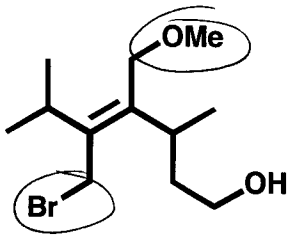
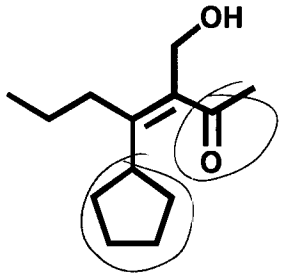
1. The degree of unsaturation for the molecule $C_8H_{11}NOCl_2$ is:

a) 1 b) 2 c) 3 d) 4 e) 5

2. Assign E/Z nomenclature to the following alkenes.

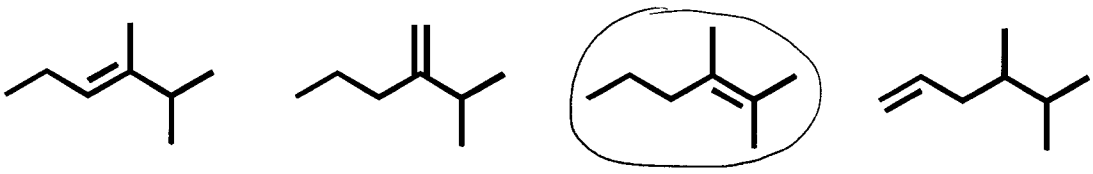


E



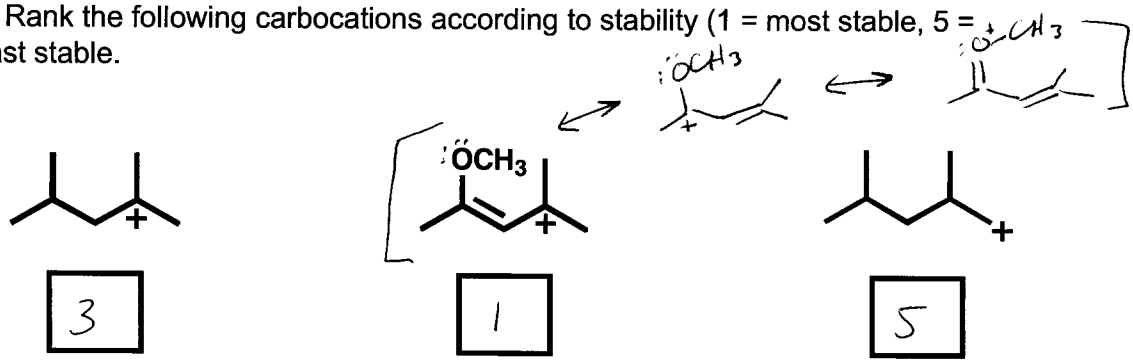
Z

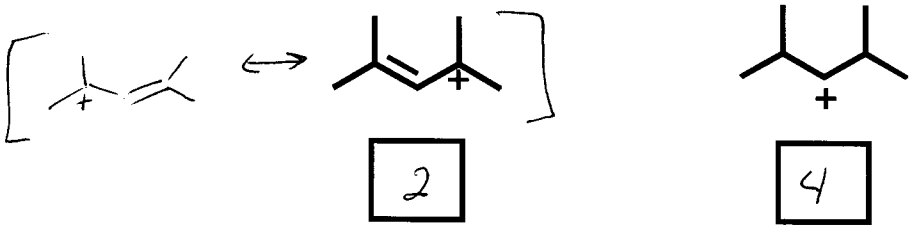
3. Circle the alkene that has the lowest energy.



