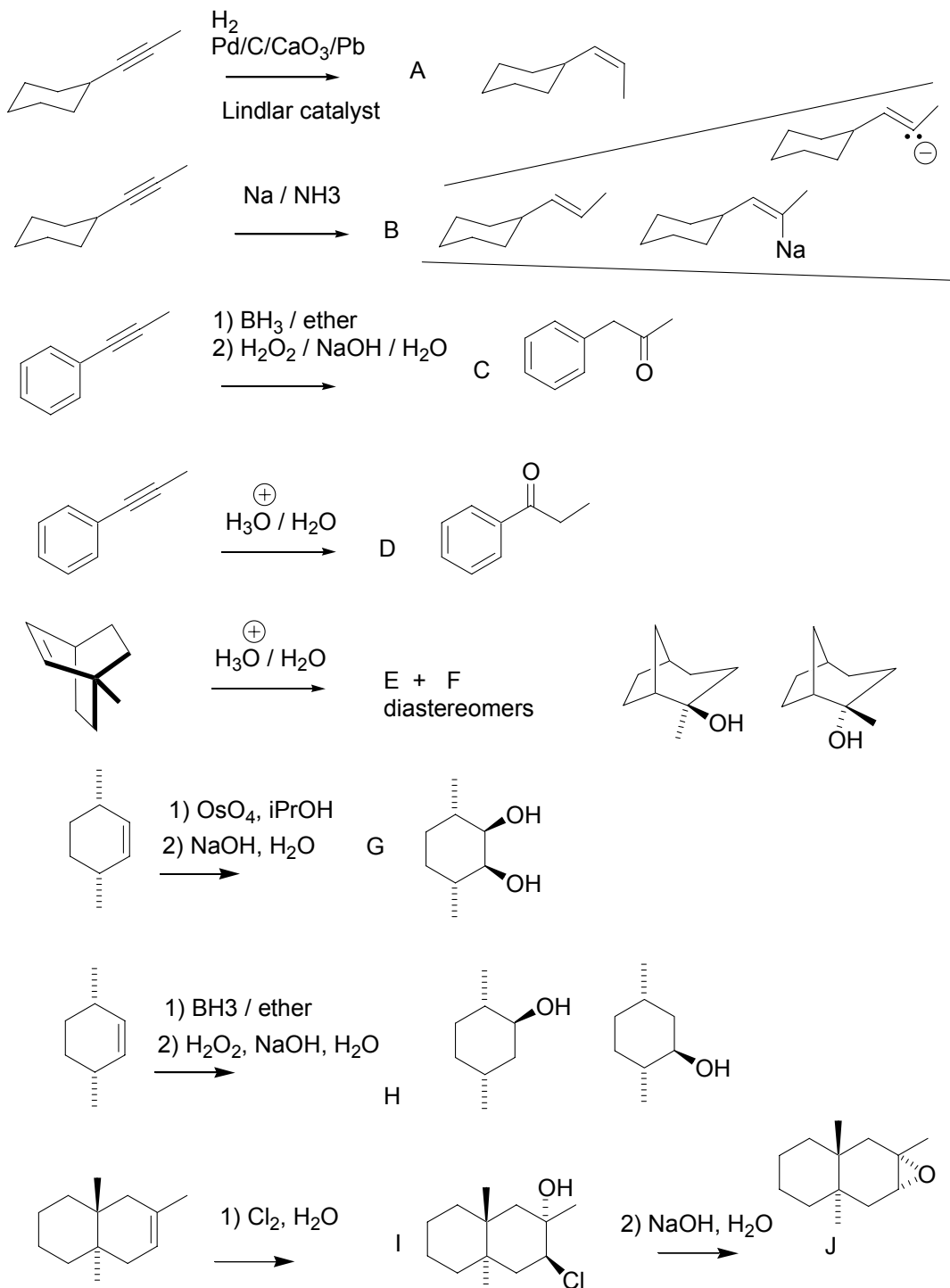
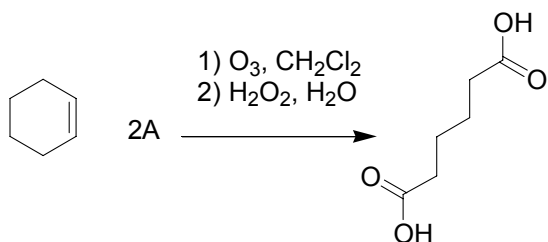


1. (50 pts) Draw the most likely product(s) to the right of the reactions and label them clearly A-J.

