Department of Chemistry and Biochemistry

Chemistry 59-230/232 **Midterm #2**
Time: 50 min. **Nov. 18, 2005**

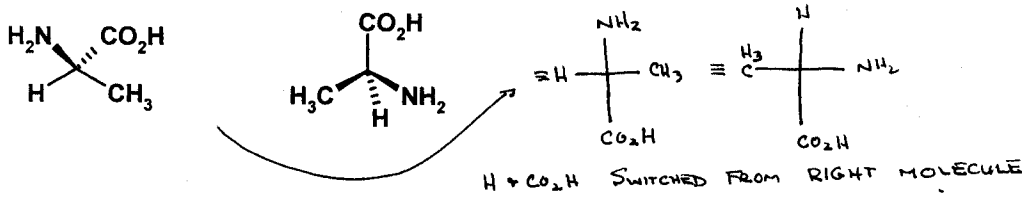
NAME _____ **ID#** _____

LAB SECTION (and TA) _____

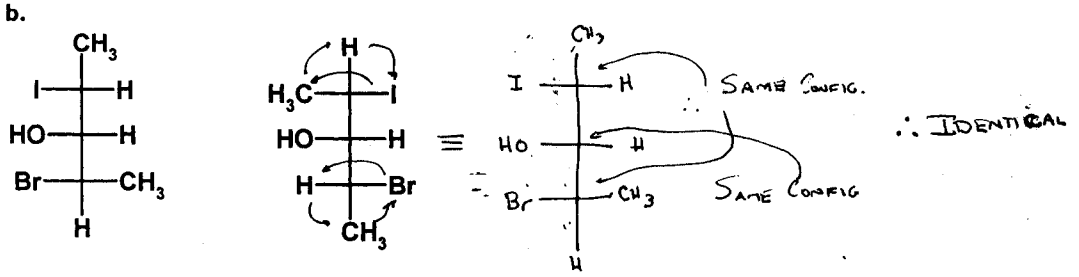
Note: ***Please answer on the test paper.*** *There is an extra sheet for rough work at the back, but it will not be marked unless asked. Tests written in pencil will be marked, but cannot be returned for remarking.*

1. Identify the relationship between each of the following pairs (i.e., enantiomers, diastereomers, identical, structural isomers). Are any of the compounds meso forms? If so, indicate which one(s). (total 14 marks)

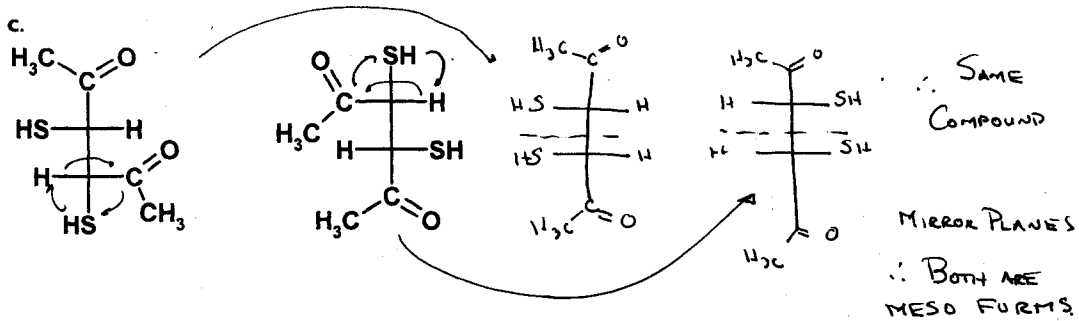
a.



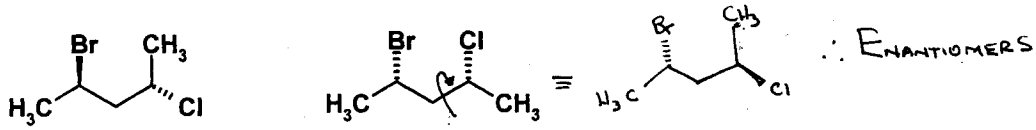
b.



c.