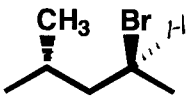
lowest energy = most stable

4. Rank the following carbocations according to stability (1 = most stable, 5 = least stable.

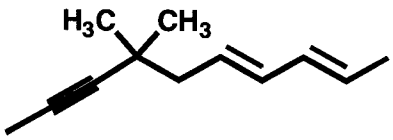




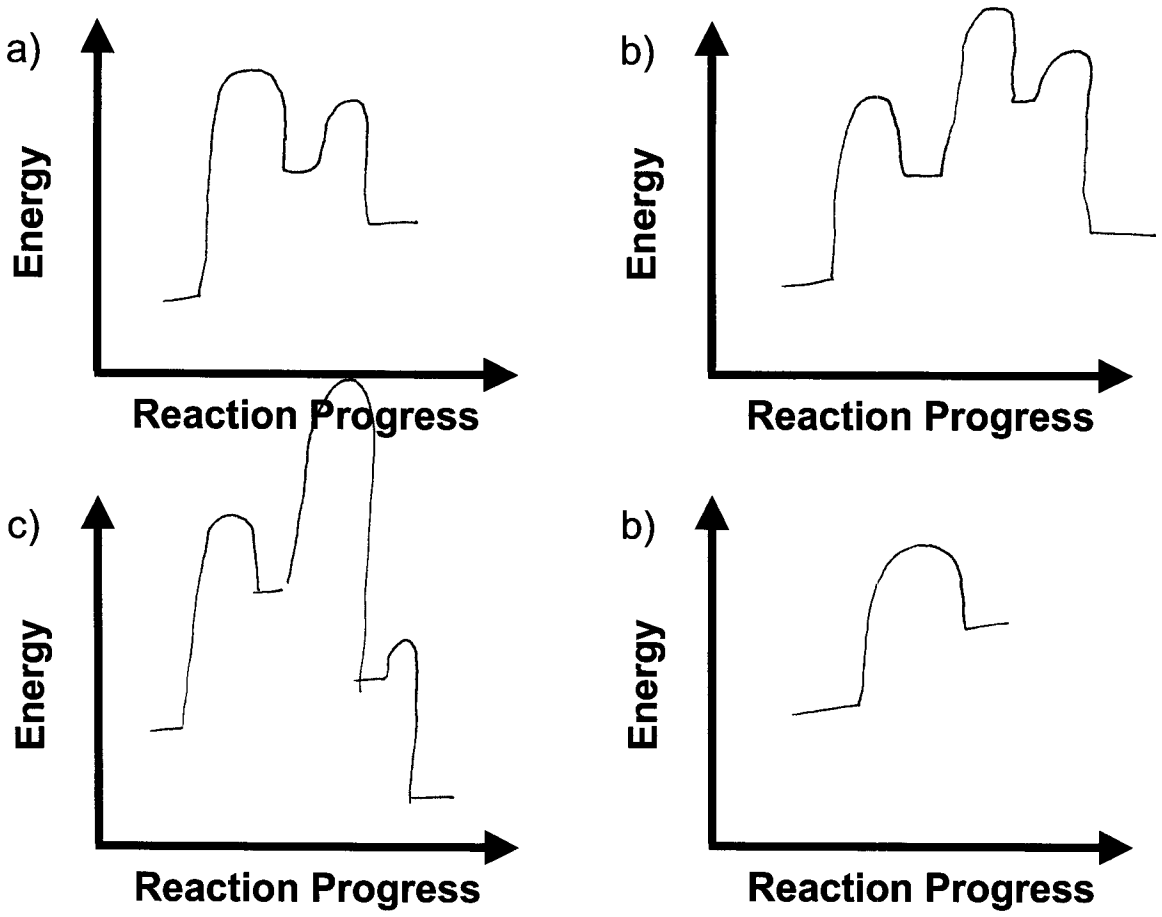
5 Name the following molecules.



(2S)-2-bromo-4-methylpentane



(2E,4E)-7,7-dimethyl-2,4-decadien-8-yne



6. Draw hypothetical reaction coordinate diagrams for:

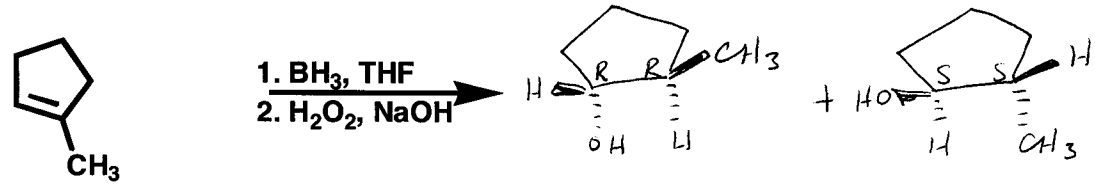
(a) An endergonic, two-step reaction with the first step being the rate-determining step.