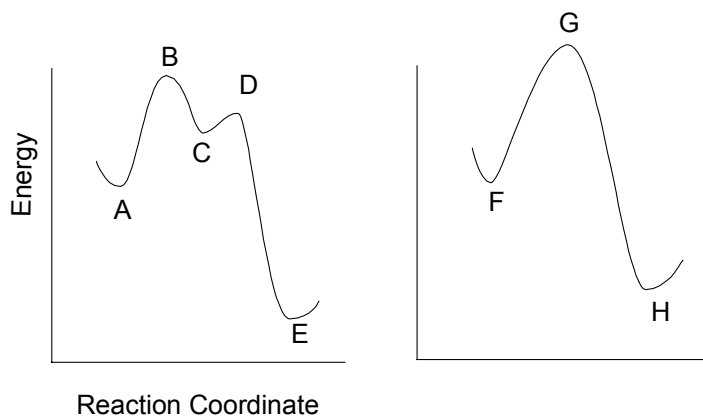
Hints: A-B, and E-J have stereochemical issues; in some cases you have to evaluate which is the least hindered side of the molecules, in other cases cis versus trans etc. *Pay attention to regiochemistry—most stable carbocation.* E and F are rearranged addition products. The bonds that interact best with the carbocation are the ones most likely to shift to the *most stable carbocation*. H is a racemic mixture of enantiomers, draw one enantiomer.



2. (10 pts) Draw the starting material 2A. 2A has only 3 signals in its ^{13}C NMR spectrum.



3. (20 pts) Answer the following question in reference to the reaction energy diagrams below. The labeled points on the reaction energy diagrams are either energies or chemical species, depending on the sentence.



3a. ___C___ might be a catalytic intermediate or even a carbocation.

3b. ___G-F___ This difference in energy might determine the rate of an $\text{S}_{\text{N}}2$ reaction.

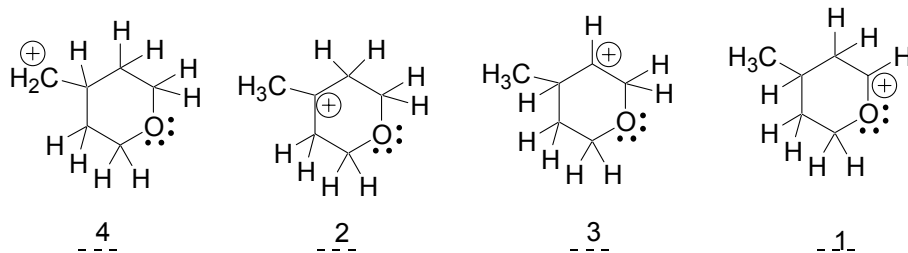
3c. ___E-A___ This difference in energy might determine the ratio of product to starting material of an $\text{E}1$ reaction.

3c. The Hammond postulate states that D is most similar in structure to ___C___.

4. (10 pts) Rank the following carbocations by stability from 1-5. **Use 1 as the most stable!**

Pick the most stable 4 pts.

Pick the least stable 4 pts.



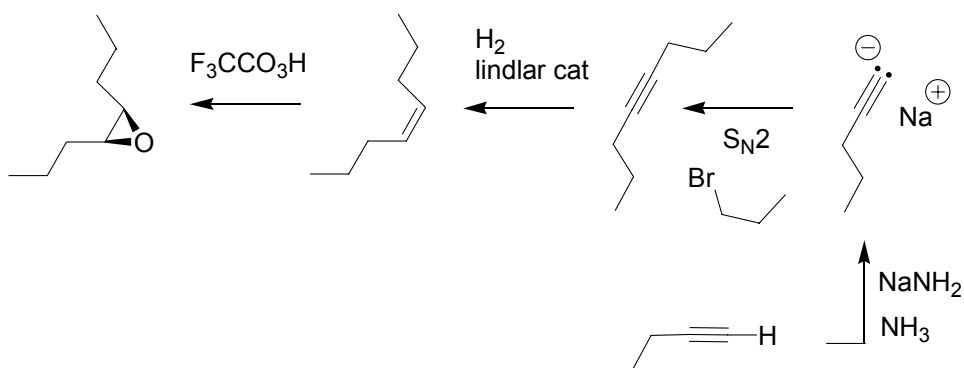
5. (10 pts) In general additions reactions of double and triple bonds are (exothermic or endothermic) exothermic because _____

More electrons in s-like orbitals in the product versus react. (one way to say)_

Sigmabonds overlap better than pi-bonds to products are more stable. _____

Another acceptable answer. _____

6. (10 pts. bonus) Starting from molecules possessing five carbon atoms or less, draw the chemical equations needed to show how you would synthesize **6A**. Remember that the conjugated bases of terminal alkynes can be used as nucleophiles in substitution reactions.



a possible route.