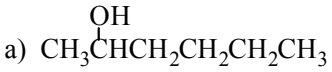
Sample Exam, #2. March 2002

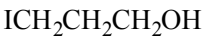
CHEM 263, Section B2

1. (12 pts) Structure and Nomenclature

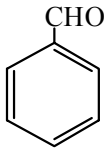
(2 point each)

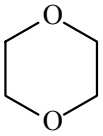
Draw structures for which names are given, and name the given structures by any accepted system

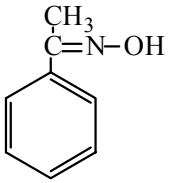
a)  2-hexanol

b) 3-iodo-1-propanol 

c)  5-hexenal

d) benzaldehyde 

e)  1,4-dioxane

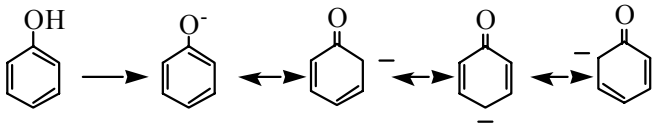
f)  benzophenone oxime

2. (9 points) Physical Properties

(3 points each)

a) Explain using diagrams why phenols show acidic properties

The proton on the OH group is quite readily lost since the resulting anion is stabilized by resonance



b) Ethers tend to be unreactive and insoluble in water. Why do they dissolve in concentrated sulfuric acid?

Concentrated sulfuric acid is strong enough to protonate the oxygen atom of the ether. This formas an ion which is soluble in aqueous solution.

c) Why are epoxides very useful in organic synthesis?

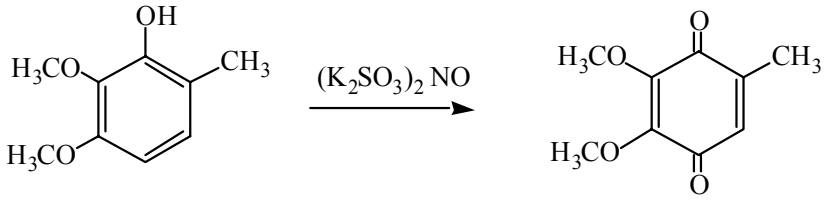
They are reactive and add two carbon atoms to the chain.

3. (34 points) Reactions

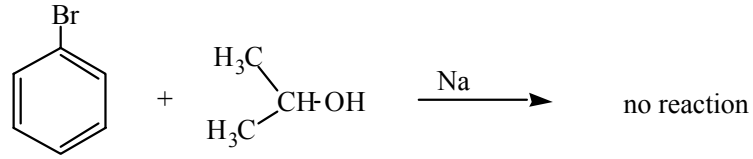
A. 3 points each. Draw the structures of the major organic product(s) (if any) of the following reactions.

a) $CH_3CH_2OCH_2CH_3$ —excess HI→ $2\ CH_3CH_2I$

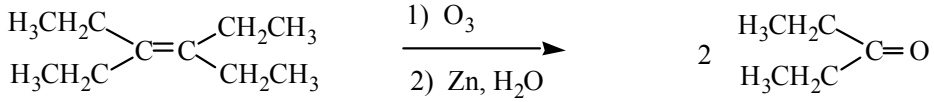
b)



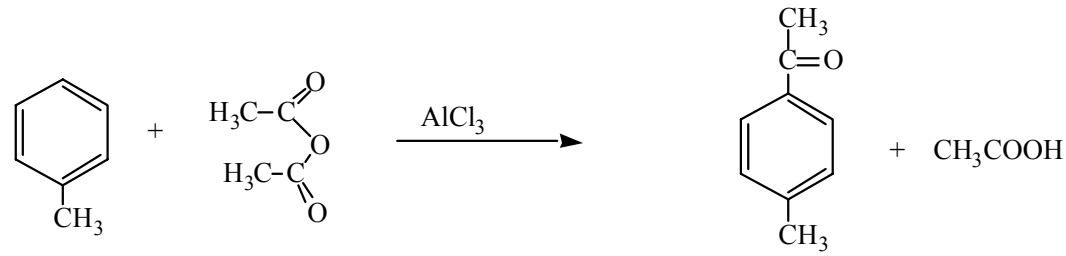
c)



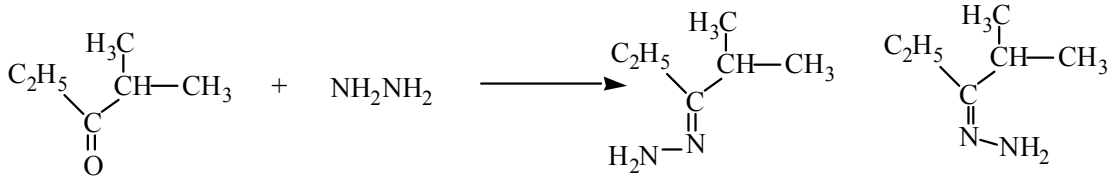
d)



e)

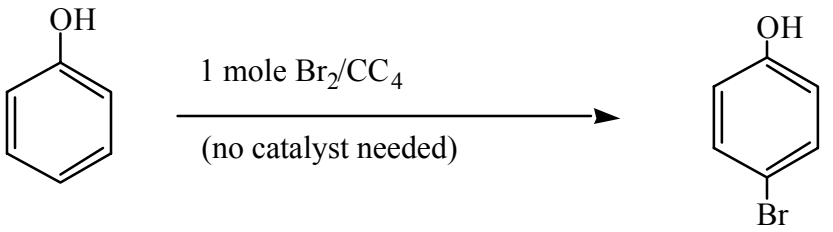


f)

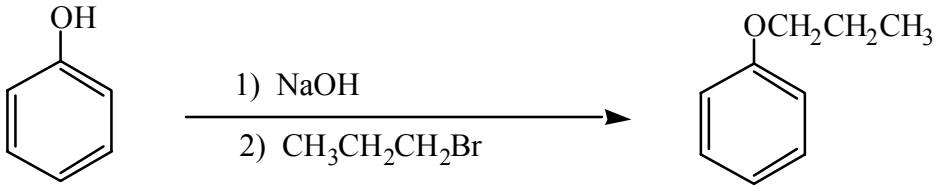


B. (4 points each) List the reagents which will accomplish the following transformations. More than one step may be required

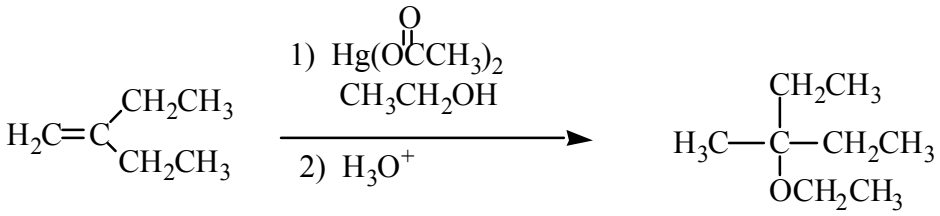
a)



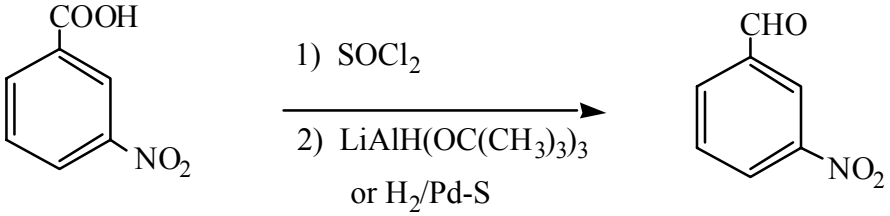
b)



c)



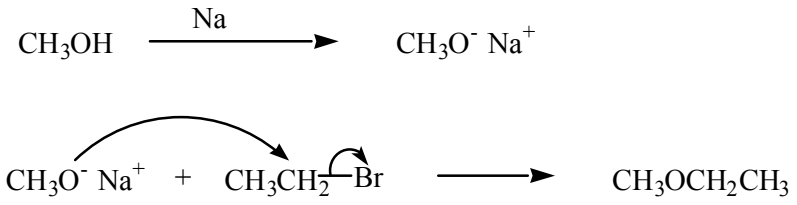
d)



