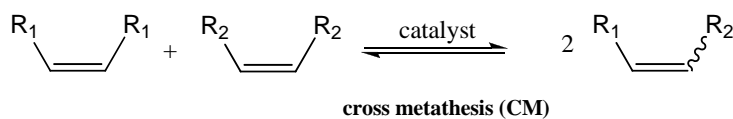
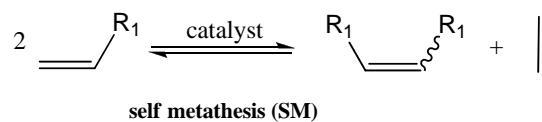
(b)

Structure (a) correctly represents Grubbs catalyst. Due to the π donating effect of the two nitrogen heteroatoms (Fischer carbene) α to the NHC carbene carbon the empty p orbital on the carbene carbon is stabilized, i.e. is not π acidic. Thus, π back donation from the metal center, although possible, is not required for stabilization of the NHC carbene and the metal carbon bond is predominantly a single bond ligand-to-metal σ bond interaction.

3.

(7 x 1 pts)

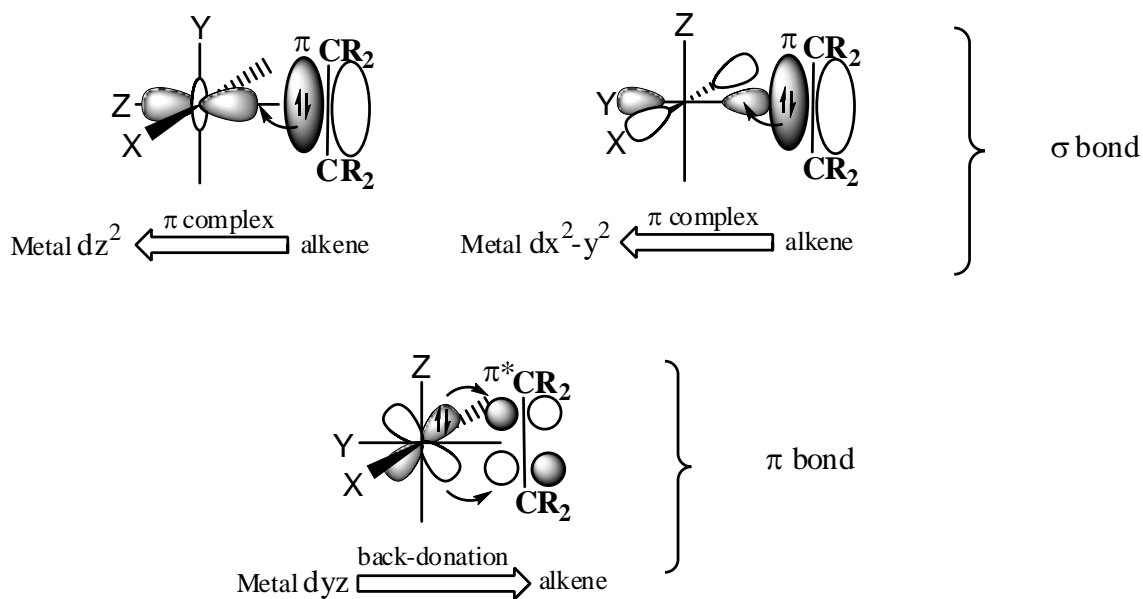
Label each of the following metathesis reactions accordingly:



4.

(6 pts)

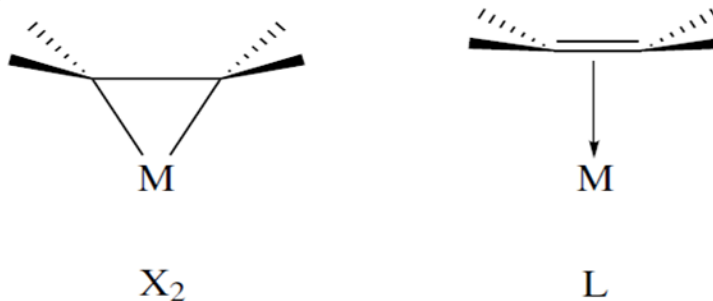
Draw an illustration of the Dewar-Chatt-Duncanson model for the bonding of an alkene ligand to a transition metal complex (label sigma and pi bonding interactions).



5.

