CHEMISTRY 59-135
Intersession 1992

FINAL EXAMINATION

Time 3 hr June 1992

NAME: ______________________________

ID #: ____________________

1. Fill in the blank in the following equations with the correct structural formula. If stereochemical details are important, make sure your drawing shows these. Show any required catalysts over the arrow. [33 points]

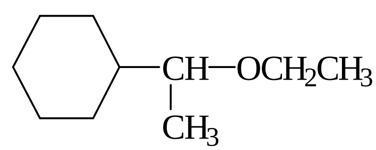
(a)

$CH_3CH_2CH_2C{\equiv}CH \quad + \quad H_2O \longrightarrow$ ____________________

(b)

$(CH_3)_2CHCOOH \quad +$ ____________________ $\longrightarrow (CH_3)_2CH\overset{\overset{\Large O}{||}}{C}{-}Cl$

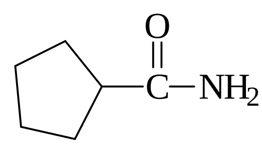
(c)

____________________ $+ \quad CH_3CH_2OH \longrightarrow$ 

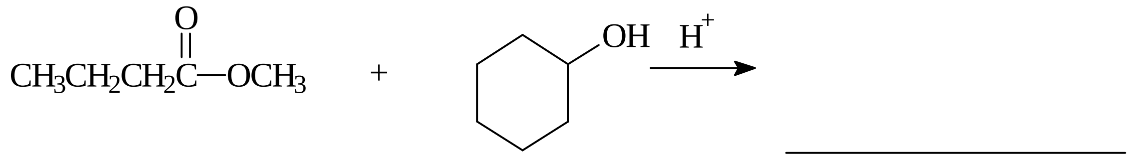
(d)

____________________ $+ \quad \underset{\text{(excess)}}{CH_3CH_2MgCl} \longrightarrow CH_3CH_2CH_2\overset{\overset{OH}{|}}{\underset{\underset{CH_2CH_3}{|}}{C}}CH_2CH_3$

(e)

____________________ $+ \quad NH_3 \longrightarrow$ 

(f)

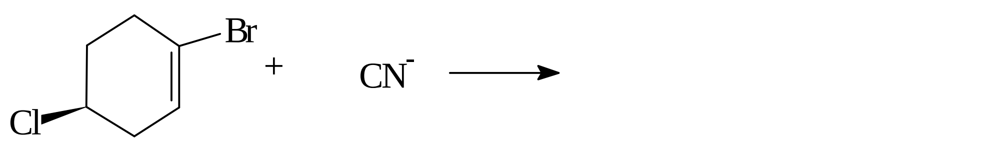


(g)

$CH_3CH(OCH_3)CH_2CH_2CH(OCH_3)OCH_3 \quad + \quad H_2O \longrightarrow$ ____________________

(h)

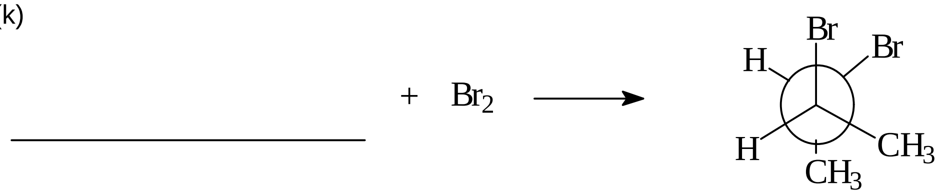
(i)



(j)

____________________ $+ \quad BH_3 \longrightarrow CH_3CH_2CH(OH)CH(CH_3)_2$

(k)



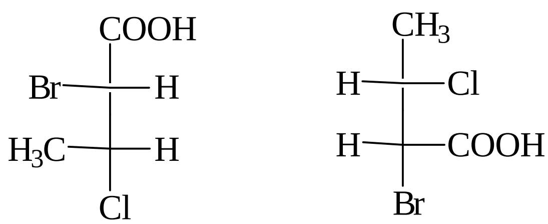
2. Draw the NEWMAN projection of the more stable chair conformation of <u>trans</u> 3-isopropylcyclohexanol and label the substituents as being either axial (a) or equatorial (e).[5 points]

(b) Draw the FISCHER projection of (2R, 4S) 4-bromo-2-butanol [4 points]

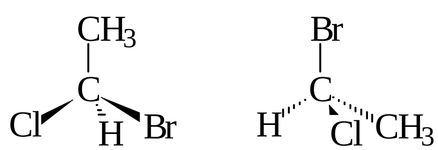
(c) Draw the perspective drawing of the less stable configuration of 1-methyl-4 ethylcyclohexane in its less stable chair conformation. [4 points]

