

1. (12 pts.) Explain why *cis*-2-butene cannot be converted to *trans*-2-butene by rotating around the C₂ to C₃ bond.

1. _____

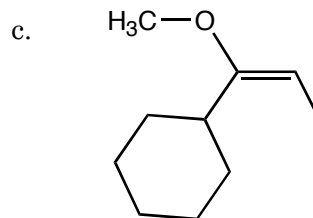
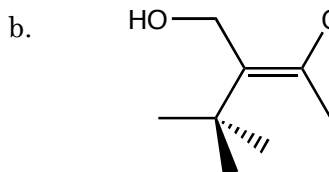
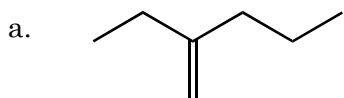
2. _____

3. _____

4. _____

5. _____

2. (12 pts.) For the following alkenes, indicate whether the *Z/E* nomenclature is necessary, and if it is, determine whether the *Z* or *E* stereoisomer is drawn.



6. _____

7. _____

8. _____

3. (12 pts.) Provide structures for the following alkenes

9. _____

a. *Z*-3,4-dimethyl-2-pentene

b. 3-chloro-4-ethyl-3-hexene

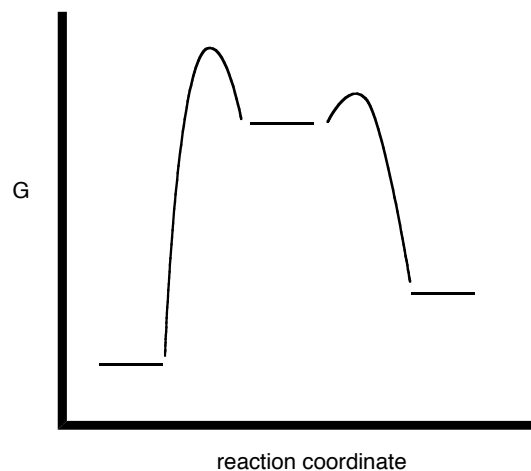
4. a. (3 pts) Label the reactants and products.

b. (3 pts.) Put a star next to the transition state(s).

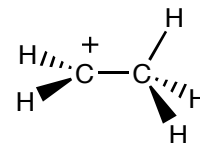
c. (3 pts.) Which is the faster step in this reaction, the first or second step?

d. (3 pts.) Which are higher in energy, the reactants or the products?

e. (3 pts.) This reaction would have a large or a small *K*?



5. a. (2 pts.) Determine the hybridization of the C atom that bears the positive charge on the carbocation drawn to the right.

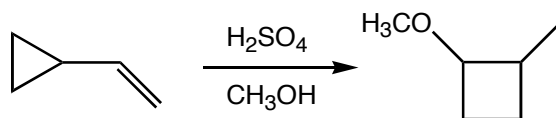


b. (2 pts.) The positive charge indicates that one of the C atoms orbitals is empty. What is the name of the empty orbital?

c. (2 pts.) Add a drawing of the empty orbital to the drawing on the right.

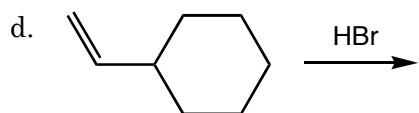
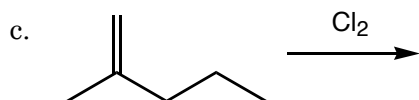
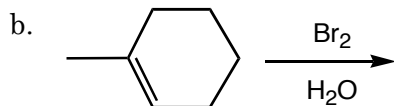
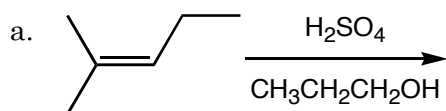
d. (6 pts.) Explain how carbocations are stabilized and why a secondary carbocation would be more stable than the extremely unstable 1° carbocation drawn above.

6. (12 pts.) Draw a mechanism that accounts for the formation of the product in the following reaction.



7. (12 pts) Explain why electrophilic addition reactions initiated by Cl_2 or Br_2 are not prone to rearrangements. Drawing the intermediate produced in the reaction might help demonstrate your point.

8. (6 pts. each) Predict the major product(s) of the following reactions.



9. (12 pts.) Both Reactions 1 and 2 will produce 1-methylcyclopentanol, but Reaction 2 will produce a higher yield of the desired product. Consider which reaction is more likely to produce unwanted byproducts, and explain why Reaction 2 is a better method for synthesizing 1-methylcyclopentanol.