(b) A reaction with three transition states and $\Delta G > 0$.

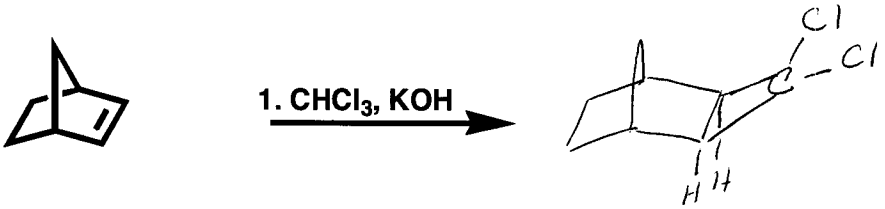
(c) A three-step reaction where $K > 1$, and the third step is faster than the first step, which is faster than the second step.

(d) A one-step reaction where the conversion to reactants is faster than conversion to products. Is ΔG positive or negative?

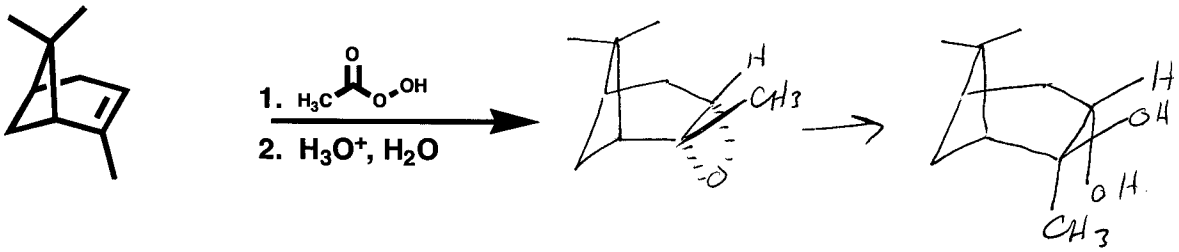
7. Provide products for each reaction (**include all stereoisomers**). Indicate if the products are achiral/optically inactive (**A**), racemic/optically inactive (**R**), meso/optically inactive (**M**), or chiral/optically active (**C**).



