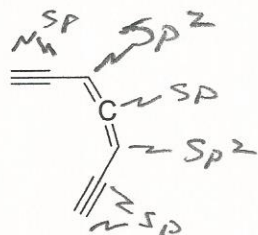
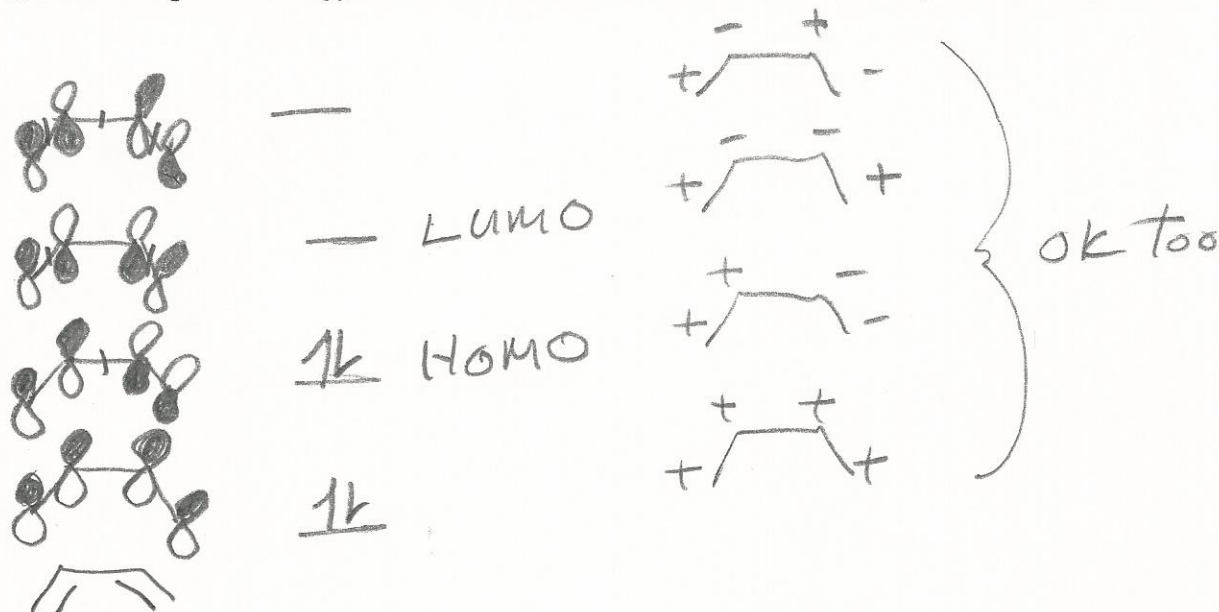


7. (3 pts) For the ene-yne drawn below label the carbons as to their hybridization (sp, sp², sp³). Are the pi-bonds of this molecule in conjugation from one end to the other?



