

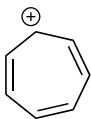
**Chemistry 234**  
**Chapter 14 Problem Set**

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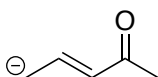
**Resonance and Conjugation**

1) For each of the structures below, draw all other possible resonance structures. Use curved arrow to show the flow of electrons. For b, c, d, f, and g circle the structure that you would expect to be the major contributor to the resonance hybrid. *Hint: It helps to draw in lone pairs.*

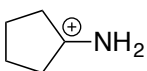
a



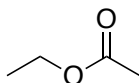
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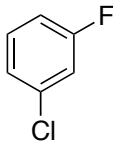
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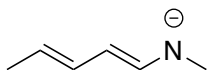
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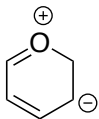
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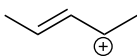
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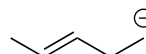
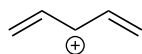
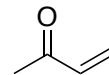
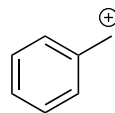
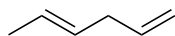
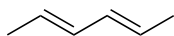
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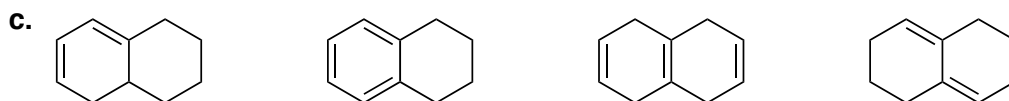
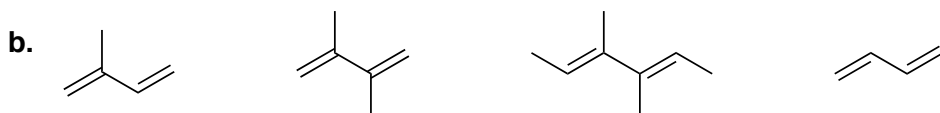
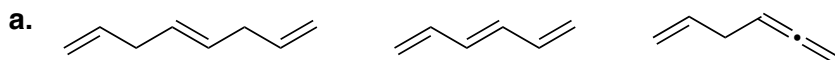
h.



- 2) For each of the compounds below, draw a representation showing all of the p-orbitals. Determine if each compound is conjugated. For the conjugated compounds, circle the atoms involved in conjugation.

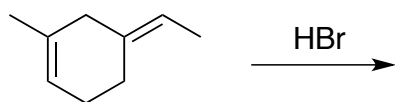
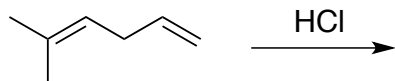
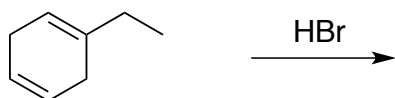
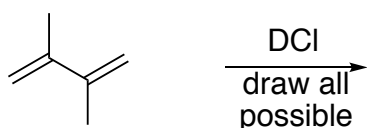
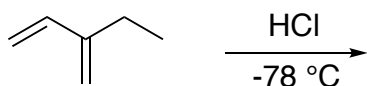
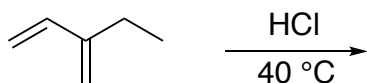
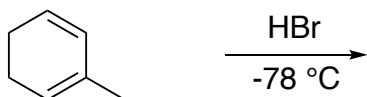
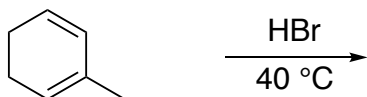
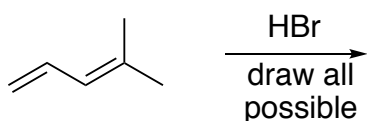


- 3) For each of the following sets of compounds, rank the series in order of increasing stability

