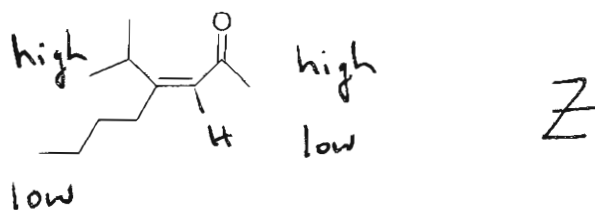
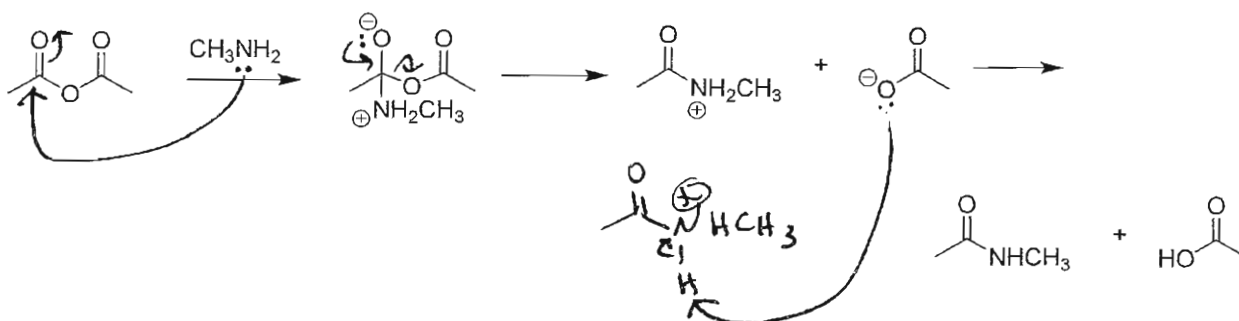


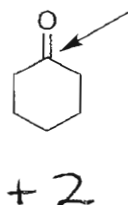
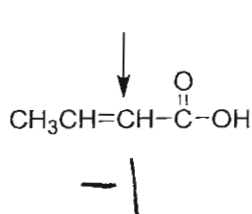
1. (3 points) Does the following alkene have an E or Z configuration? Show your reasoning for full credit.



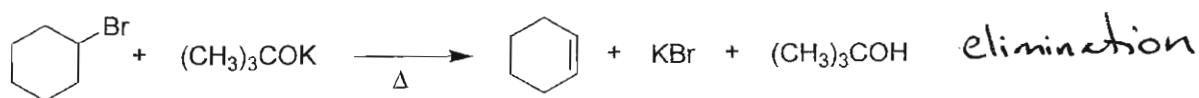
2. (6 points) Provide electron-pushing arrows to indicate the flow of electrons in each step of the following reaction. Just as in a similar homework problem, you will need to redraw one of the structures so you can clearly indicate the particular bond that is breaking.



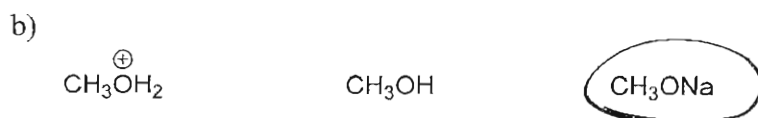
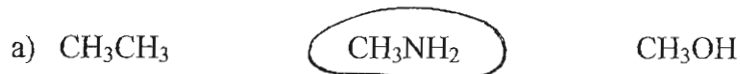
3. (4 points, 2 each) Calculate the oxidation state of the indicated carbon atoms.



