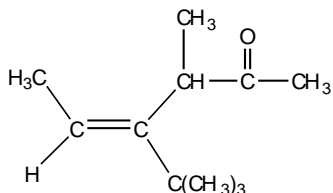


**Part 1. Multiple Choice (3 points each). Choose the one best answer, and mark it on the answer form provided by your instructor.**

1. Consider the reaction of bromocyclohexane with KOH in ethanol. This reaction is best described as
  - a) an addition reaction
  - b) an elimination reaction
  - c) a substitution reaction
  - d) a rearrangement reaction
  - e) a free-radical reaction
  
2. How many degrees of unsaturation are present in  $C_8H_{12}ClN_3O_2$ ?
  - a) 2
  - b) 3
  - c) 4
  - d) 5
  - e) 6
  
3. A compound with the formula  $C_{13}H_{20}$  contains three rings. This compound is allowed to react with hydrogen over a palladium catalyst. How many molar equivalents of hydrogen will react with this compound?
  - a) 1
  - b) 2
  - c) 3
  - d) 4
  - e) 5
  
4. Which compound is expected to have the highest heat of hydrogenation?
  - a) 2,3-dimethyl-2-pentene
  - b) 2,3-dimethyl-1-pentene
  - c) 3,4-dimethyl-1-pentene
  - d) (E)-3,4-dimethyl-2-pentene
  - e) (Z)-3,4-dimethyl-2-pentene

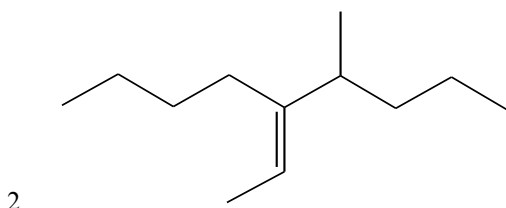
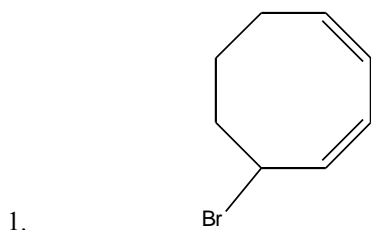
5. Which term best describes the stereochemistry about the indicated double bond?



- a) E
- b) Z
- c) cis
- d) trans
- e) none of these terms is appropriate

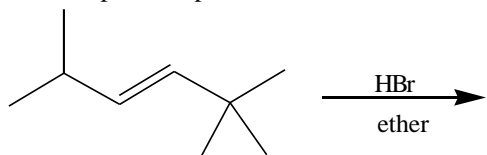
6. Suppose that each of the substances below is allowed to react with HCl in ether. Which of these will form the most stable carbocation intermediate?
- (E)-2,2-dimethyl-3-hexene
  - 3,3-dimethyl-1-hexene
  - (Z)-2,5-dimethyl-3-hexene
  - 3,4-dimethyl-1-hexene
  - (Z)-3,4-dimethyl-2-hexene
7. Of those listed below, which is the best explanation for the stability order of carbocations?
- steric strain
  - Hammond's postulate
  - Markovnikov's rule
  - Zaitsev's rule
  - hyperconjugation
8. Which of the following substances, when treated with HBr in ether, is most likely to undergo a hydride shift?
- 1-methylcyclopentene
  - 1,2-dimethylcyclopentene
  - 1,3-dimethylcyclopentene
  - 1,4-dimethylcyclopentene
  - 3-methylcyclopentene
9. How are carbocations hybridized?
- $sp^3$
  - $sp^2$
  - $sp$
  - depends on the compound
10. Which term best describes the catalytic hydrogenation of an alkene?
- elimination
  - free-radical
  - oxidation
  - reduction

**Part 2. Short Answer (5 points each). Give the complete IUPAC name of each compound shown below.**

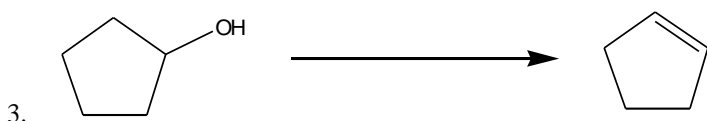
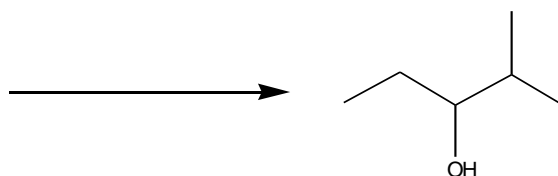
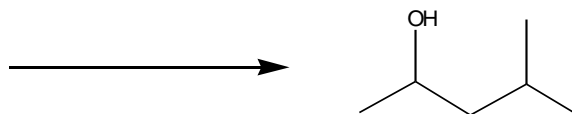


**Part 3. Reactions. Draw the reactant, product, or reaction conditions as indicated. Clearly indicate the regiochemistry and stereochemistry when appropriate. (Please do not draw the mechanism for any of the questions in Part 3.) (4 points each)**

1. Draw all possible products of the reaction below:



2. Starting with the appropriate alkene, show how you could use either hydroboration/oxidation or oxymercuration to make the two alcohols below. For each product shown, show the starting alkene and the appropriate reagents.



4. Show the starting alkene and the appropriate reagents required to synthesize the compound shown:

