Test 2A **Name**_____
Chemistry 2321-005 *Please Print*
March 11, 2005
McMurry, Chapters 5-7.6

Part I. Multiple choice. (4 points each) Choose the one best answer and mark your answer on the ScanTron answer form.

1. Which compound below is expected to have the highest (i.e., most exothermic) heat of hydrogenation?

   a) (E)-4-methyl-2-pentene
   b) (Z)-4-methyl-2-pentene
   c) 2-methyl-2-pentene
   d) 3-methyl-1-pentene
   e) 2-methyl-1-pentene

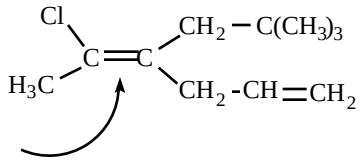
2. What is the degree of unsaturation in $C_{10}H_{11}Br_2NO_2$?

   a) 3
   b) 4
   c) 5
   d) 6
   e) 7

3. A compound of formula $C_{12}H_{12}BrCl_2N$ has two rings. How many molar equivalents of hydrogen does it absorb if all of the remaining unsaturations are double bonds?

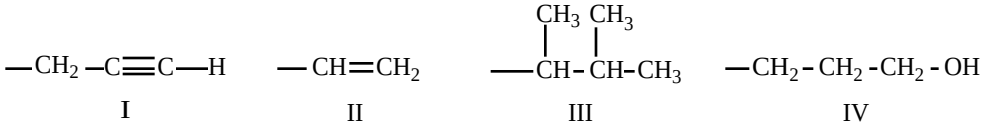
   a) 2
   b) 3
   c) 4
   d) 5
   e) 6

4. What is the best way to describe the stereochemistry of the double bond indicated in the compound below?



   a) *cis*
   b) *trans*
   c) E
   d) Z
   e) anti

5. Rank the following sets of substituents in order of priority according to the Cahn-Ingold-Prelog sequence rules. Place the *highest* priority substituent *first* and place the *lowest* priority substituent *last.*



I II III IV

a) I > II > III > IV
b) II > III > I > IV
c) I > II > IV > III
d) IV > I > II > III
e) III > II > I > IV

6. Which compound below is *most likely* to undergo a carbocation rearrangement when allowed to react with HBr in ether?

a) 2-methyl-2-hexene
b) (Z)-3-methyl-2-hexene
c) (E)-4-methyl-2-hexene
d) (E)-5-methyl-2-hexene
e) (E)-5,5-dimethyl-2-hexene

7. Which statement below is the best description of hyperconjugation?

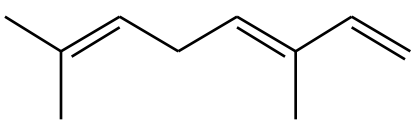
a) Since there is no free rotation around double bonds, substituted alkenes can exist as cis-trans stereoisomers.
b) In electrophilic addition of HX to an alkene, the H will add to the less substituted C, and the X will add to the more substituted C.
c) A hydride shift can occur resulting in the formation of a more stable carbocation.
d) A repulsive interaction occurs when atoms are forced closer together than their atomic radii allow.
e) Stabilization results when there is overlap between an empty C=C antibonding π orbital and a filled C-H bonding orbital on a neighboring atom.

8. Which of the compounds below cannot exist as cis-trans stereoisomers?

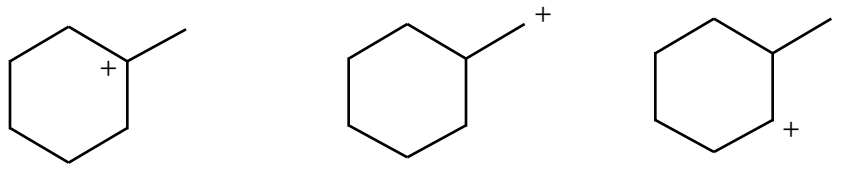
a) 2-pentene
b) 2-methyl-2-pentene
c) 3-methyl-2-pentene
d) 4-methyl-2-pentene
e) All four choices above can exist as cis-trans isomers.

Part II. Short Answer. (4 points each)

1. Write the complete IUPAC name of the compound below.



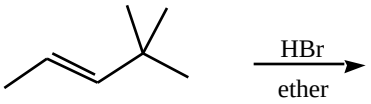
2. The carbocations below are labeled **A**, **B**, and **C**. Rank the carbocations below in order of decreasing stability. (That is, list the *most* stable carbocation *first*, and the *least* stable carbocation *last.*)



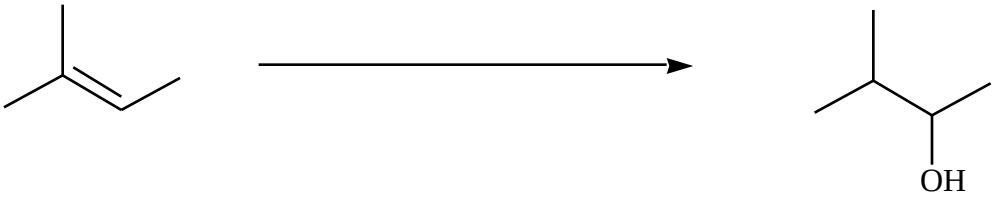
A **B** **C**

Part III. Reactions. Draw the reactant, product, or reagents as indicated. Clearly indicate the regiochemistry and stereochemistry when appropriate. (Please do not draw the mechanism for any of these questions in part III.) (36 points)

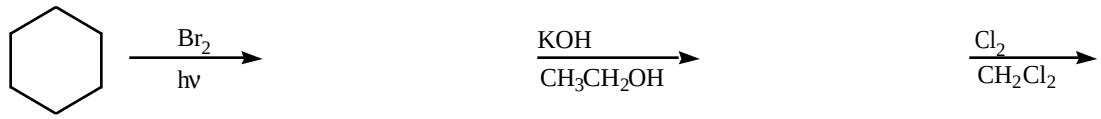
1. Draw all possible products resulting from the reaction below:

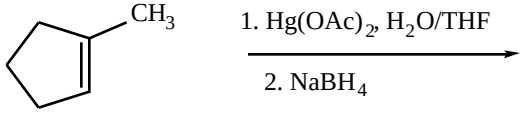


2. What reagents are required to accomplish the transformation indicated below?



3. *trans*-2-butene $\xrightarrow{CHCl_3,\ KOH}$

4. 

5. 

Part IV. Mechanisms.

1. (3 points) Draw the structure of the intermediate that is formed when 2-methyl-2-hexene reacts with HBr in ether. (Only draw the intermediate; do not draw the complete mechanism.)

2. (7 points) Methane reacts with chlorine gas when irradiated with ultraviolet light. Write the propagation steps for this reaction. (Do not write the entire mechanism; only write the propagation steps.)

3. (7 points) When 3-methylcyclohexene reacts with HCl in ether, one of the products is 1-chloro-1-methylcyclohexane. Show the complete mechanism for the formation of this product using the curved arrow formalism.

4. (7 points) Draw the complete mechanism for the reaction of 1-methylcyclopentene with Br_2 and H_2O using the curved arrow formalism.