NO

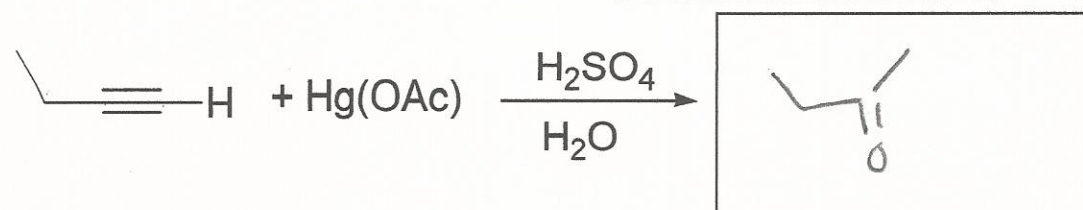
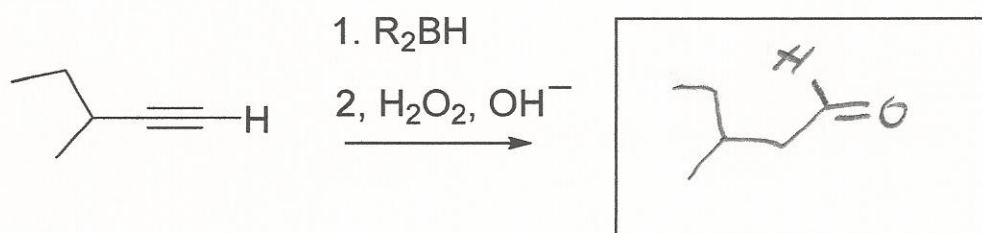
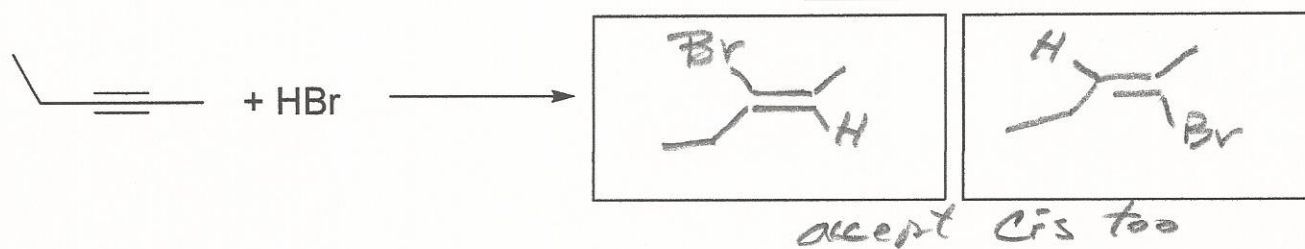
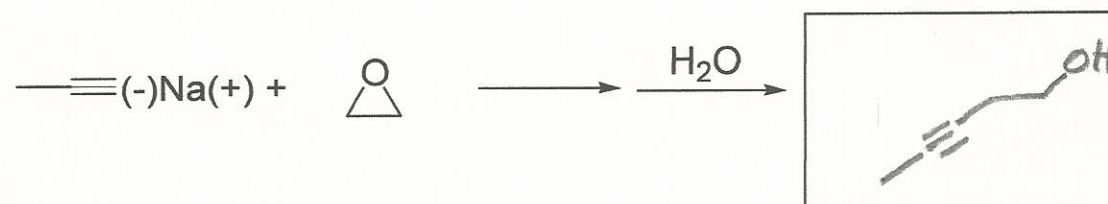
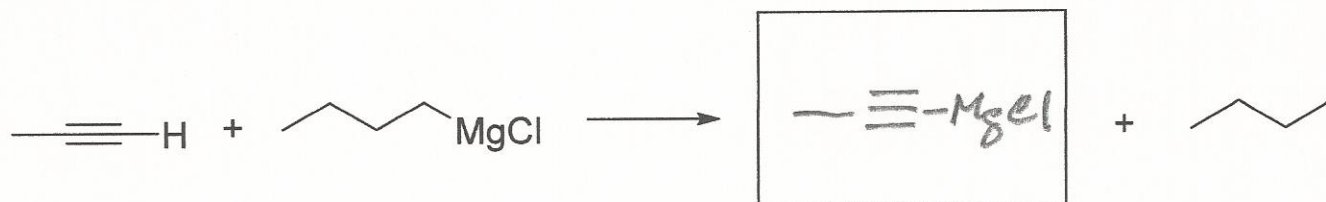
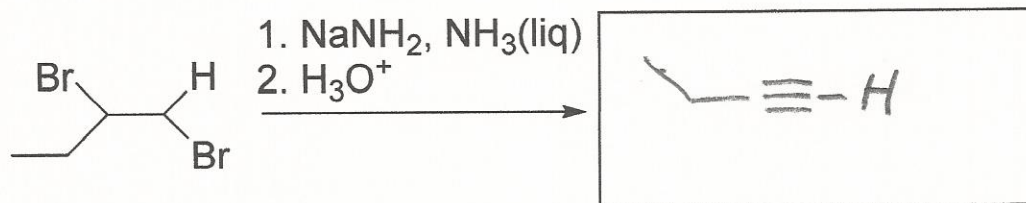
8. (5 pts) Draw the MO diagram of butadiene and show the phases as they change from lowest to highest energy orbital. Label the HOMO and LUMO in your drawing.



