

## CHEMISTRY 59-135/137

## FINAL EXAMINATION

Time 3 hr

April 25, 1994

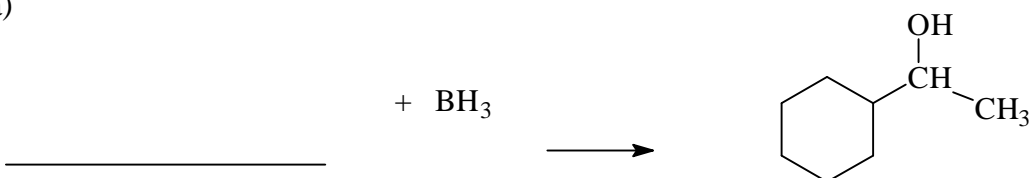
NAME: \_\_\_\_\_

ID #: \_\_\_\_\_

READ ALL QUESTIONS CAREFULLY AND ANSWER THE QUESTION ASKED!! Answer all questions on the test paper. Extra sheets have been attached for rough work which will not be marked. Only the FIRST answer to any question will be considered. Point values for each question are given. There are 8 questions and 7 pages in this test and the available points total 106 [including the bonus question]

1. In each of the following reactions fill in the blanks with the correct structural formula. If stereochemistry is important, make sure your drawing shows it clearly. If a catalyst is required for a successful reaction, show it over the arrow. [36 points]

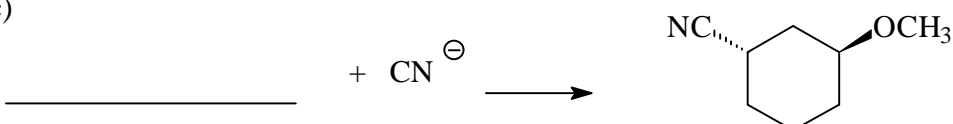
a)



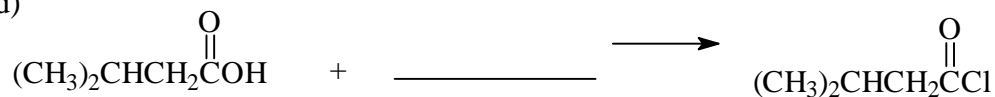
b)



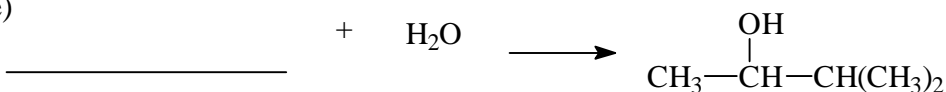
c)



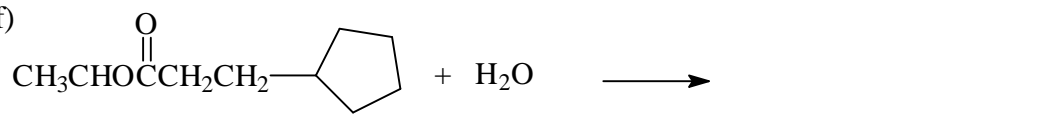
d)