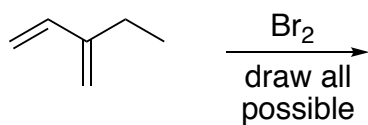
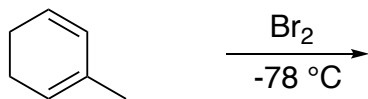
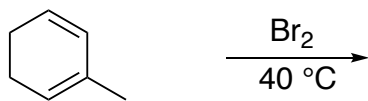
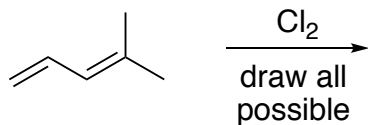


**Electrophilic Addition to Dienes**

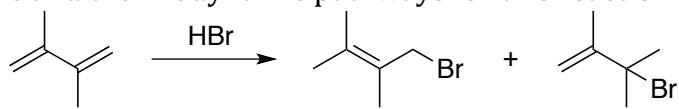
- 4) Predict the major product(s) for each of the reactions below. Unless otherwise specified, assume 1 equivalent of reagent is added. \*rt stands for room temperature (where you have the potential of both the 1,2 and 1,4 products).

*Isolated Dienes**Conjugated Dienes With H-X*

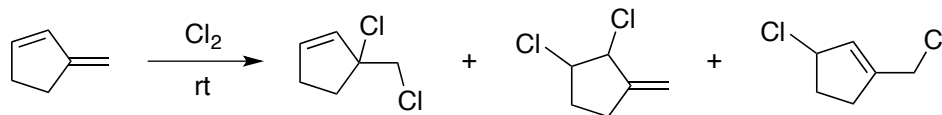
*D = deuterium, which reacts similarly to H*

Conjugated Dienes With  $X_2$ 

- 5) Provide a full electron pushing mechanism for the reaction below. Draw a reaction energy diagram that illustrates the kinetic and thermodynamic pathways for this reaction.



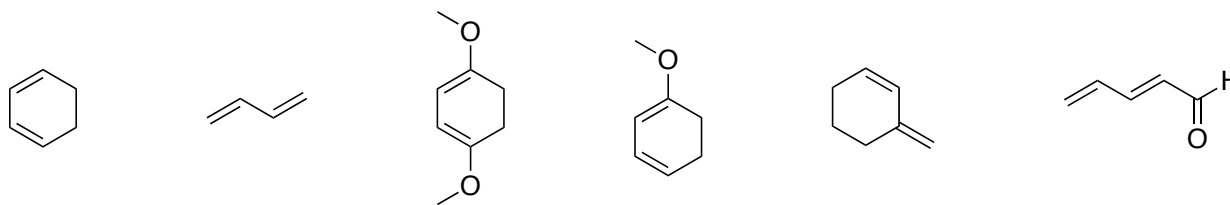
6) Provide a full electron pushing mechanism for the reaction below. Label the 1,2- and 1,4-products.



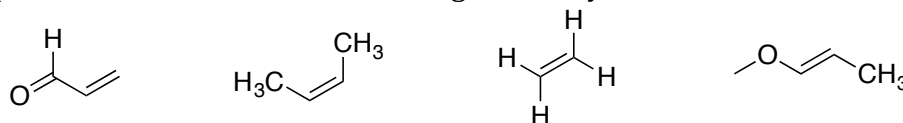
7) Challenge Problem: If you dare, determine all of the possible stereoisomers that could be formed in the reaction above. *Don't worry, I would not put this on an exam.*

**The Diels-Alder Reaction**

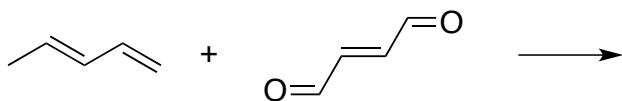
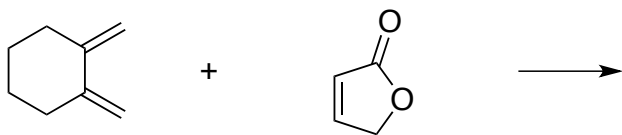
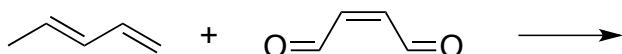
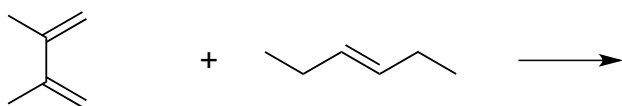
8) Rank the dienes below in order of increasing reactivity in a normal Diels-Alder reaction.