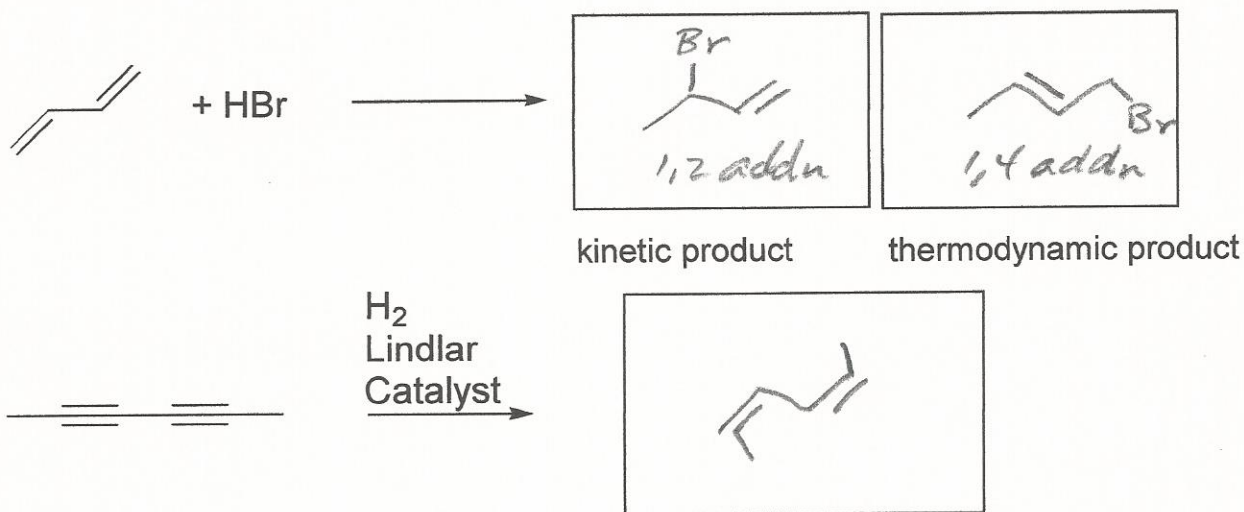
9. (3 points) For benzene the structure is comprised of:
- alternating single and double bonds
 - a combination of sp and sp² hybridization at carbon
 - all carbons being sp hybridized
 - all carbon-carbon bond lengths being the same
 - a and b
 - c and d

10. (2 points) The pi-systems of Benzene:
- has resonance making it higher in energy than hexatriene
 - is defined with fewer nodal planes in the pi-system compared to hexatriene
 - has degenerate energy in the HOMO orbital making it more stable than hexatriene
 - a) and c)

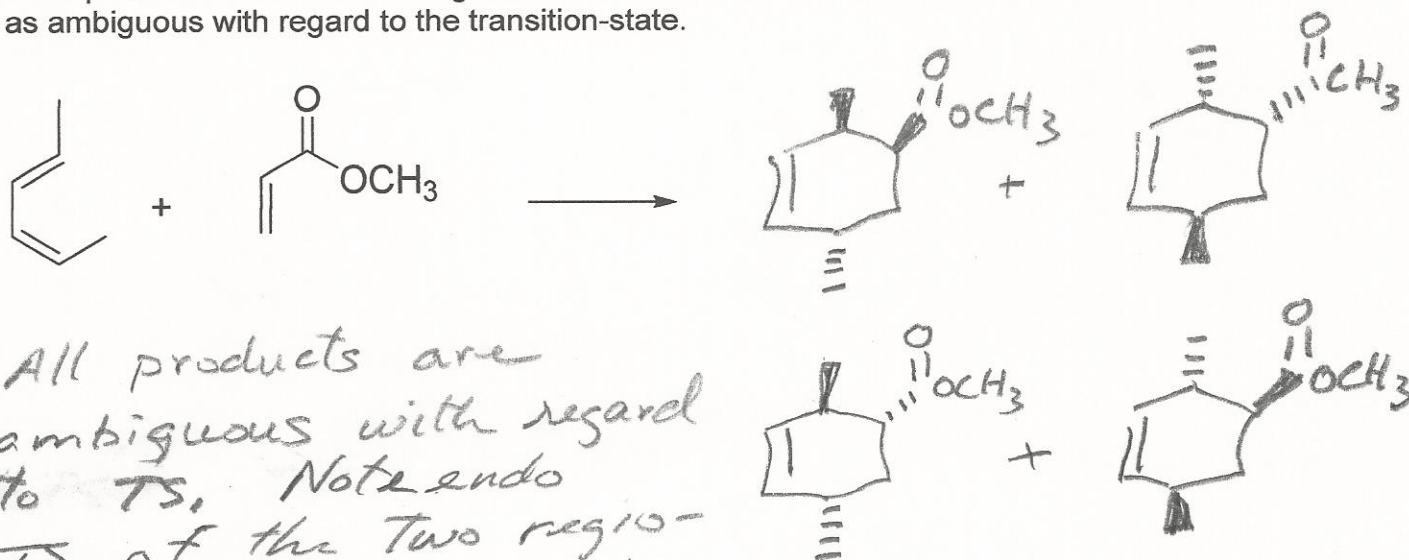
11. (50 pts) for the reactions shown below fill in the box to complete the chemical equation