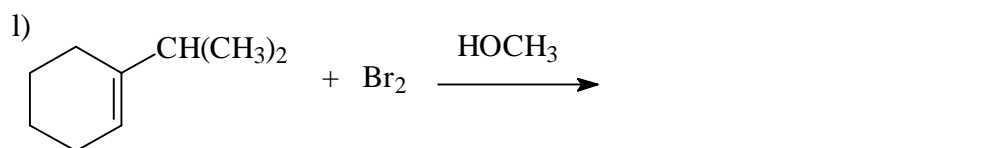
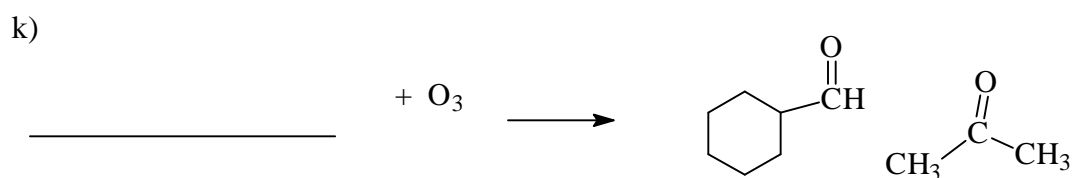
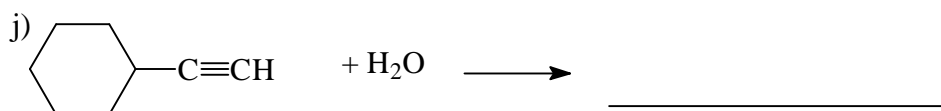
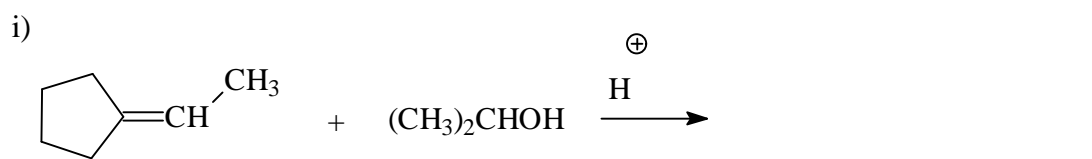
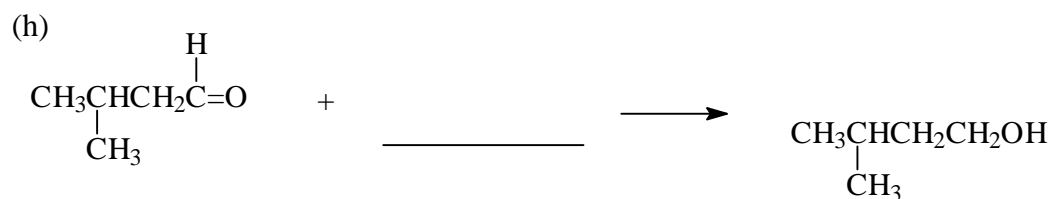
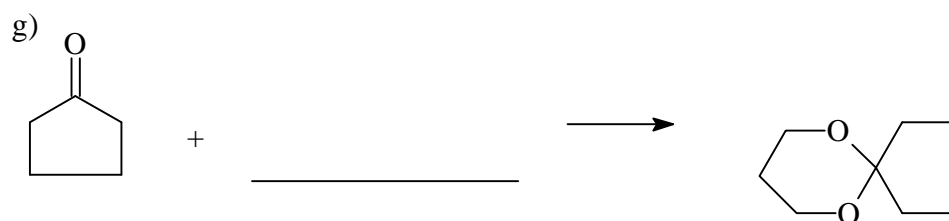


e)



f)

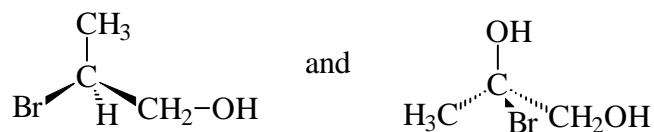




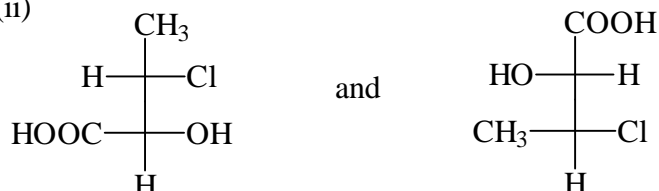
2. (a) Draw the NEWMAN PROJECTION of the least stable staggered conformation of 2-methylpentane viewed down the C2-C3 axis. [4 points]

(b) Pick the word from the following list (enantiomer, diastereomer, identical positional isomers) which correctly describes the relationship between the following pairs of compounds. [8 points]

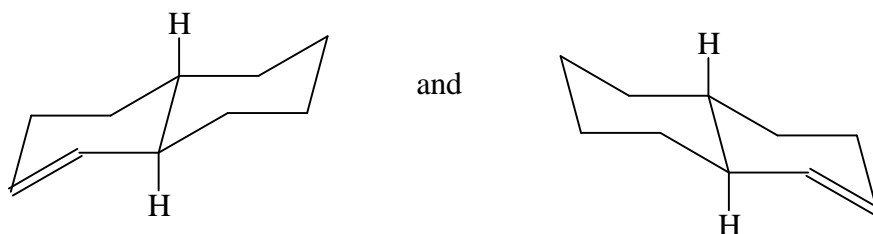
(i)



