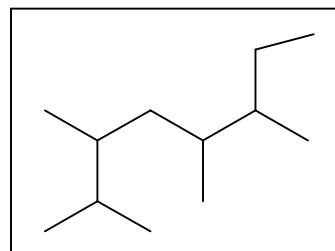


Exam # 2
Chemistry 2401 – March 7, 2007

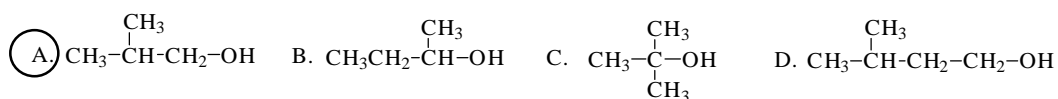
(40) I. MULTIPLE CHOICE: Circle the letter corresponding to the correct response.

1. If you were naming the compound shown at the right, then the longest chain that forms the basis of the name would be called.

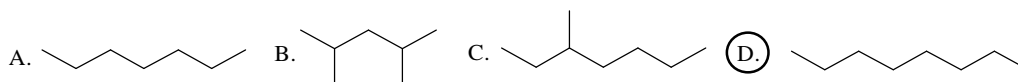


- A. hexane B. nonane **C. octane**
D. heptane E. decane F. propane

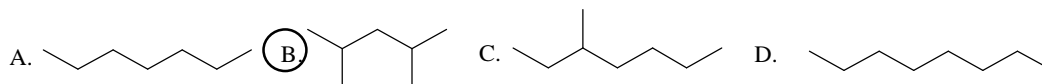
2. Which of the following is isobutyl alcohol?



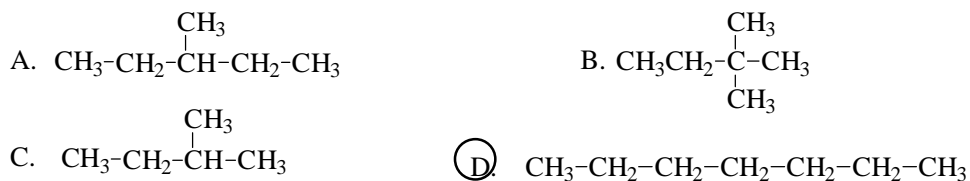
3. Which of the following has the highest boiling point?



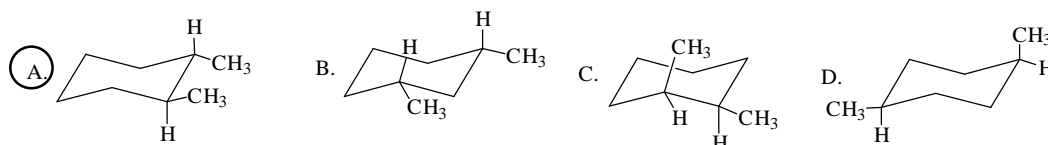
4. Which of these compounds would produce three signals in its ^{13}C NMR spectrum?



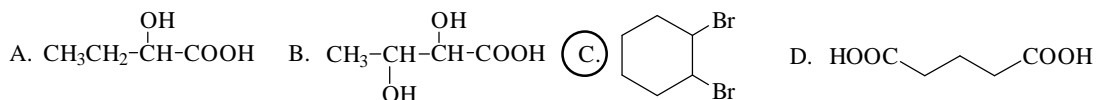
5. Which of the compounds shown below would produce a DEPT spectrum with one peak up and three peaks down?



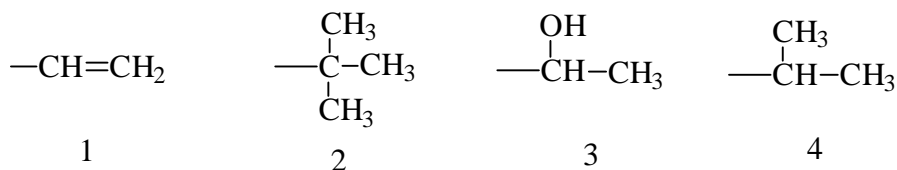
6. Which of the following is a trans- isomer?



7. For which of the following are there 3 stereoisomeric forms?

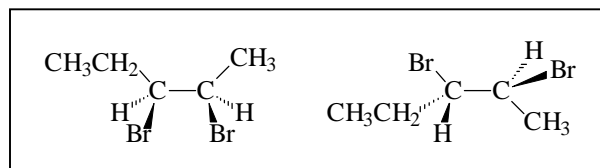


8. The correct Kahn-Ingold-Prelog priorities for the four groups below is



- A. $2 > 3 > 1 > 4$ B. $3 > 2 > 1 > 4$ C. $2 > 3 > 4 > 1$ D. $3 > 2 > 4 > 1$

9. Consider the structures at the right. Which of the following describes the relationship between these two structures?

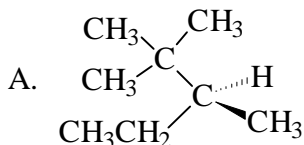


- A. the same compound B. enantiomers C. **diastereomers**
D. none of the above

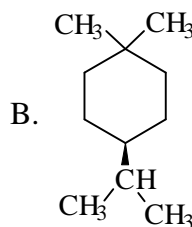
10. Which of the following is characteristic of a reaction mixture that contains more product molecules than reactant molecules when it is at equilibrium?

- A. $\Delta G^\circ = -15.3$ B. $\Delta H^\circ = +10.4$ C. $\Delta S^\circ = -3.2$ D. $K_{\text{eq}} = 1.4 \times 10^{-2}$

(8) II. Name each of the following including stereochemical designations where appropriate.