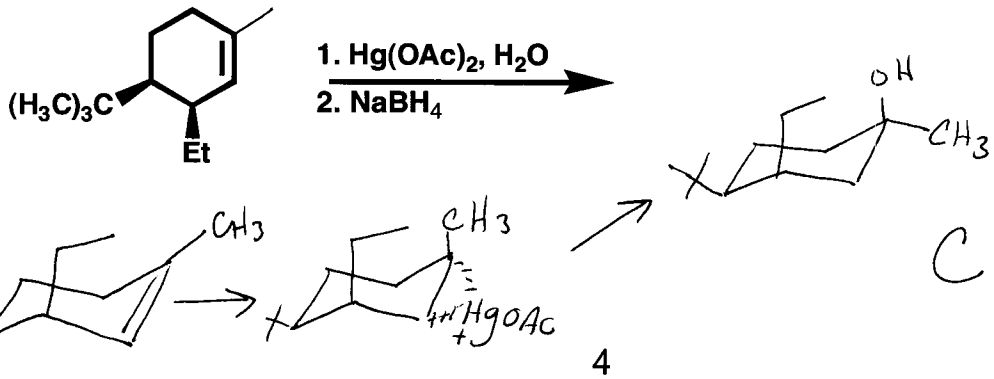
R



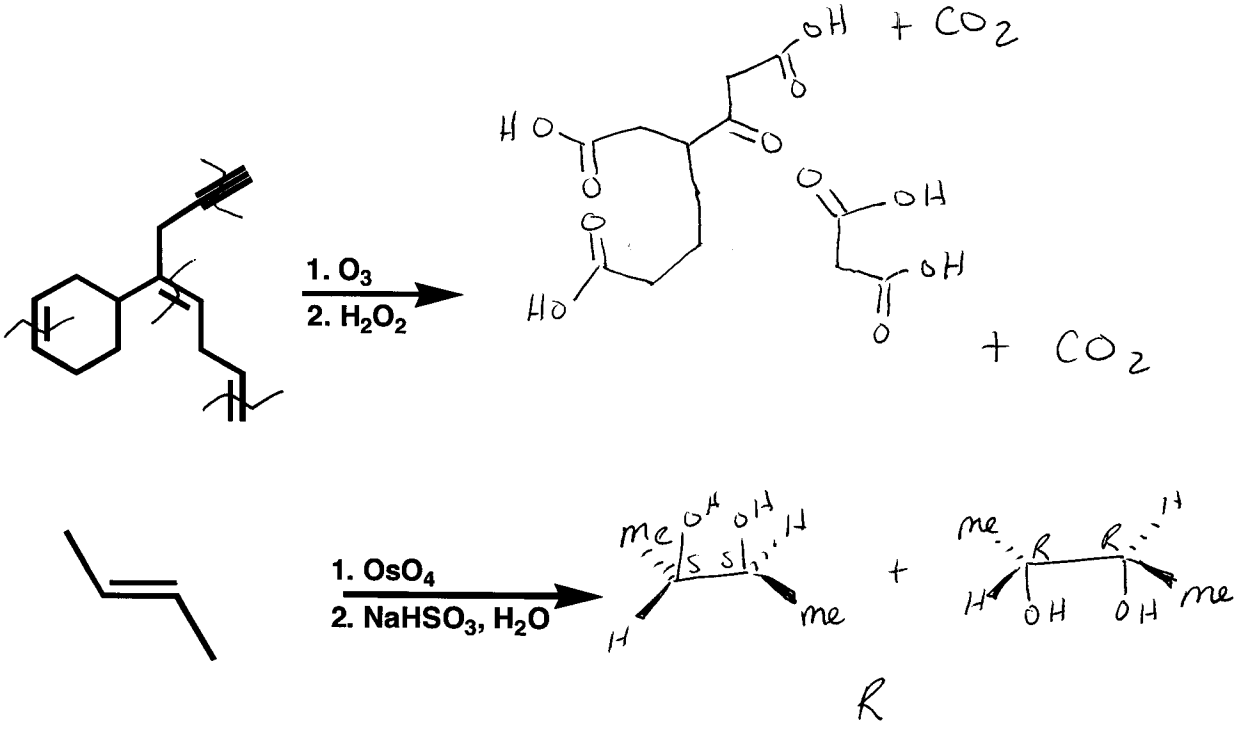
M



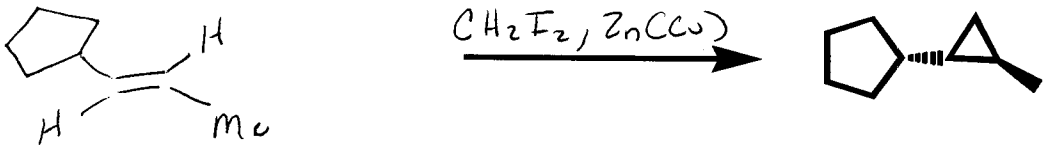
C

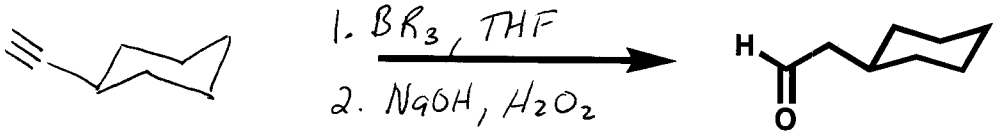


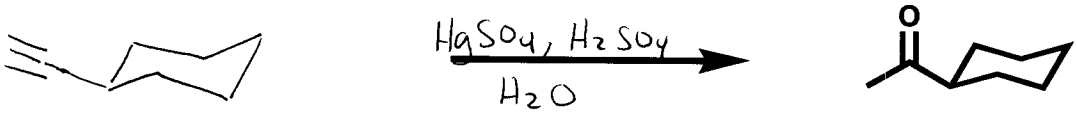
C

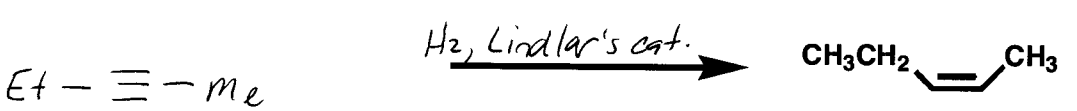


8. Provide alkene or alkyne reactants and reagents for the following reactions. The number of carbon atoms in the reactant should equal the number of carbon atoms in the product.