(d) Pick the term from the following list (enantiomer, diastereomer, identical, postional isomers) which correctly describes the relationship between the compounds shown below. [9 points]

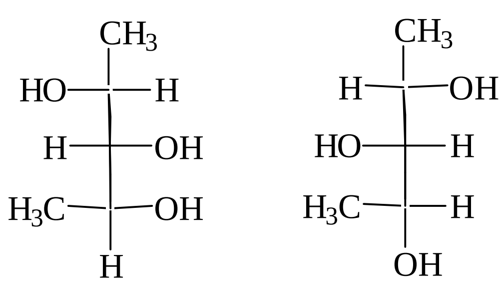
(i)



(ii)



(iii)



(e) Identify which (if any) of the above six compounds are meso forms. [3 points]

(f) Assign the correct stereochemical designator to each of the chiral centers in the <u>LEFT</u> drawing of question 2(d)(i). Show your answer on the drawing given in that question. [4 points]

3. Draw the complete mechanism for the acid-catalyzed reaction of ethyl 2-methylbutanoate with water. Make sure you show which steps are reversible. <u>ALSO</u>, write the equation for the overall transformation. [10 points]

4. Answer the question posed about the following reactions. In each case give a brief reason for your answer. [3 points each]

(a) Which reaction is more likely to proceed via a Sn2 mechanism and why?

$$CH_3CH_2CH{=}CHCH_2Br \ + \ H_2O \longrightarrow CH_3CH_2CH{=}CHCH_2OH$$

$$CH_3CH_2CH{=}CHCH_2Br \ + \ OH^- \longrightarrow CH_3CH_2CH{=}CHCH_2OH$$

(b) Is this reaction more likely to proceed faster in a solvent of high or low dielectric constant?

$$CH_3CH_2CH_2\overset{\overset{Br}{|}}{C}HCH_3 \ + \ OH^- \longrightarrow CH_3CH_2CH_2\overset{\overset{OH}{|}}{C}HCH_3$$

(c) If each of the chiral centers in the compounds below have the <u>R</u> configuration, which reaction is more likely to give an optically active product and why?

$$CH_3CH_2CH{=}CH\overset{\overset{Cl}{|}}{C}HCH_3 \ + \ CN^- \longrightarrow$$

$$CH_3CH_2CH_2CH_2\underset{\underset{Cl}{|}}{C}HCH_3 \ + \ CN^- \longrightarrow$$

5. If cyclohexanone in which the oxygen atom is the isotope ^{18}O is reacted with excess ethanol and anacid catalyst, will the organic product contain ^{18}O? Explain your reasoning. [5 points]

6. Describe a simple chemical test which will allow you to <u>visually</u> distinguish between the following pairs of compounds. Describe what you would do and what would be observed for each compound. [2 points each]

(a) 3-penten-2-one and 3-penten-2-ol

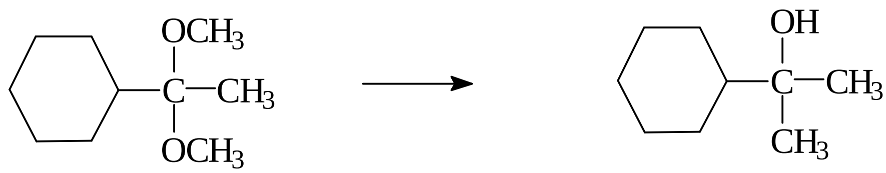
(b) ethyl butanoate and 2-ethylbutanoic acid

(c) 2-methyl-3-hexanol and 3-methyl-3-hexanol

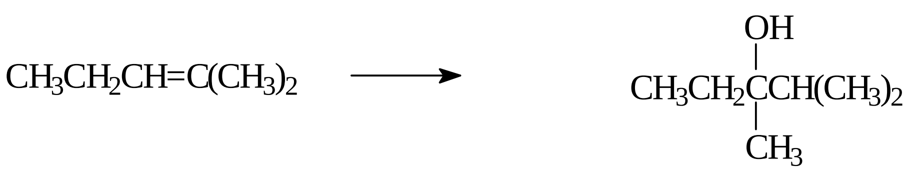
<u>DO ANY TWO OF THE FOLLOWING THREE PARTS</u>

7. Show by equation how each of the following transformations could be accomplished. Each may require up to three steps. Show all reagents and catalysts. [4 points each]

(a)



(b)



(c)