Department of Chemistry and Biochemistry

Chemistry 59-230/232 **Midterm #2**
Time: 50 min. **Nov. 12, 2007**

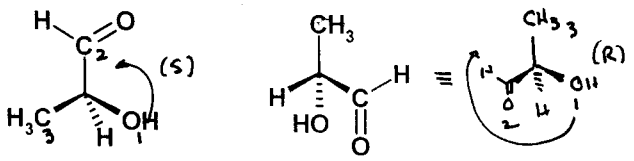
NAME _____ **ID#** _____

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.*

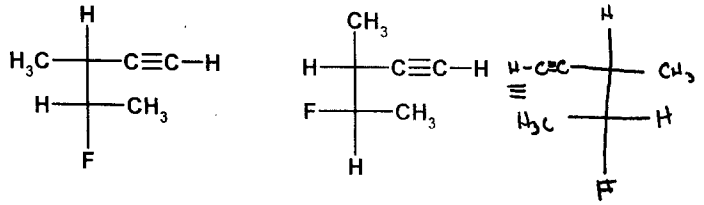
1. Identify the relationship between each of the following pairs (i.e., enantiomers, diastereomers, identical, structural isomers). Are any of the compounds meso forms? If so, indicate which one(s). (total 11 marks)

a.



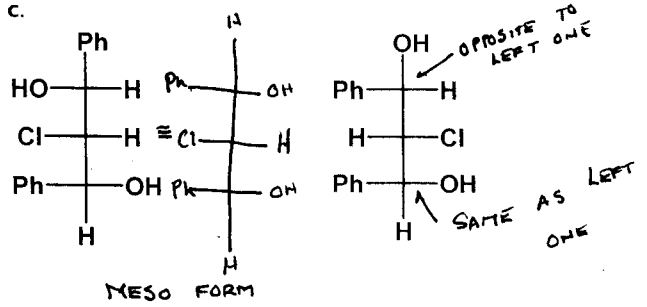
ENANTIOMERS

b.



ENANTIOMERS

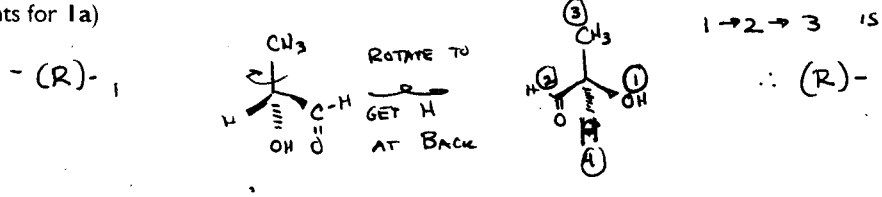
c.



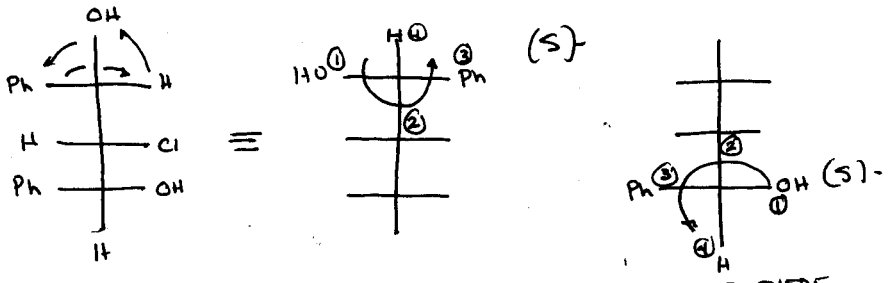
DIASTEREOMERS

2. For the structures on the **right** side of **1a** and **1c** only, identify each chiral centre as (R)- or (S)-. Show how you arrived at your answer. (total 15 for **a** and **c**). Note – there is *no* **2b.**

a. (assignments for **1a**)

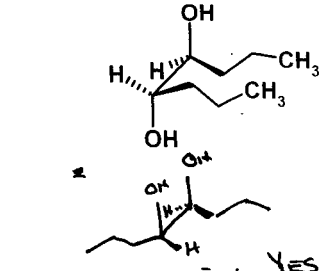


c. (assignments for 1c)

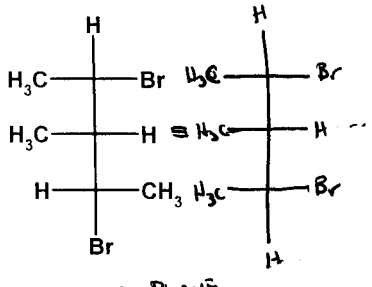


THE 'MIDDLE' CENTRE IS NOT CHIRAL, SINCE THERE ARE TWO IDENTICAL GROUPS ON IT.