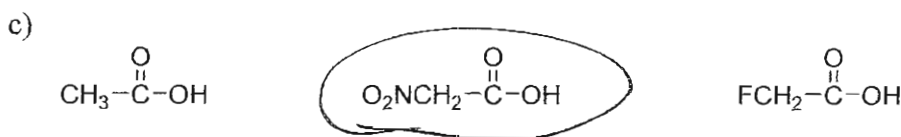
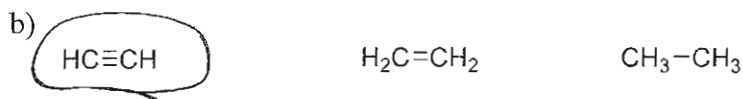
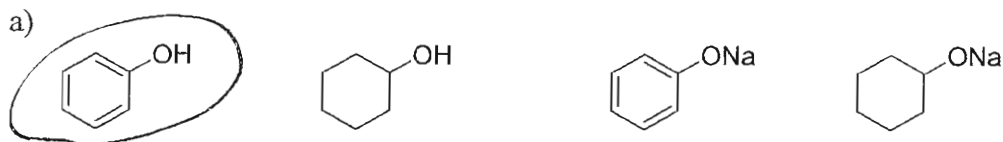
4. (4 points, 2 each) Classify each of the following reactions as substitution, elimination, addition, or rearrangement reactions.



5. (4 points, 2 each) Circle the strongest base in each set.



6. (6 points, 2 each) Circle the strongest acid in each set.

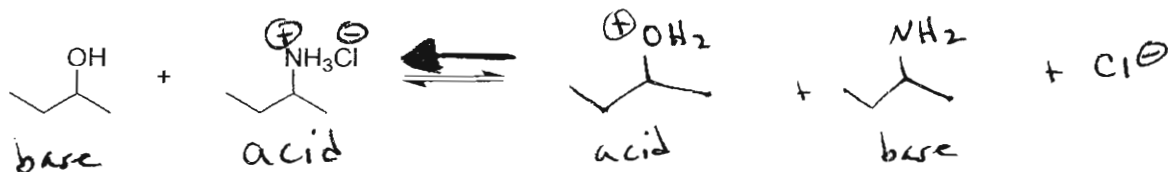
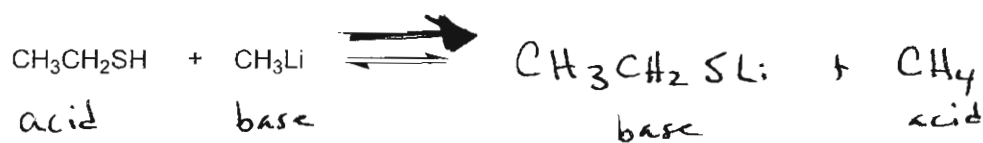


7. (15 points, 5 each) For each of the following Bronsted-Lowry acid/base reactions

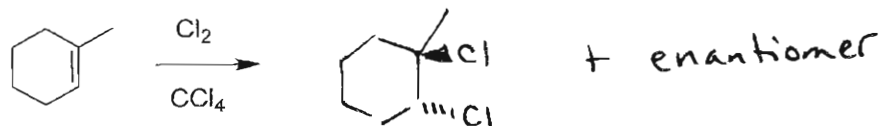
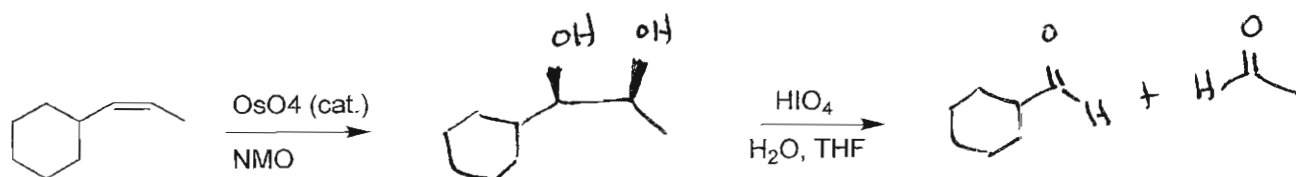
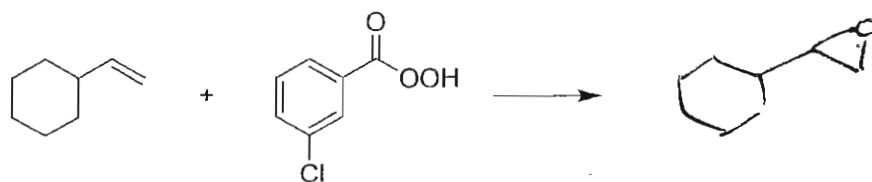
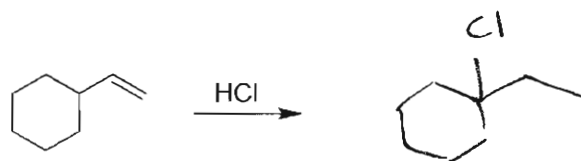
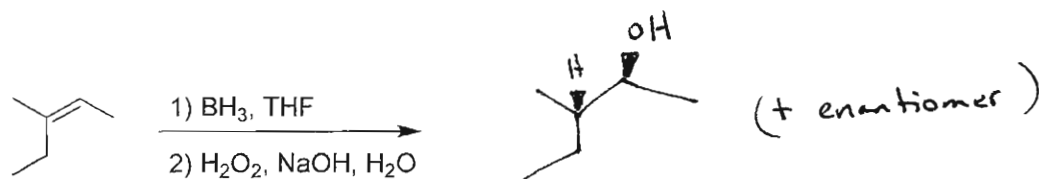
a) provide products that would form if the reaction proceeds as written.

