CHEMISTRY 59-135 (Intersession)

FINAL EXAMINATION

Time 3 hr June1991

NAME: ____________________________________

ID #: ____________________

1. FIll in the blanks in the following equations with the correct structural formula. If stereochemical details are important, make sure your drawing show these. Show any required catalysts or additional reagents over the arrow. [36 points]

(a)

$$\_\_\_\_\_\_\_\_\_\_ + H_2O \longrightarrow (CH_3)_2CH\overset{\displaystyle OH}{\overset{|}{C}}HCH_3$$

(b)

$$CH_3CH_2CH\begin{matrix} \diagup O\,CH_2CH_3 \\ \diagdown O\,CH_2CH_3 \end{matrix} + H_2O \longrightarrow \_\_\_\_\_\_\_\_\_\_$$

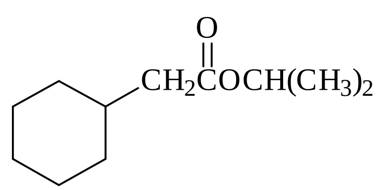
(c)

$$(CH_3)_2CHCH_2CO_2H + \_\_\_\_\_\_\_\_\_\_ \longrightarrow (CH_3)_2CHCH_2\overset{\displaystyle O}{\overset{||}{C}}—Cl$$

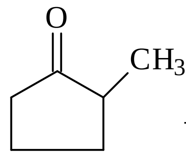
(d)

$$CH_3CH_2CH_2\overset{\displaystyle I}{\overset{|}{C}}HCH_2CH_3 + CN^- \xrightarrow{Sn2} \_\_\_\_\_\_\_\_\_\_$$

(e)

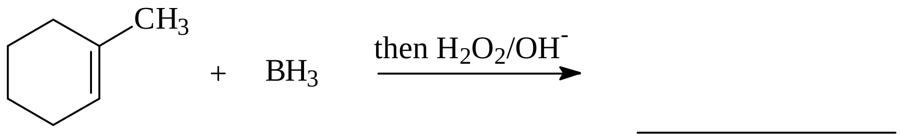
$\_\_\_\_\_\_\_\_\_\_$ + $(CH_3)_2CHOH$ $\longrightarrow$ 

(f)

$\_\_\_\_\_\_\_\_\_\_$ + O_3 $\longrightarrow$ 

+ $CH_3CH{=}O$

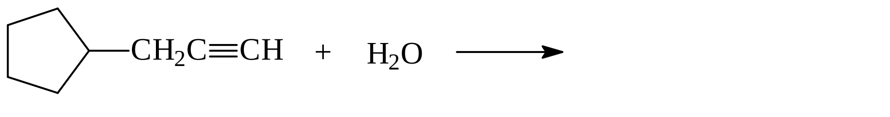
(g)



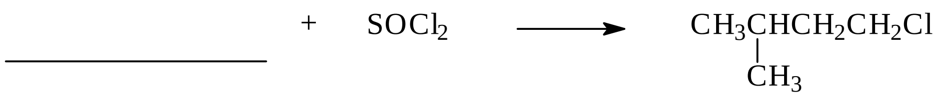
(h)

$CH_3CH{=}CHCH_2CH_2CH{=}O$ + ____________ $\longrightarrow$ $CH_3CH{=}CHCH_2CH_2CH_2OH$

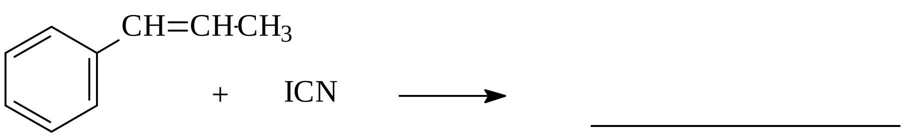
(i)



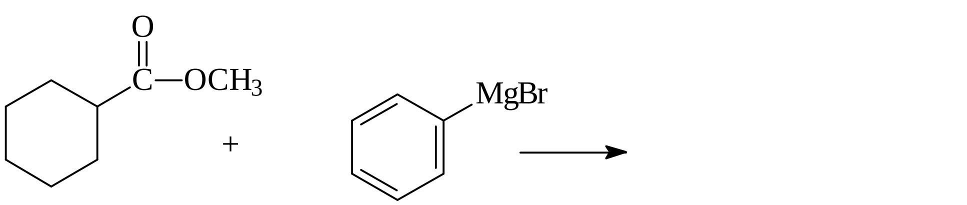
(j)