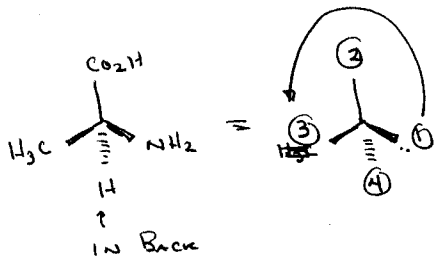
d.



1

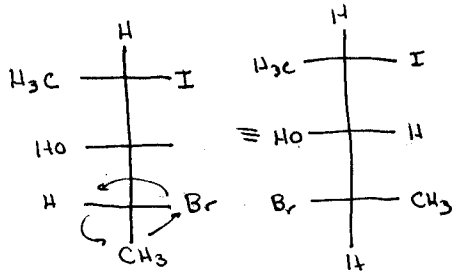
2. For the structures on the **right** side **1a** and **1b** only, identify each chiral centre as (R)- or (S)-. Show how you arrived at your answer (4 marks each centre, total 16)

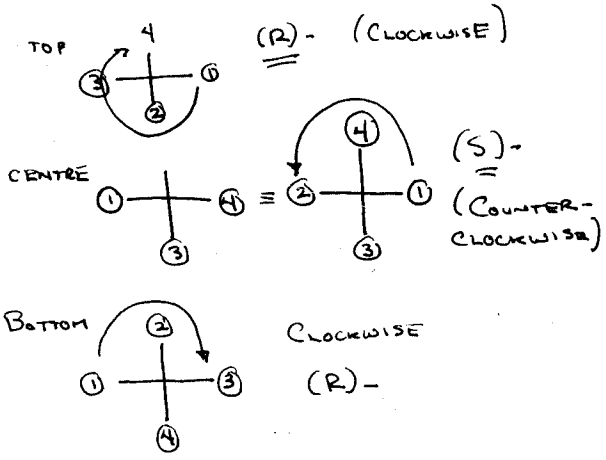
a.



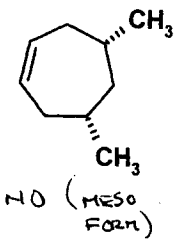
1→2→3
COUNTERCLOCKWISE
∴ (S)-

b.

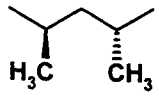




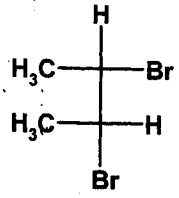
c) Do the following compounds rotate plane polarized light? Answer only yes or no. (6 marks)



NO (MESO FORM)

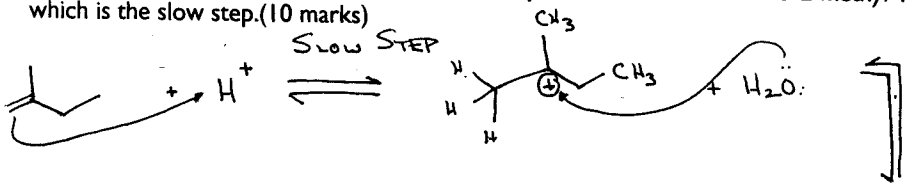


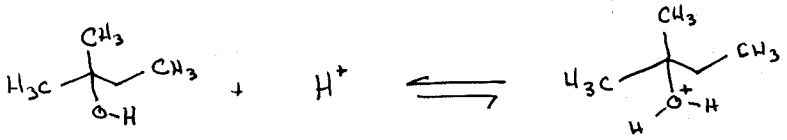
NO (2 IDENTICAL GROUPS ON ALL CARBON)



YES

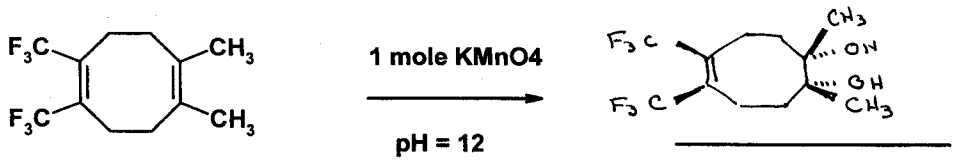
3. Draw the complete mechanism of the acid catalyzed addition of water to 2-methyl-1-butene. Indicate which is the slow step.(10 marks)





