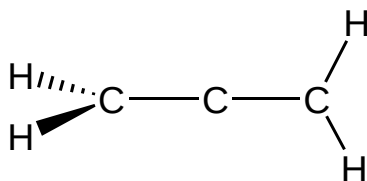


Organic Chemistry c3444y

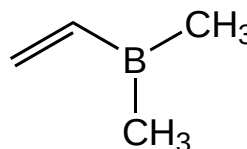
Problem Set 1

1. Using the incomplete structure shown for allene ($\text{H}_2\text{C}=\text{C}=\text{CH}_2$), draw the p orbitals in their proper orientation and indicate which of these orbitals are interacting to form π bonds. Indicate the hybridization of each of the carbon atoms. Can allene properly be described as a conjugated system?



2. If you were to view 1,3-butadiene as 2 connected but *non-interacting* double bonds, what prediction would you make about the relative energy levels of the two pairs of π electrons? Is your prediction consistent with the molecular orbital picture we discussed in class?

3. Consider the molecule shown at right, dimethylvinylborane:



a. What reasonable resonance structure(s) can you draw, if any?

b. Starting from the relevant atomic orbitals, construct molecular orbitals (as we have done in class) that best match your answer to part a.

c. The electronic structure of dimethylvinylborane most closely resembles that of which of the following: allyl cation; allyl radical; allyl anion; none of the above?

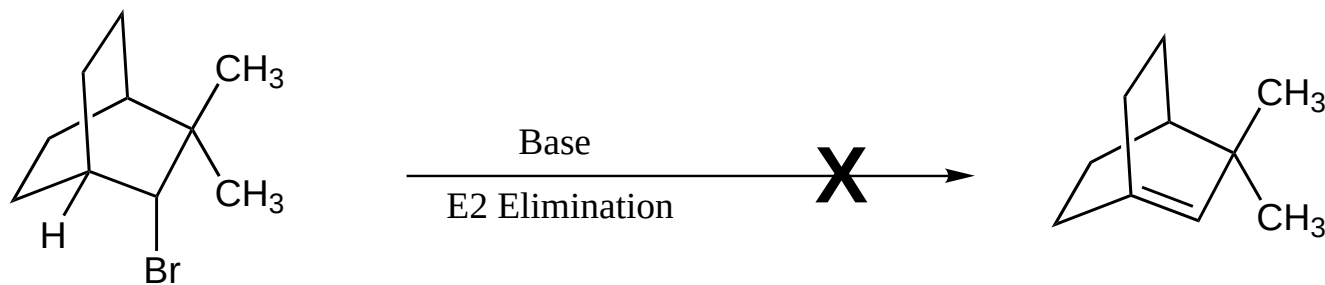
4. You are a brilliant organic chemist, and you have just developed the theory of delocalization in 1,3-dienes. You decide to try to prove your theory to your disbelieving colleagues by reacting 1,3-butadiene with HCl (what are you looking for?) Unfortunately, the only diene you have available is 1,3-cyclohexadiene.

a. Draw the product(s) that you would expect from this reaction:



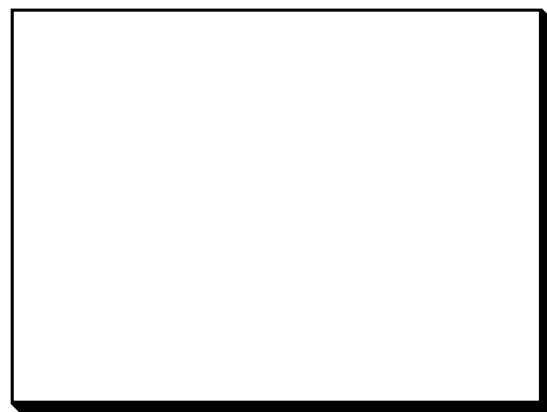
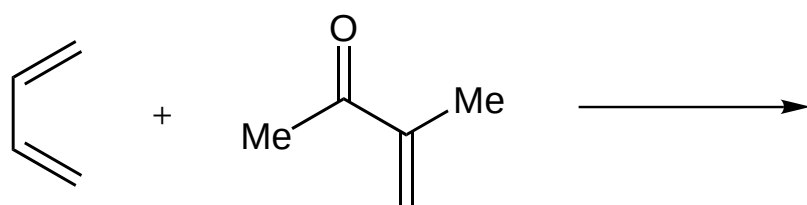
b. Can you prove your theory rigorously with this diene?

5. When treated with base, the bicyclic alkyl bromide shown below does *not* undergo E2 elimination. Why not? (Models, AS ALWAYS, will be helpful here....)

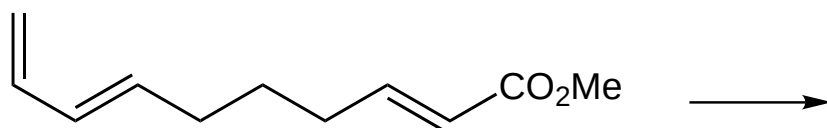


6. Predict the major product of the following Diels-Alder reactions:

a.



b.



(Don't worry about stereochemistry here.)



c.

