FIRST HOUR EXAM - CHEMISTRY 3311

February 12, 2008

NAME: Answers

PROBLEM 1._____

PROBLEM 2._____

PROBLEM 3._____

PROBLEM 4._____

PROBLEM 5._____

PROBLEM 6._____

PROBLEM 7._____

PROBLEM 8._____

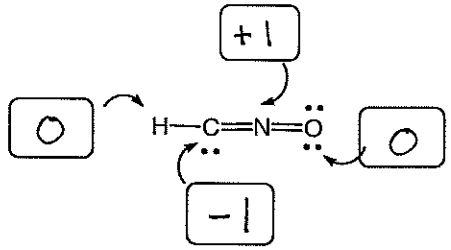
Total: _____

Circle Name of Discussion TA

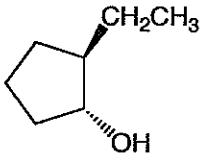
Ashley

Heather

Problem 1. (5 points) Given the following Lewis representation, determine the formal charge on each atom. Write the charge in the appropriate box.

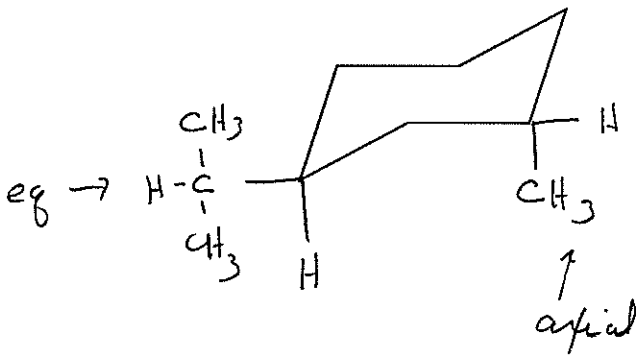


Problem 2. (5 points) Give the IUPAC name for the following compound.

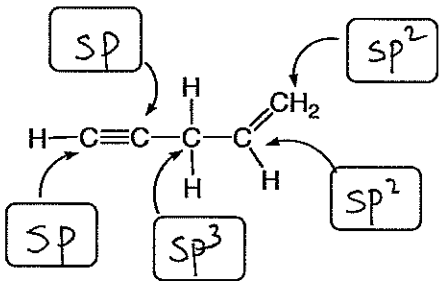


trans - 2 - ethyl - cyclopentanol

Problem 3. (5 points) Draw the most stable conformation of *trans* 1-isopropyl-3-methyl- cyclohexane. Show clearly which groups are axial and which are equatorial.



Problem 4. (5 points) Give the nature of the orbital hybridization at each carbon atom for the following molecule. Write the hybridization in the appropriate box.

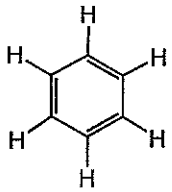


Problem 5 (25 points) Consider the following acid-base reactions. Give the product for each reaction and *determine whether the equilibrium lies to the left or to the right.* **See last page for pKa's.**

A) $H-C\equiv C^{\ominus}\ Na^{\oplus} + CH_3OH \rightleftharpoons H-C\equiv C-H + CH_3O^- Na^+$ (R)

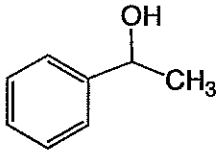
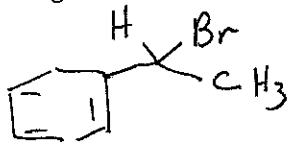
B) $CH_3OH + HBr \rightleftharpoons CH_3O^{(+)}H_2 + Br^-$ (R)

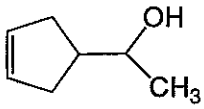
C) $H_3C-\overset{O}{\overset{\|}{C}}-O^{\ominus}\ Na^{\oplus} + H_2O \rightleftharpoons CH_3-\overset{O}{\overset{\|}{C}}-OH + NaOH$ (L)

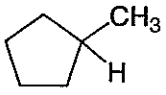
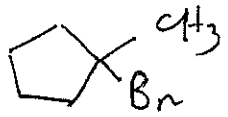
D)  $+ NaOH \rightleftharpoons$  $+ H_2O$ (L)

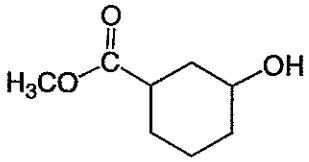
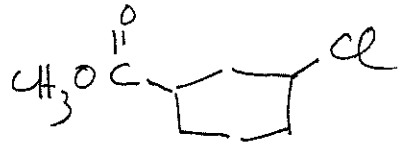
E) $H_3C-\overset{O}{\overset{\|}{C}}-O^{\ominus}\ Na^{\oplus} + H_3O^{\oplus} \rightleftharpoons CH_3-\overset{O}{\overset{\|}{C}}-OH + H_2O$ (R)

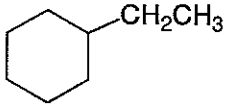
Problem 6 (25 points) Give the **major** product for the following reactions. **If no reaction occurs, state so.**