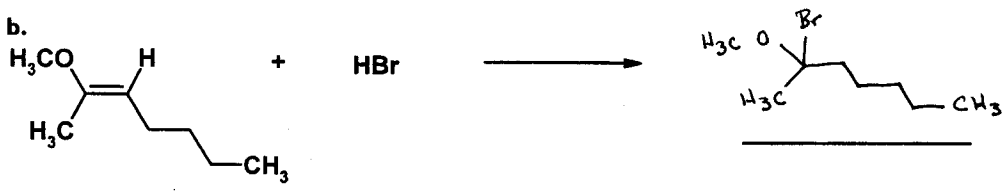
4. For each of the following reactions, fill in the blank with the structural formula of the required chemical. Show any required catalysts over the reaction arrow. Be sure to include stereochemistry where it is important (except c). Note: There *may* be more than one reagent or more than one step required per blank. (Total 30 marks)

a.

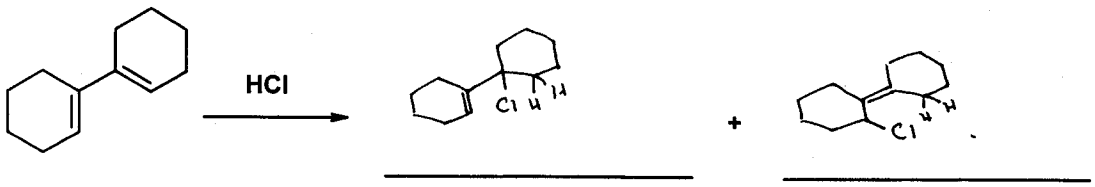


1 mole

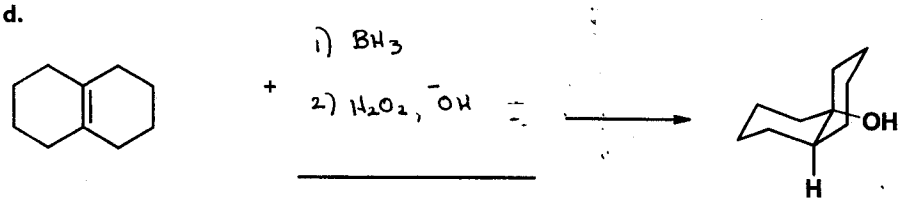
b.



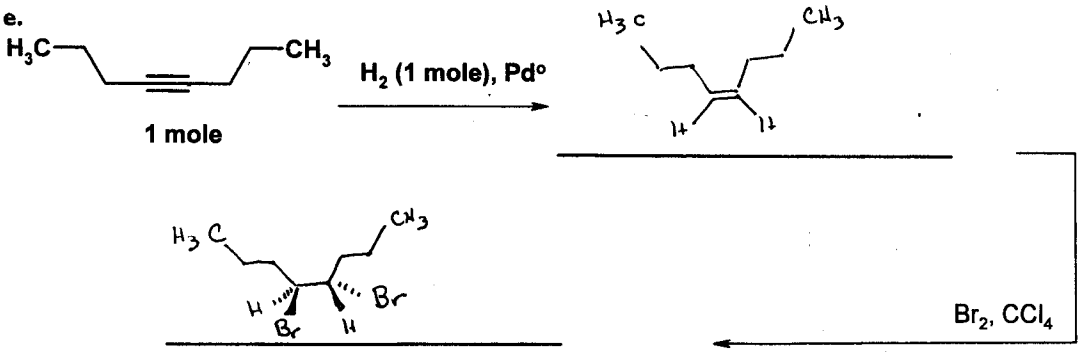
c.



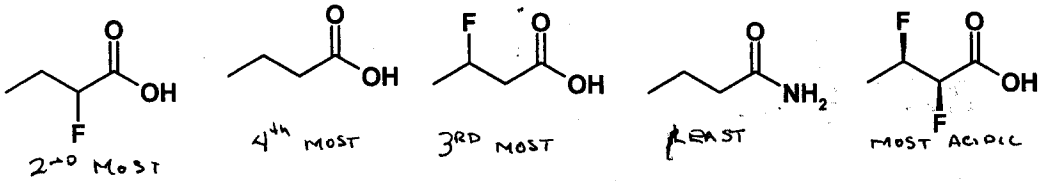
d.



e.