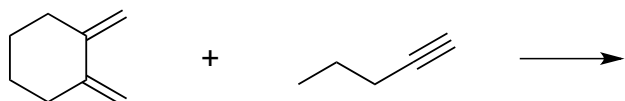
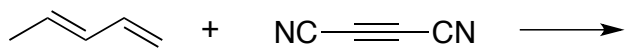
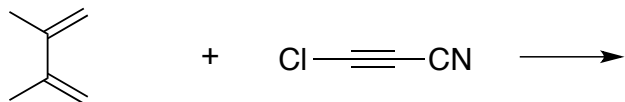
9) Rank the dienophiles below in order of increasing reactivity in a normal Diels-Alder reaction.



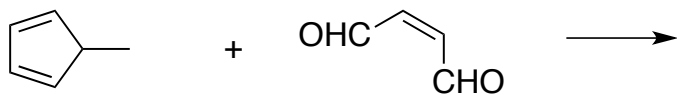
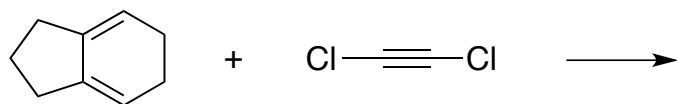
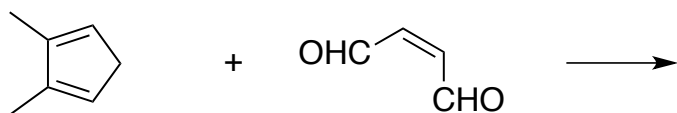
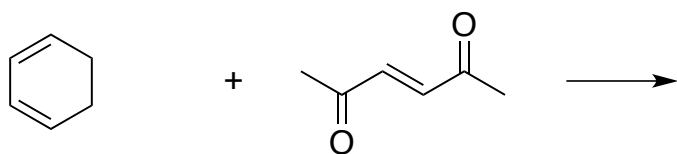
10) Predict the product for each of the Diels-Alder Reactions shown below.

*Basic Reactions*

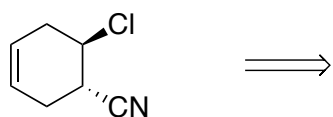
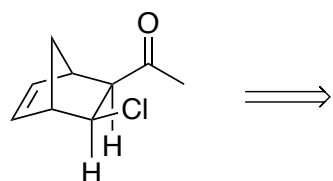
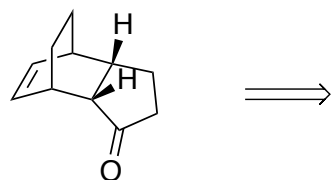
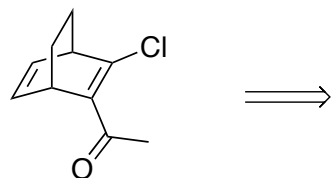
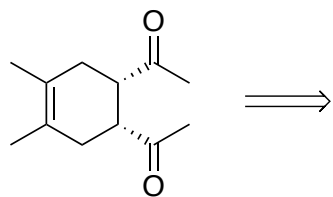
## Reactions with an Alkyne Dienophile



## Reactions Involving Cyclic Dienes



11) Determine the starting materials that could have been used to synthesize each of the Diels-Alder adducts shown below.





12) Fill in the empty boxes in the synthetic scheme below. Yes, I have thrown in some organic I reactions. Remember, you will be taking the ACS final exam, which includes both organic I and II material.