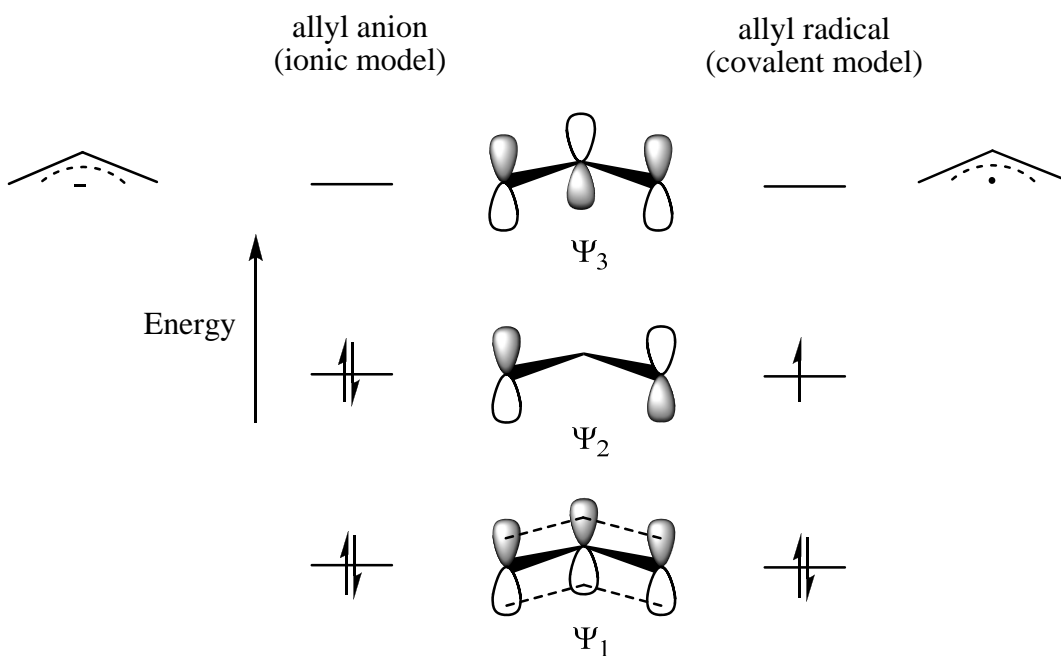
(2 + 2 pts)

Draw the X_2 and L bonding modes of a metal-alkene complex.



6. (5 pts)

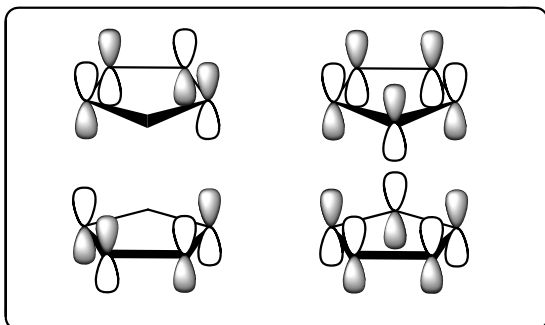
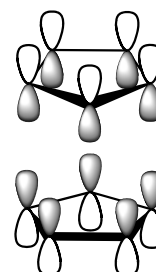
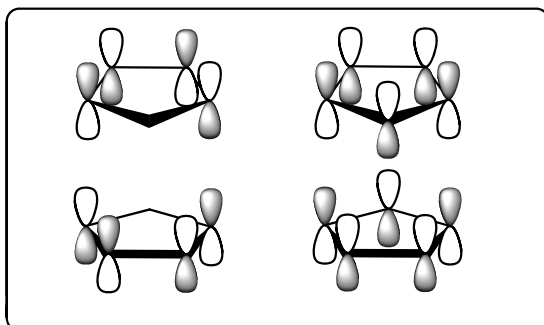
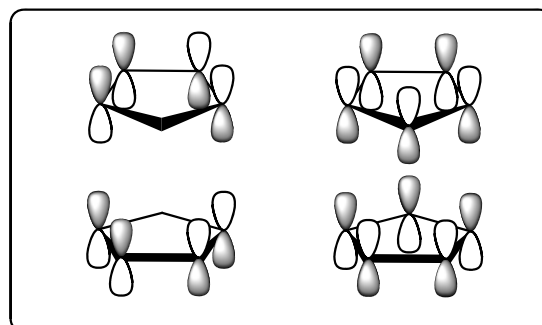
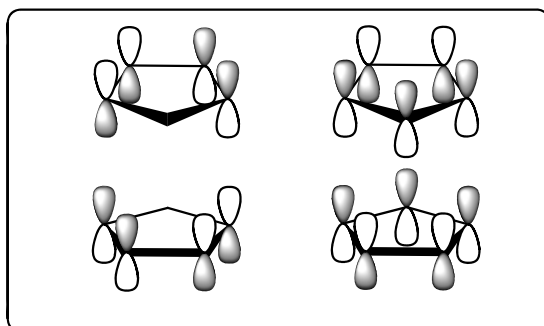
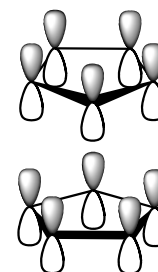
Complete the following diagram by drawing lobes and nodes of each orbital and filling electrons.



7.

(6 pts)

Label each of the metallocenyl SALC orbitals below according to the D_{5d} set of irreducible representations $\Gamma = A_{1g} + A_{2u} + E_{1g} + E_{1u} + E_{2g} + E_{2u}$

 e_{2g}  a_{1g}  e_{2u}  e_{1g}  e_{1u}  a_{2u}