A)  $\xrightarrow[\text{pyridine}]{PBr_3}$ 

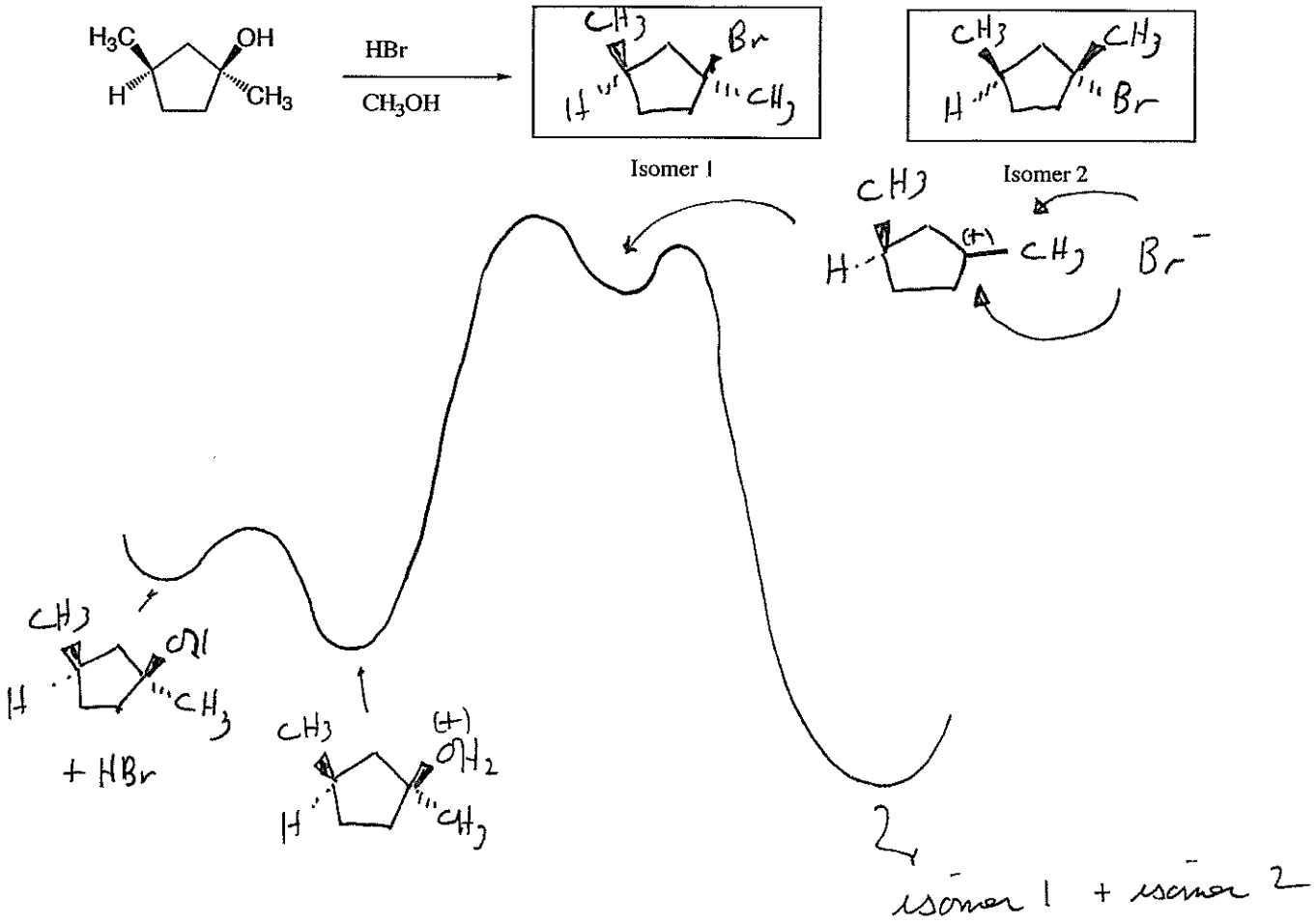
B)  $\xrightarrow[CH_3OH]{NaCl}$ NR

C)  $\xrightarrow{Br_2,\ light}$ 

D)  $\xrightarrow[\text{pyridine}]{SOCl_2}$ 

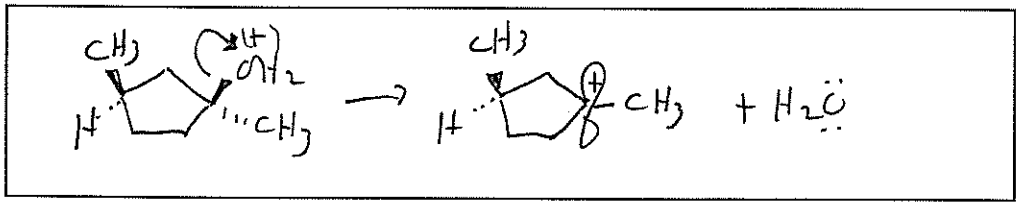
E)  $\xrightarrow{I_2,\ light}$ NR

Problem 7. (15 points) Show the two stereoisomers that are formed in the following reaction. Draw a potential energy diagram for the reaction and give the structures of the intermediates that are formed along the reaction pathway.



What reaction is associated with the rate determine step(RDS)?

RDS =



Problem 8. (15 points) Give the overall enthalpy change for the two chain propagation steps in the free radical chlorination of ethane. **Write you answer in the box and express energies in kcal/mole. Show the two chain propagation reactions.** *See last page for bond energies.*

$\Delta H =$ $\boxed{-28 \text{ kcal/mole}}$ or -116 kJ/mole

$Cl\cdot \quad H-CH_2CH_3 \longrightarrow H-Cl + CH_3\dot{C}H_2$

98 kcal/mole 103 kcal/mole $\Delta H_1 = -5$ kcal/mole

$CH_3CH_2\cdot + Cl-Cl \longrightarrow CH_3CH_2-Cl + Cl\cdot$

58 kcal/mole 81 kcal/mole

$\Delta H_2 = -23$ kcal/mole

$\Delta H = -28$ kcal/mole