(k)

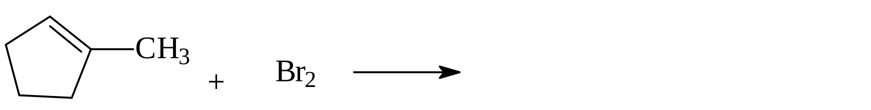


(l)



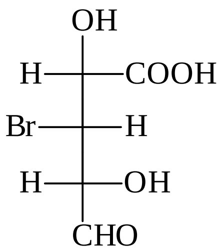
excess

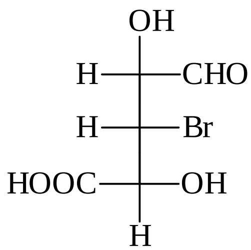
(m)



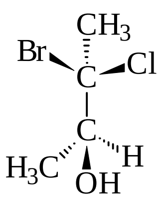
2. (a) Pick the word from the following list [enantiomers, diastereomers, identical, positional isomers] which correctly describes the relationship between the following pairs of compounds. [6 points]

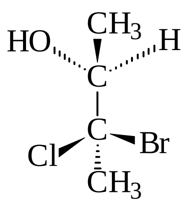
(i)



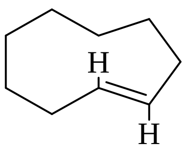


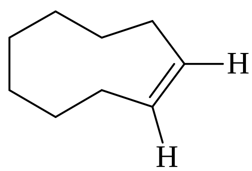
(ii)





(iii)





(b) Draw the Fischer Projection of all the meso forms of 2,3,4,5-tetrachlorohexane. [3 points]

(c) Draw the Fischer Projection of (2S, 3S, 5R) 5-bromo-2,4-dihydroxy-3-heptanone. [4 points]]

(d) Draw BOTH the NEWMAN projection AND the chair representation of the less stable chair conformation of trans 4-chlorocyclohexanol and label the substituents as being axial (a) or equatorial (e). [6 points]

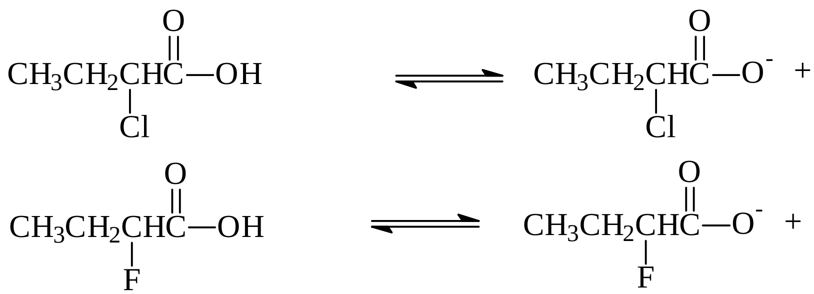
3. For each of the following pairs of equations, answer the question asked and GIVE A REASON FOR YOUR CHOICE. [each part is worth 2 points]

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

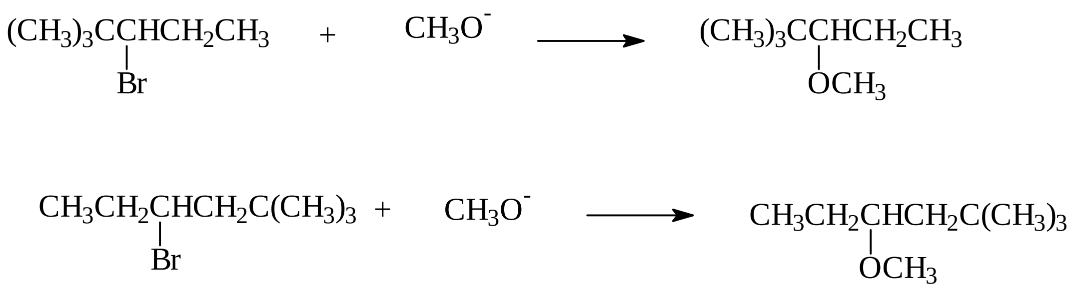
$$CH_3CH_2CH_2CH_2Br \quad + \quad H_2O \longrightarrow CH_3CH_2CH_2CH_2OH$$