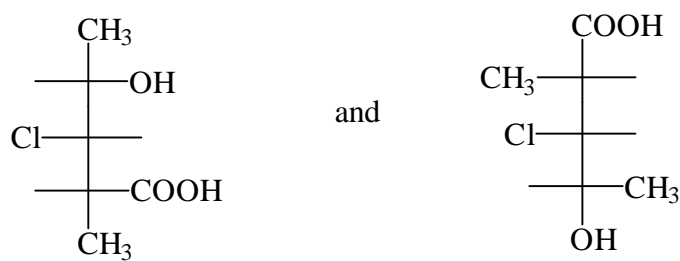
(ii)



(iii)



(iv)

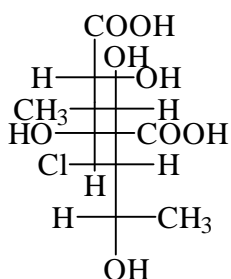


(c) Draw the 3-DIMENSIONAL perspective drawing of the most stable chair conformation of trans 3-methylcyclohexanol and label the substituents as axial or equatorial. [4 points]

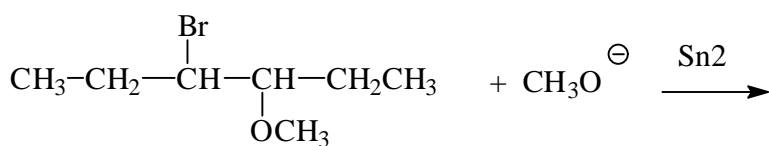
(d) Give the definition of a meso form. [2 points]

(e) Indicate whether the compound shown or the product of the reaction given is a meso form. [6 points]

(i)

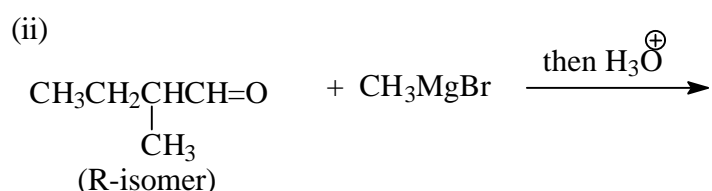
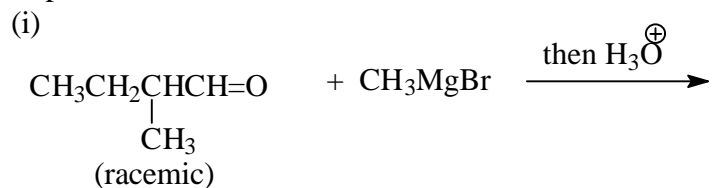


(ii)

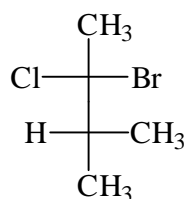


iii) (2R,3R) isomer

(f) Indicate whether the product of each of the following reactions will be optically active or not. [4 points]

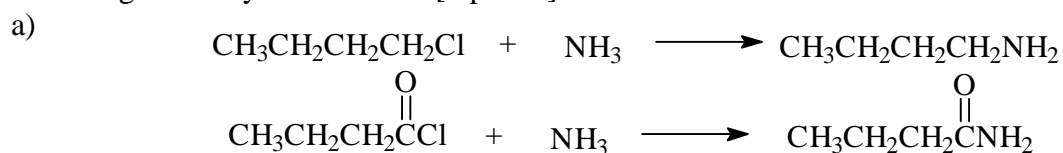


(g) Assign the correct stereochemical descriptor (R or S) to each of the chiral centres in the molecule shown below. Also show your assignment of priorities. [4 points]



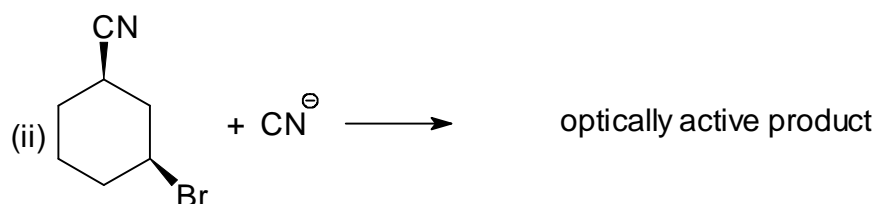
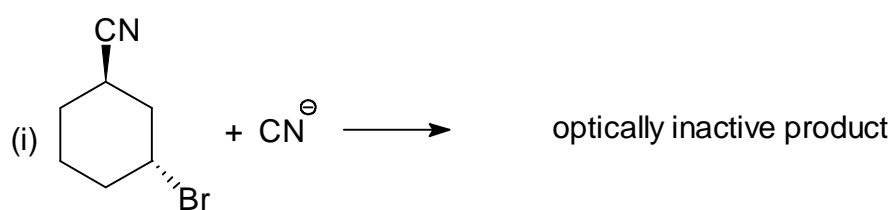
3. Give the COMPLETE MECHANISM for the reaction between ethyl 2-methylbutanoate and aqueous hydroxide ion. Make sure you show which steps are reversible. Also show the equation for the overall reaction. [7 points]