b) label the acid and base on each side of the reaction.

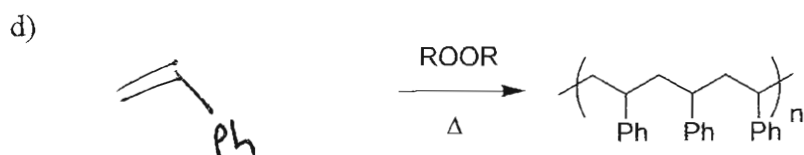
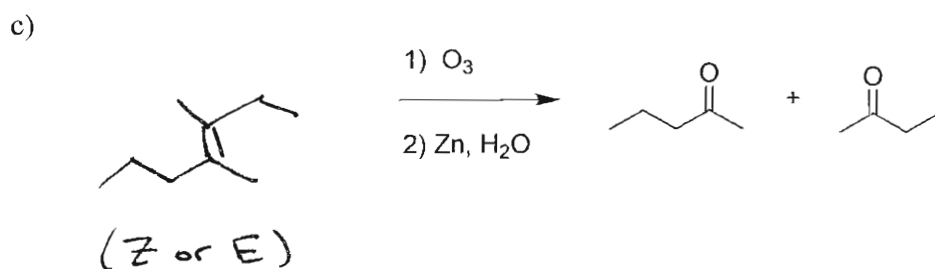
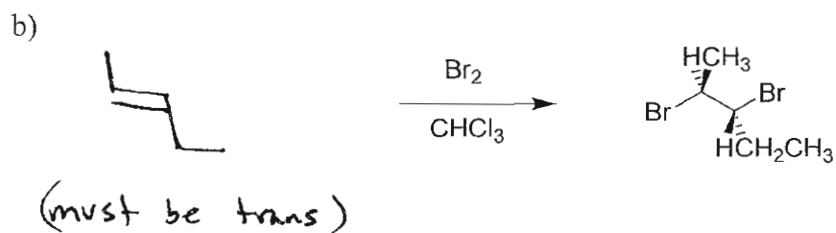
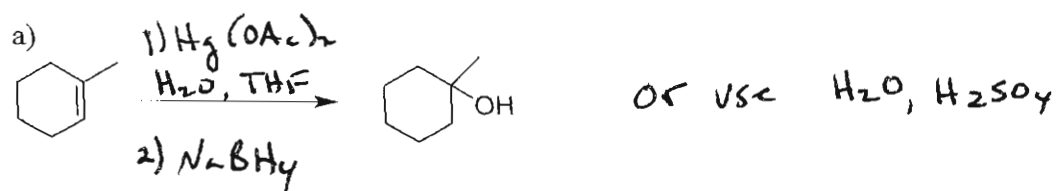
c) draw an arrow indicating which way the equilibrium actually lies.