$$CH_3CH_2CH_2CH_2Br \quad + \quad OH^- \longrightarrow CH_3CH_2CH_2CH_2OH$$

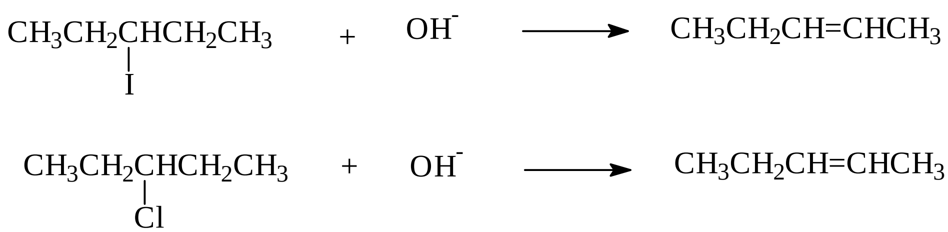
(b) Which compound will be more acidic (i.e. will have a larger Keq for the ionization reaction)



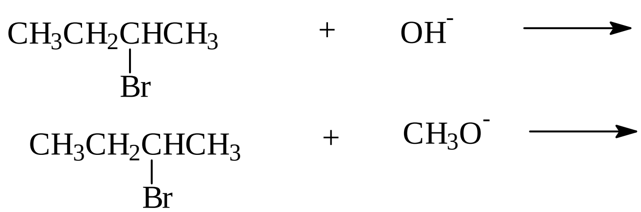
(c) Which reaction will proceed more rapidly?



(d)Which reaction will be more likely to proceed via an E1 mechanism



(e) Which reaction will be more likely to favour elimination over substitution?



4. Show by equation how 2-methyl-2-butene could be transformed into each of the compounds shown. Each transformation can be accomplished in one operation. [6 points]

(a) $CH_3CH{=}C(CH_3)_2$ ---------------> 3-methyl-2-butanol

(b) $CH_3CH{=}C(CH_3)_2$ --------------> 2-methylbutane

(c) $CH_3CH{=}C(CH_3)_2$ --------------> 2-propanone

5. Draw the complete mechanism for the acid-catalyzed reaction of ethyl 2-methylpropanoate with water. Make sure you show which steps are reversible. Also, write the overall reaction. [8 points]

6. You are given two bottles, each of which contains a liquid, and two labels with names of chemicals written on them. Indicate briefly how you could decide, on the basis of a VISUAL TEST, which label should be attached to each bottle. In each case, describe what test you would use and what result would be observed with each material. [6 points]

(a) the labels read 1-butanol and 2-butanol

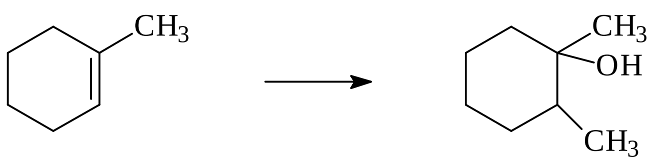
(b) the labels read 3-chloro-1-butene and 3-chlorobutane

(c) the labels read methyl butanoate and pentanoic acid.

DO ONLY THREE OF THE FOUR PARTS OF THIS QUESTION

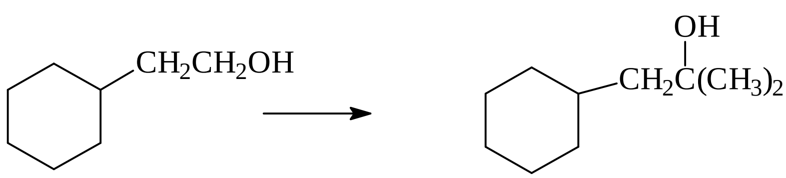
7. Show by equation how you could accomplish the transformations shown below, each of which may require up to three reactions. Show all reagents you would use to effect each step. [4 points each]

(a)



(any stereoisomer)

(b)



(c)

$$CH_3CH_2CH_2Br \longrightarrow CH_3CH_2\overset{\overset{\displaystyle O}{\|}}{C}{-}OCH_3$$

(d)

$$CH_3CHO \longrightarrow CH_3\overset{\overset{\displaystyle CH_3}{|}}{C}H\underset{\underset{\displaystyle O}{\|}}{C}CH_3$$

8. E2 elimination of HBr from cis 1-ethyl-2-bromocyclohexane is much faster than elimination from the trans isomer. Explain this fact. [3 points]