11. Continued

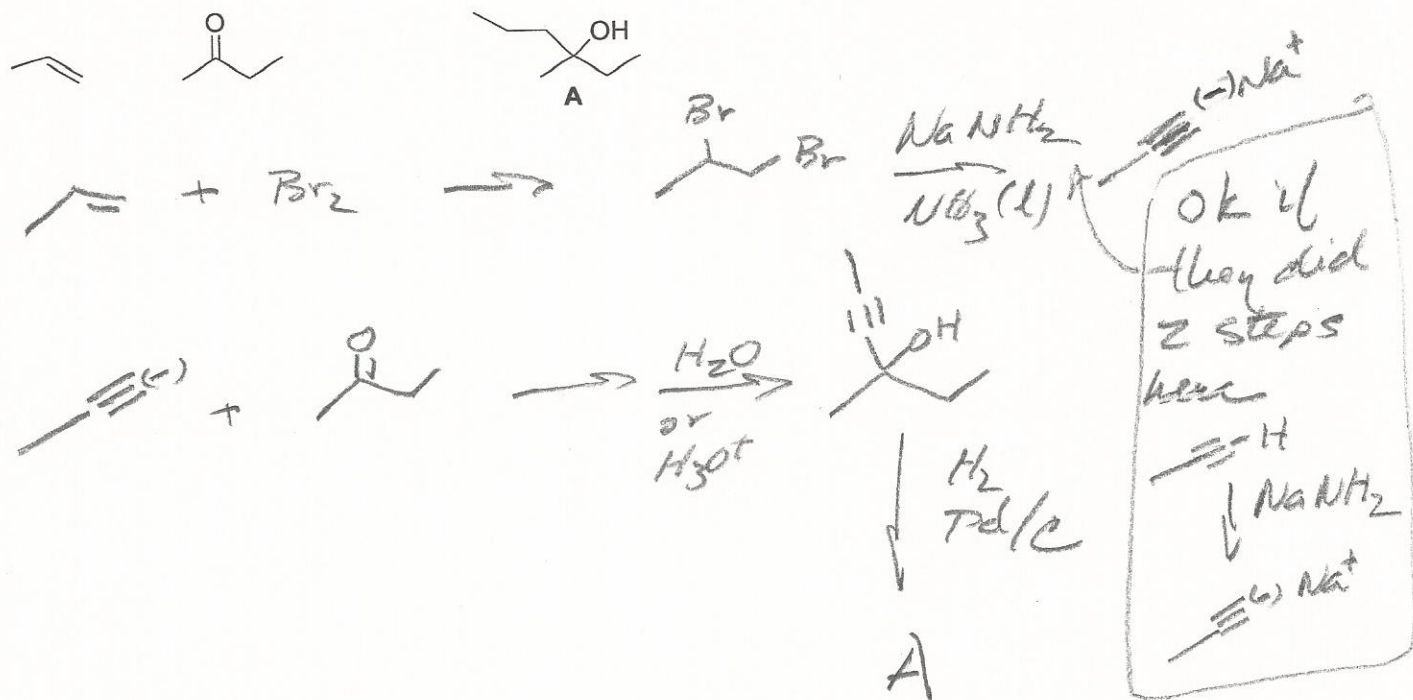


12. (8 points) For the Diels-Alder reaction drawn below please draw all products from the reaction clearly indicating stereochemistry. Assume NO regio-control of this reaction. If possible label the products as coming from an endo or exo transition-state. If not possible to label as coming from an endo or exo transition-state label the molecule as ambiguous with regard to the transition-state.

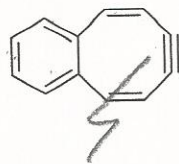


All products are ambiguous with regard to TS. Note endo TS of the two regio-isomer TS give either cis or trans relationship of vicinal methyl to ester.

13. (8 points) Using only the organic molecules shown below but any other reagents or catalysts you need draw a synthetic scheme for the preparation of the alcohol labeled as A below. .



14. (5 points) For the molecule drawn below assume that the structure is planar and use the $4n+2$ rule to predict if it is aromatic. Explain your answer in one or two sentences.



Only 12e in the same plane
so $4n$ not $4n+2$, The molecule
is not aromatic.

2e in plane
2e orthogonal