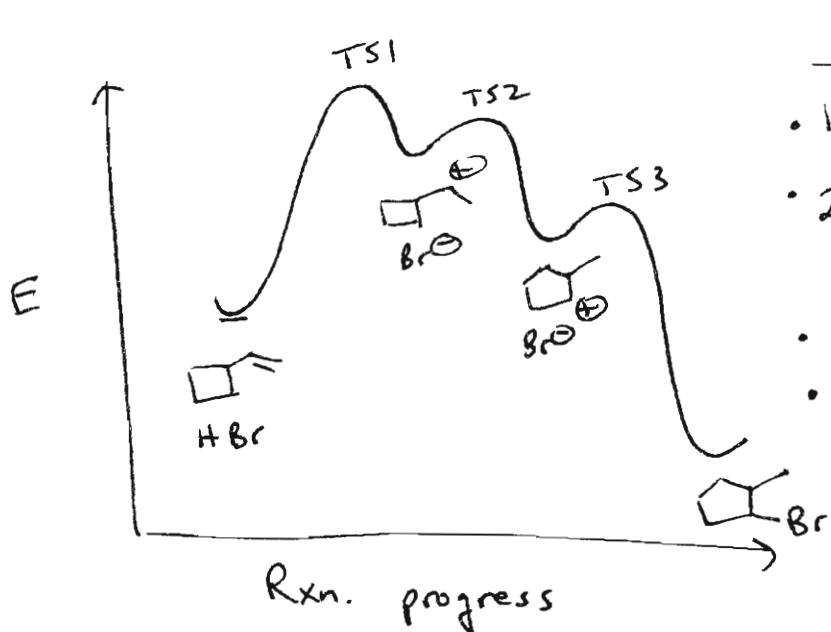
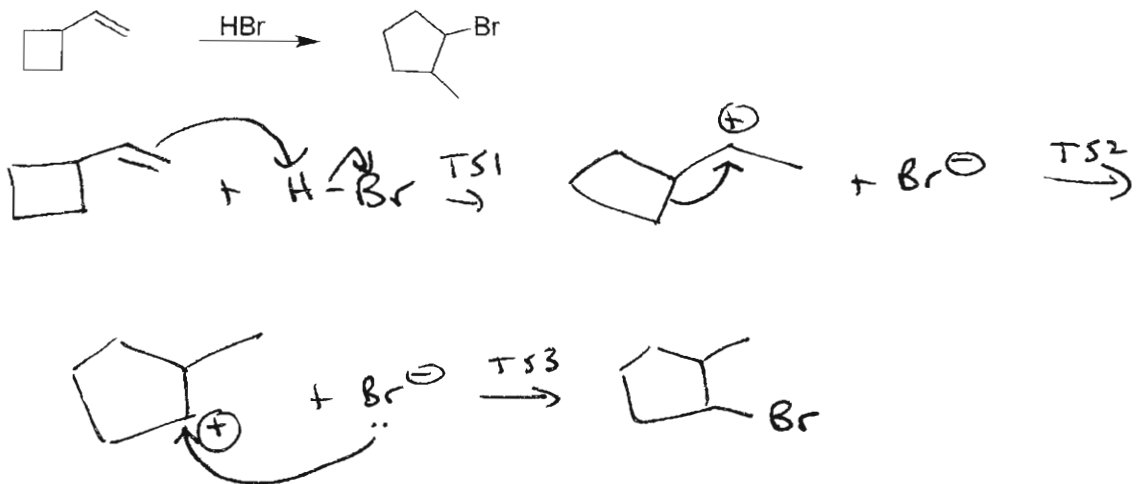
8. (28 points, 4 each) Provide the major organic product for each of the following reactions. Include stereochemistry where necessary.



9. (16 points, 4 each) Provide the missing reagent(s) for the following reactions.



10. (14 points) Provide an electron-pushing mechanism and an energy diagram for the following reaction. Label the energy diagram in such a way that I can tell what structures in your mechanism correspond to what point on the energy curve. You do not need to draw transition state structures, but do label transition states on the energy diagram as "TS1" etc. as needed.



Key Features

- 1st step is rate-determining
- 2nd C⁺ is lower energy than 1st C⁺
- rxn. is exothermic
- axes are labeled