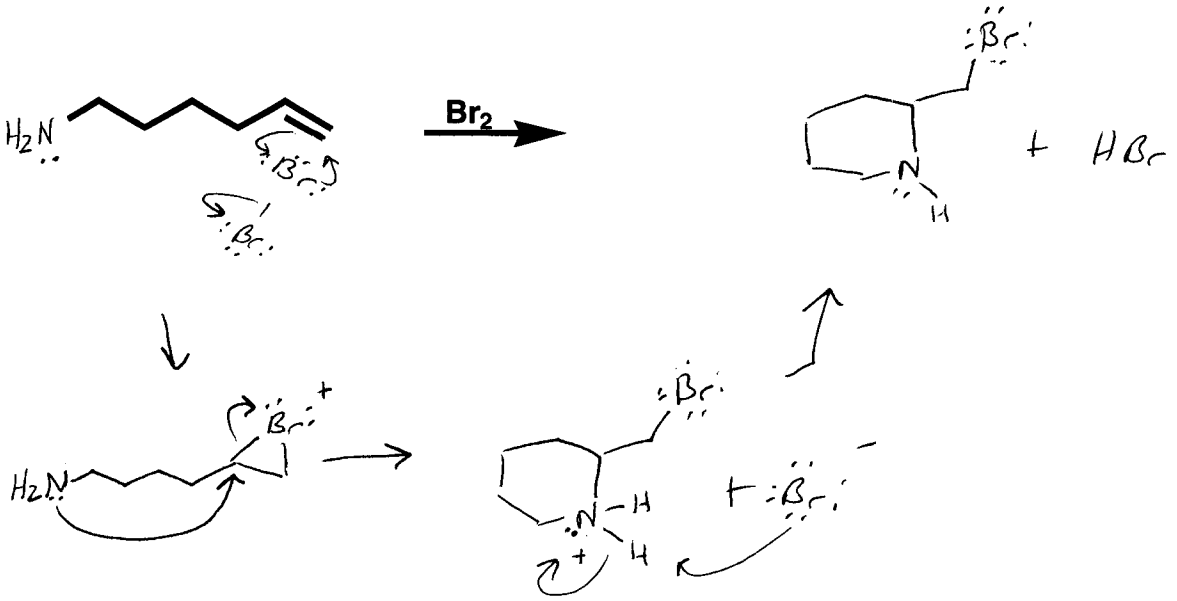


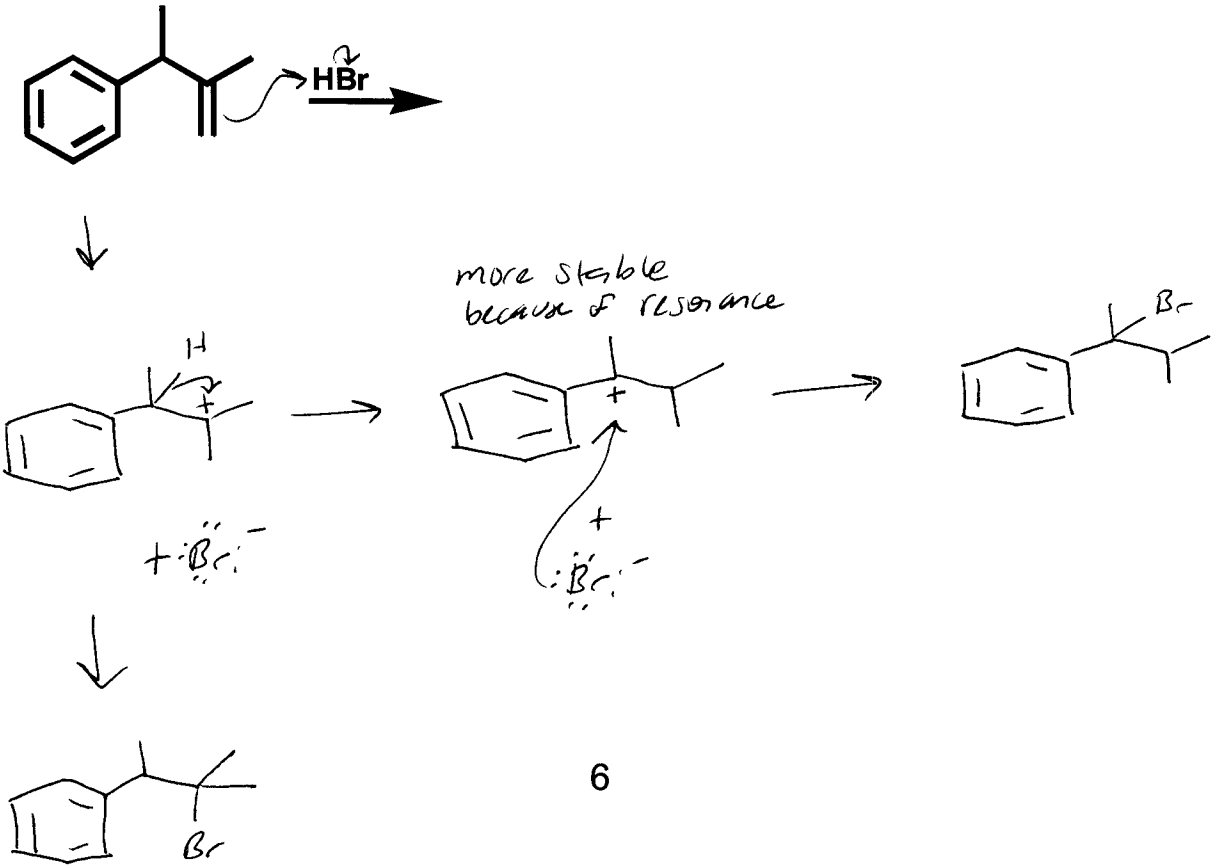




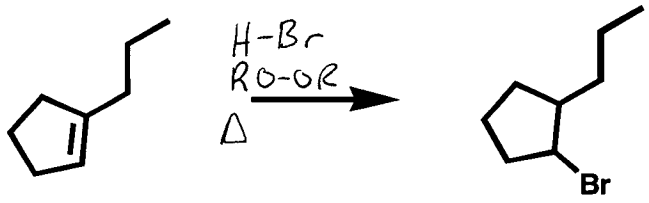


9. Write out the mechanisms and products for the following reactions. Use clear, carefully drawn structures and precise curved arrow notation for all steps. Provide distinct structures for all intermediates. Show all lone pairs.





10. Provide a detailed mechanism for the following transformation. Write in all the reagents used above the arrow. Ignore stereochemistry

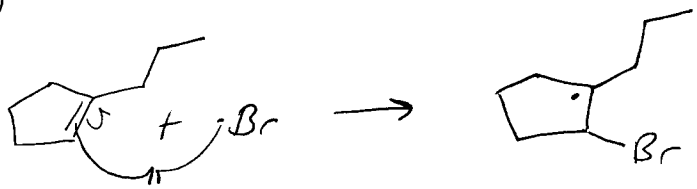


Initiation:

a) R-O-O-R $\xrightarrow{\Delta}$ 2 RO·

b) RO· + H-Br → ROH + Br·

Propagation:

a) 

b)