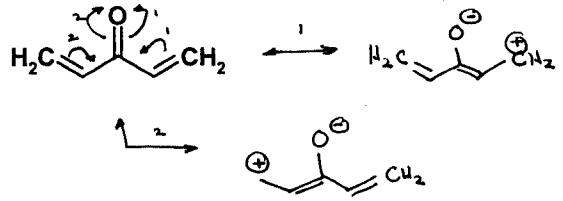
5a) Rank the following in terms of strength of acid, going from the strongest to weakest (4 marks)



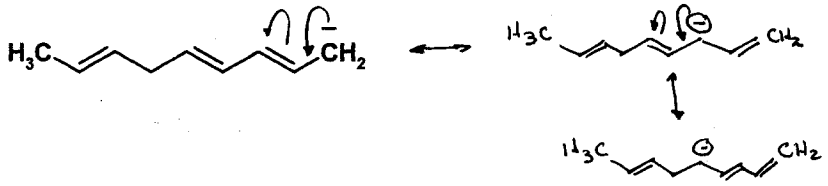
2ND MOST 4TH MOST 3RD MOST LEAST MOST ACIDIC

b) Draw all reasonable resonance forms for the following structures. For each of these, show the appropriate use of curved arrows demonstrating the electron movement leading to the other resonance forms (10 marks).

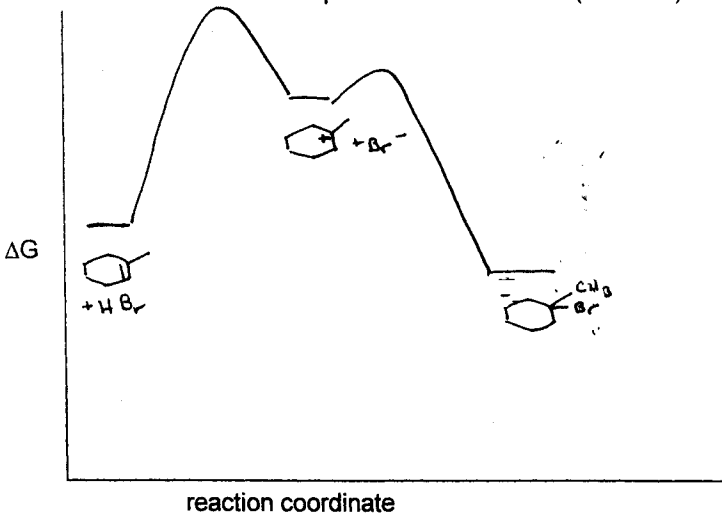
i.



ii.

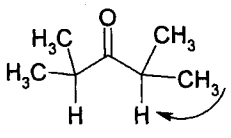


6. Draw the energy profile for the reaction of HBr with 1-methylcyclohexene. Label the product and any intermediates. Draw the rate equation for this reaction. (10 marks)

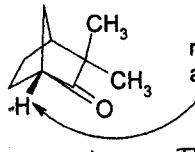


rate (v) = $k[\text{C}_6\text{H}_{11}\text{Br}][H^+]$

Bonus. Believe it or not, C-H bonds adjacent to carbonyl compounds (i.e., ketones) are reasonably acidic, *almost* as acidic as water, by virtue of resonance stabilization of the conjugate anion. On the other hand, the apparently similar C-H bond drawn in the compound on the right is not very acidic at all. Can you explain why? (Up to 5 additional marks....hmm, you can continue the answer on extra sheet)

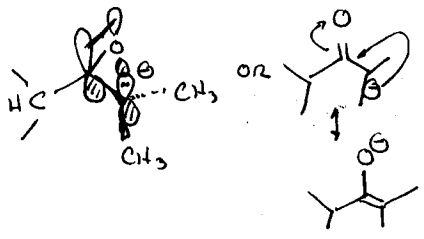


reasonably acidic (pK_a = 20)



not acidic at all

THIS IS STABILIZED BY



BUT HERE, THE MOLECULE IS TOO STRAINED FOR FORMATION OF AND sp^2 HYBRID C, AND DUE TO GEOMETRY IT CAN'T OVERLAP WITH THE π SYSTEM OF THE KETON