4. Consider the following pairs of reactions and answer the question posed in each case. Reasons must be given for your answers. [9 points]



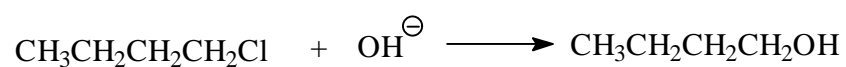
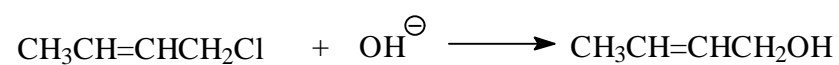
Which reaction will proceed faster and why?

b)



Both reactions are using the same mechanism. What is it and how can you tell?

c)



Which reaction is most likely to proceed via a  $\text{S}_\text{N}2$  reaction and why?

5. Show by equation how 1-butene could be transformed into each of the following compounds: 1-butanol, 2-butanol, 2-methoxybutane, butane. [4 points]

6. Consider the following facts.

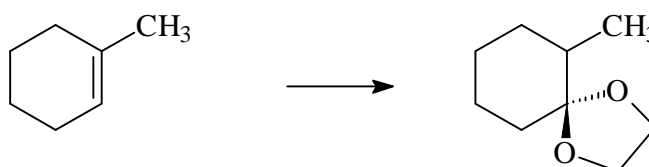
1. Two compounds A and B have the molecular formula  $C_5H_{10}O_2$
2. Both give NO REACTION with a solution of silver ion (negative Tollen's test), or with bromine and have no effect on the color of litmus paper.
3. When they are treated with an excess of acetic anhydride, each forms a new compound with the formula  $C_7H_{12}O_3$ .
4. A and B rotate light equal amounts in opposite directions.
5. Both A and B give the SAME compound ( $C_5H_8O_2$ ) when treated with  $CrO_3$ .

a) Give a possible structures for these compounds (more than one correct answer may be possible). [4 points]

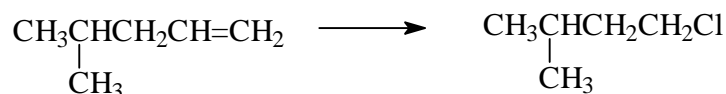
b) On the basis of the information given, what must be the relationship between A and B? [2 points]

7. Show by equation how you could effect ANY TWO of the following transformations, each of which may require up to three steps. Show all reagents and the product from each step. [6 points]

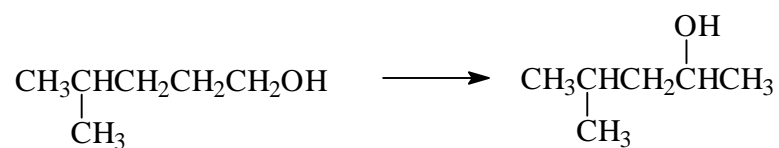
a)



(b)



c)

BONUS QUESTION

8. Deuterium (chemical symbol D) is an isotope of hydrogen ( $^2\text{H}$ ). Compounds which contain deuterium react in exactly the same ways as those containing  $^1\text{H}$ . Draw the products from each of the following reactions. [6 points]

(a) ethyl 2-methylpropanoate treated with  $\text{LiAlD}_4$  and then with  $\text{H}_3\text{O}^+$

(b) ethyl 2-methylpropanoate treated with  $\text{LiAlH}_4$  and then with  $\text{D}_3\text{O}^+$

(c) 1-methylcyclohexene treated with  $\text{BD}_3$  and then  $\text{H}_2\text{O}_2/\text{OH}^-$