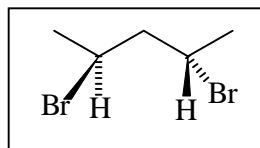


S-2,2,3-trimethylpentane



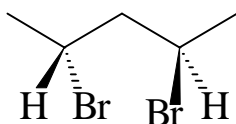
4-isopropyl-4,4-dimethylcyclohexane

(12) III. Consider the structure at the right

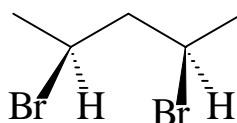


A. Determine the absolute configuration (R & S) of the two stereogenic centers. **They are S,S.**

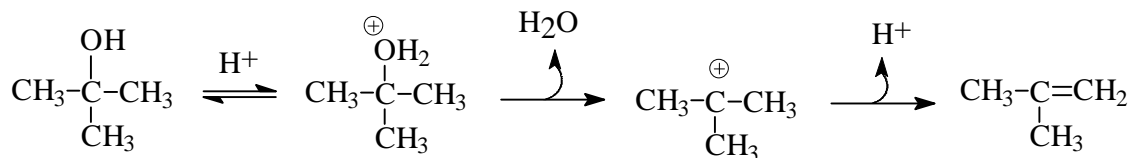
B. Draw a structural formula for the enantiomer of this structure.



B. Draw a structural formula for a diastereomer of this structure.



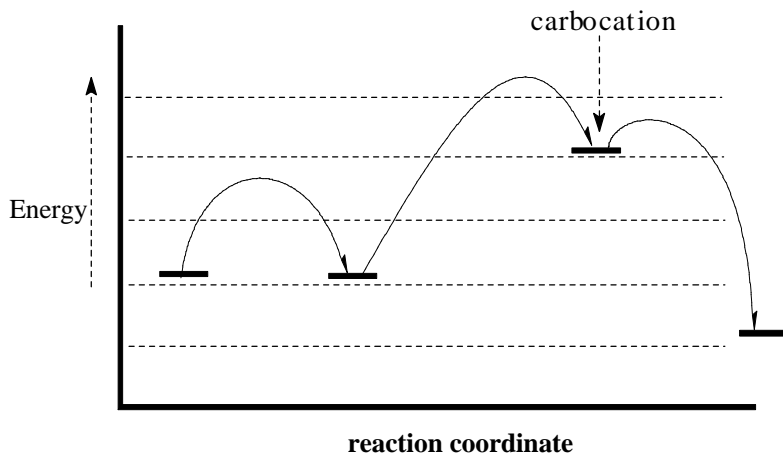
(10) IV. Consider the following reaction mechanism for the acid catalyzed dehydration of 2-methyl-2-propanol which consists of three steps. The reaction is exergonic.



The first step is a fast acid-base equilibrium followed by the much slower loss of water to yield the carbocation which rapidly loses H^+ to yield the final product.

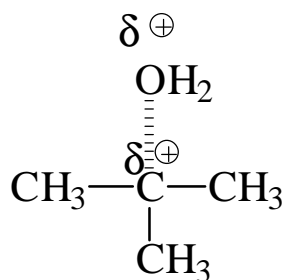
A. This is a(n) elimination reaction. (addition, elimination, substitution)

B. In the space below sketch an energy coordinate diagram for this reaction that reflects the facts provided above.



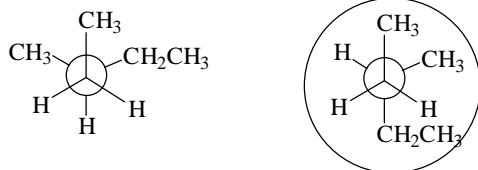
C. Indicate on your diagram the position corresponding to the carbocation intermediate.

D. In the space at the right draw a structural formula for the transition state for the second step, showing clearly the position of partial bonds and partial electrical charge.

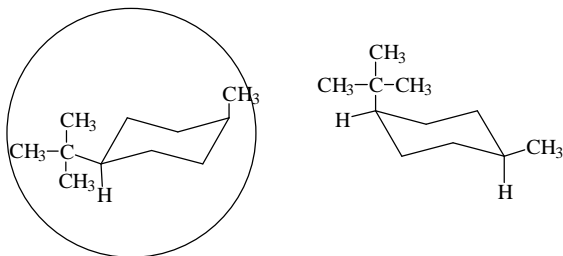


(9) V. Draw structural formulas for each of the following.

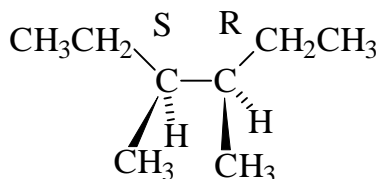
A. Draw a Newman projection formula for a staggered conformation resulting from rotation around the $C_2 - C_3$ bond of 3-methyl pentane. Now convert that to a second conformation in which the front carbon remains in place and the back carbon is rotated by 120° in a clockwise fashion. Circle the one that is lower in energy.



B. Draw a chair conformation for cis-1-tert-butyl-4-methylcyclohexane. Now convert your chair conformation into a second conformation. Circle the one lower in energy.



C. Draw a 3-D representation for the meso isomer of 3,4-dimethylhexane. Designate its stereogenic centers as R or S.



(3) VI. Explain briefly why cis-1,3-dimethylcyclohexane has a lower heat of combustion (is more stable) than trans-1,3-dimethylcyclohexane.

The cis isomer exists in two conformers (e,e and a,a). The two conformers for the trans isomer are (a,e and e,a). Since it is able to place both methyl groups in the less crowded equatorial positions the cis contains less potential energy (is more stable) and produces less heat when it is burned.