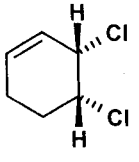
d) Do the following compounds rotate plane polarized light? I only need 'yes' or 'no'.(6 marks)



NO MIRROR PLANE ∴ YES

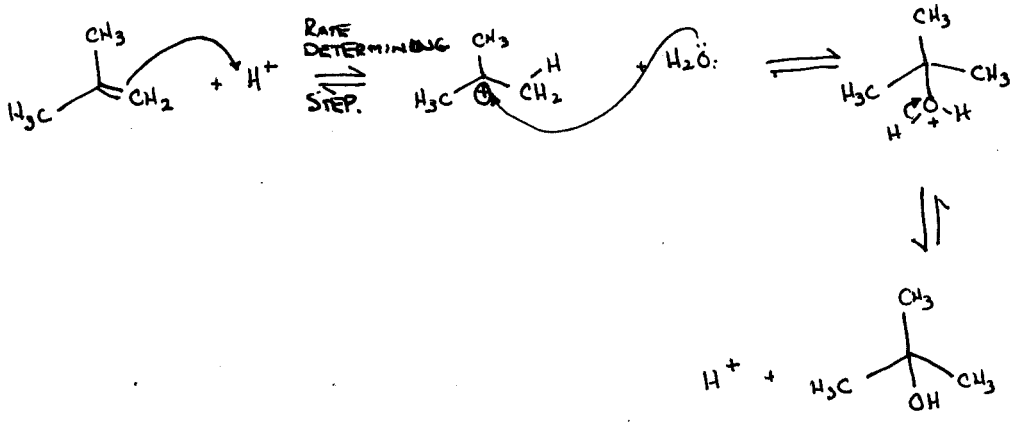


MIRROR PLANE ∴ MESO FORM ∴ NO



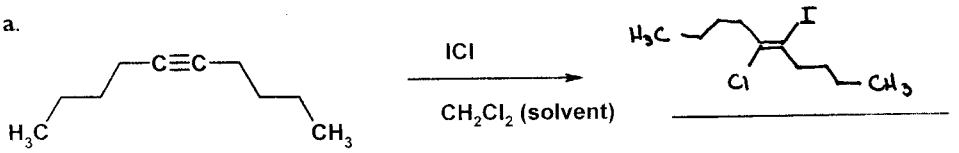
NO MIRROR PLANE ∴ YES.

3. Draw the complete mechanism of the acid catalyzed addition of water to 2-methyl-1-propene. Show all accurate intermediates, and indicate which is the slow (rate determining) step. Curved arrows showing electron movement are not required.(11 marks)



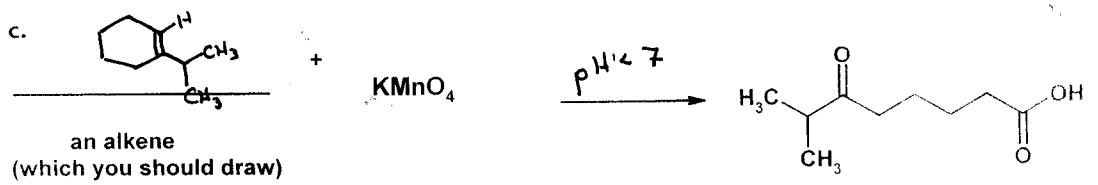
4. For each of the following reactions, fill in the blank with the structural formula of the required chemical. Show any required catalysts or conditions over the reaction arrow. Be sure to include stereochemistry where it is important. Note: Every reagent may not be shown, and there *may* be more than one reagent or more than one step required per blank. (Total 30 marks)

a.



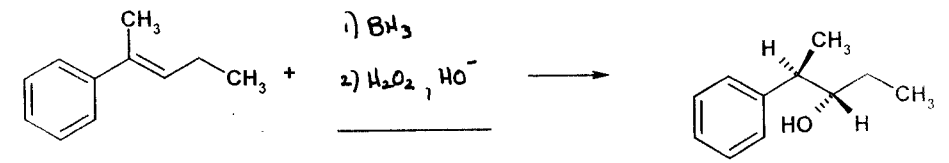
b.

c.

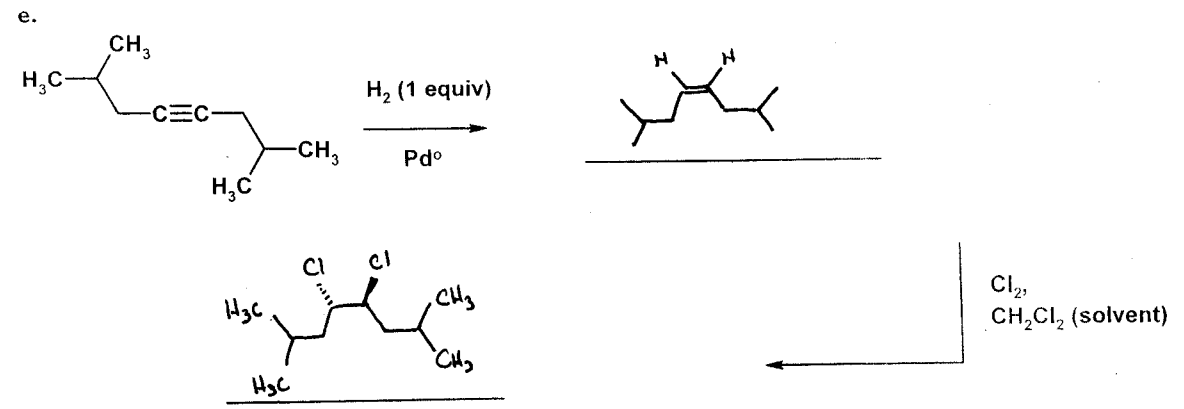


an alkene
(which you should draw)

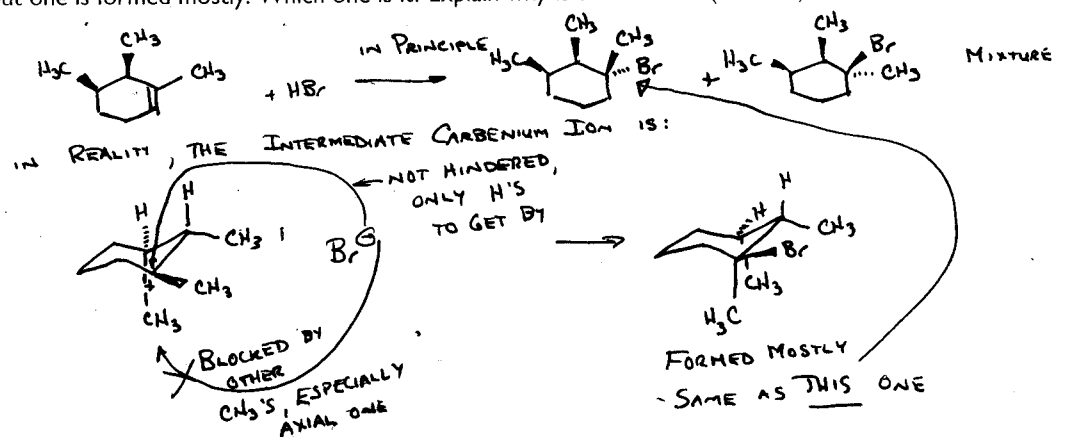
d.



e.



5a) In the reaction of *cis*- 1,5,6-trimethylcyclohexene with HBr, two diastereomers of product are *possible*, but one is formed mostly. Which one is it? Explain why is this the case (9 marks)



b) In electrophilic addition reactions with alkenes, each of I-I (I_2), I-Br, and I-Cl *can* in principle be used, but one is very reactive, one is moderately reactive, and one is not very reactive at all. Which is which? Explain why is this the case (6 marks).

SINCE IN TERMS OF ELECTRONEGATIVITY Cl > Br > I

THEREFORE $\overset{\delta+}{I}-\overset{\delta-}{Cl}$ $\overset{\delta+}{I}-\overset{\delta-}{Br}$ COVALENT $I-I$

↑ MOST ELECTROPHILIC (MOST '+' CHARGE) ↑ LESS ELECTROPHILIC (LESS '+' CHARGE) LEAST ELECTROPHILIC

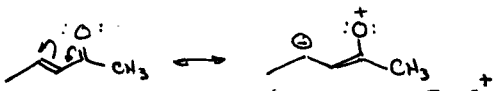
∴ VERY REACTIVE MODERATE NOT V. REACTIVE

c) 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 (12 marks).

i.

ONLY REASONABLE ONE

- CAN'T DRAW

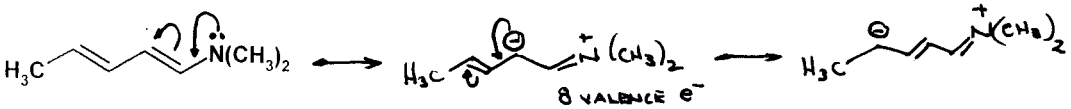


6 VALENCE e^- O

- NOT VIABLE

UNLESS YOU TELL ME THIS IS A BAD RESONANCE FORM

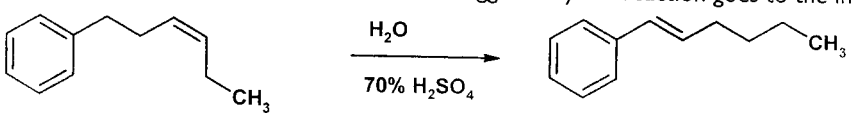
ii.



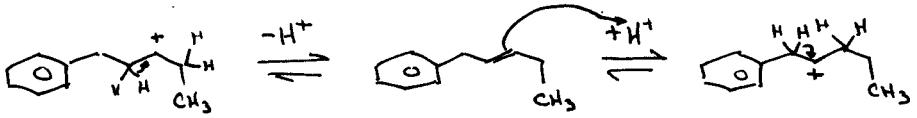
8 VALENCE e^-

N^+ → QUITE OK

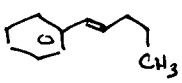
Bonus. An overenthusiastic student attempted the addition of water to the following alkene using a too concentrated acid solution, and ended up getting an isomeric alkene, also shown below. What happened mechanistically? A complete answer will also suggest why the reaction goes to the indicated compound.



H^+ ↓↑



$-H^+$ ↓↑



MORE THERMODYNAMICALLY STABLE, SINCE C=C IS NOW CONJUGATED TO BENZENE RING.