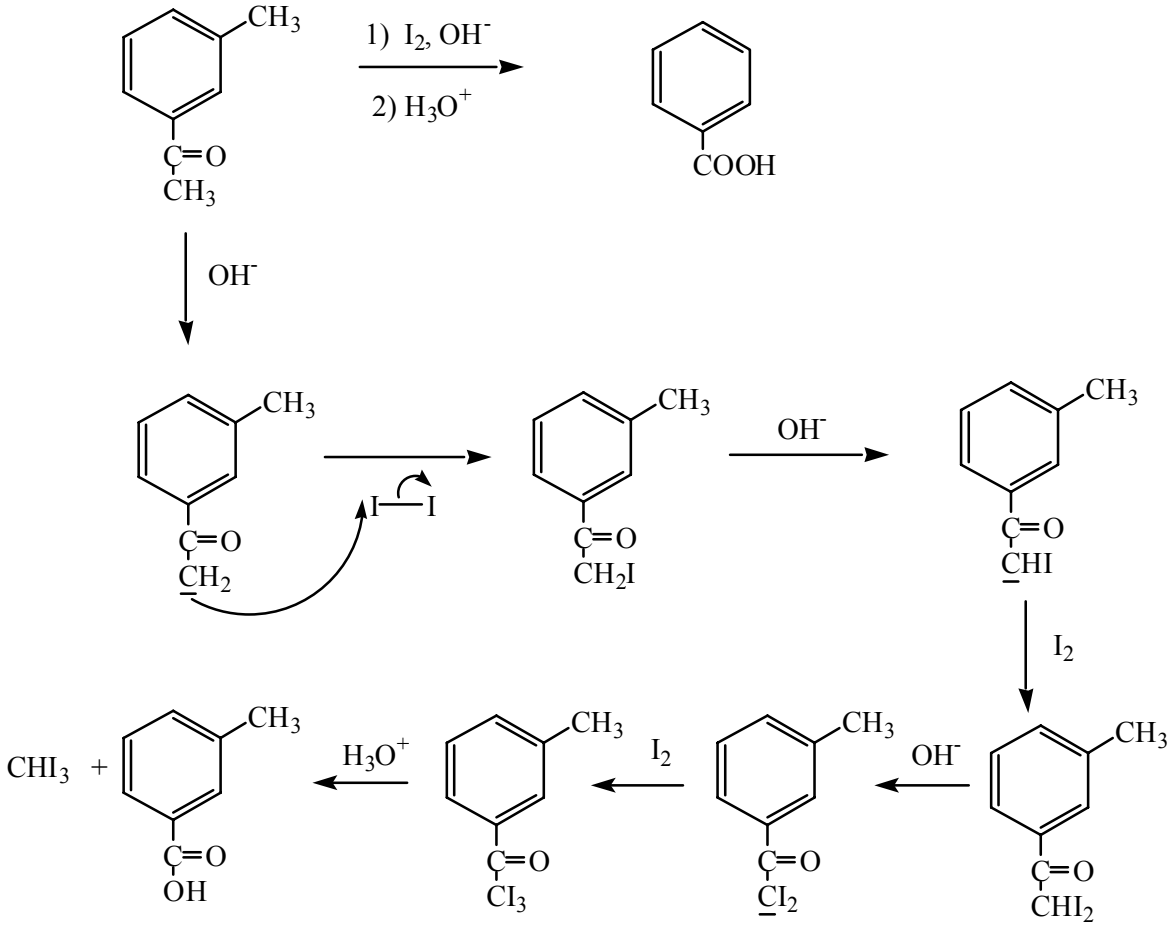
3. (10 points) Reaction Mechanisms

(5 points each)

a) Choose a specific alcohol and alkyl halide and show the intermediates in the Williamson ether synthesis.



b) Draw all of the intermediates formed in the following reaction:

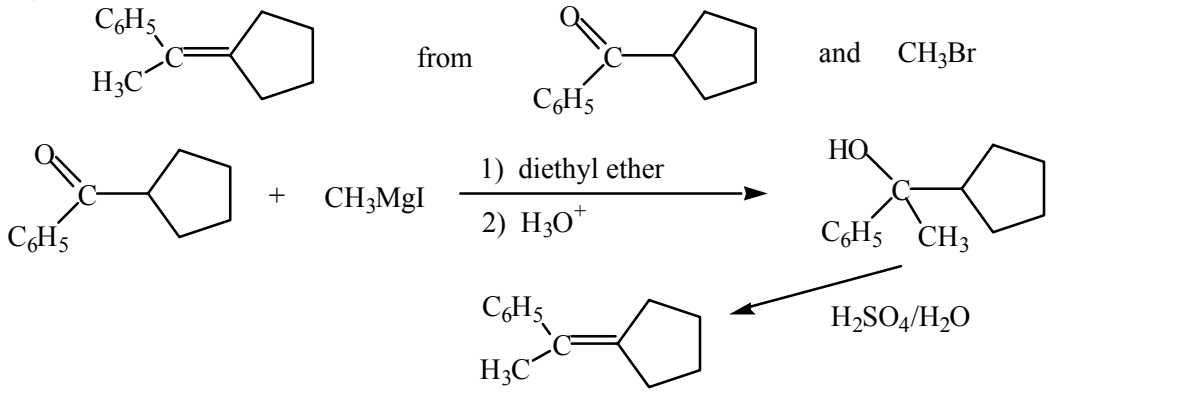


4. (12 points) Syntheses

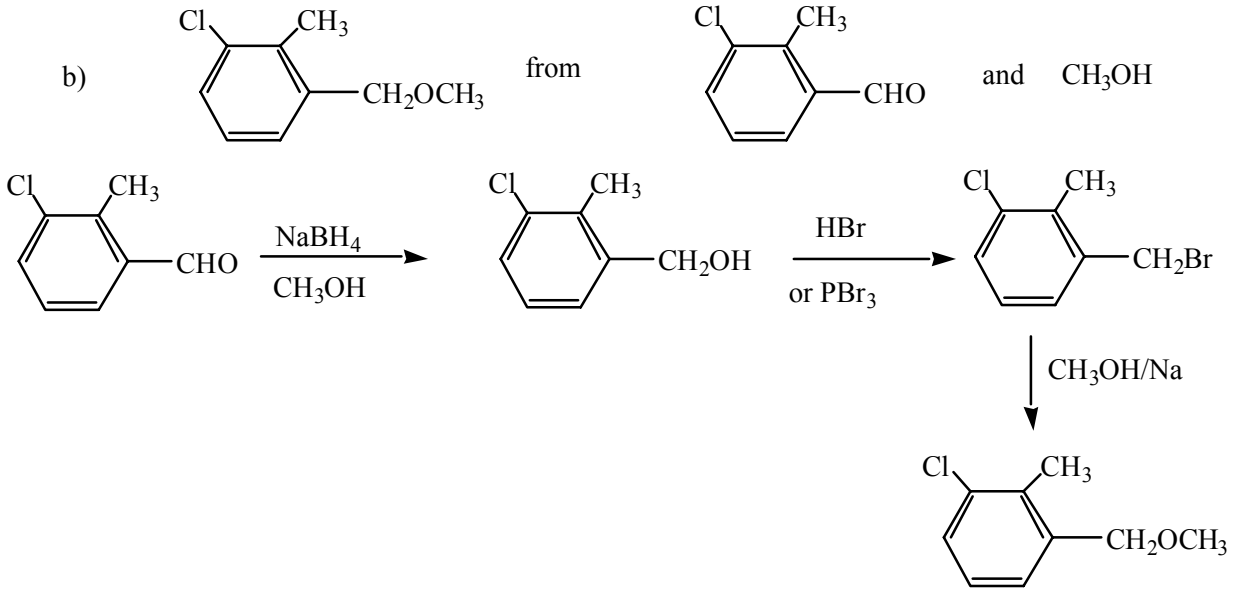
(6 points each)

Show reactions by which you could synthesize the following compounds from the indicated starting materials and any inorganic reagents required.

a)



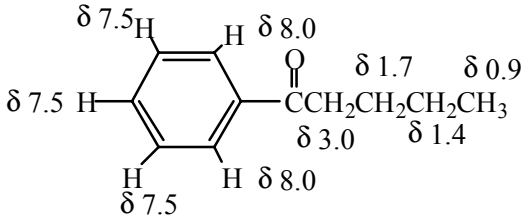
b)



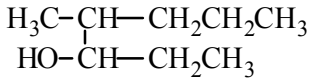
5. (12 points) Spectroscopic Identification

A compound ($C_{11}H_{14}O$) has a strong peak in the infrared spectrum near 1700 cm^{-1}. In its NMR spectrum, there is a doublet at δ 8.0 (integration 2) , a multiplet at δ 7.5 (integration 3), a triplet at δ 3.0 (integration 2), a quintet at δ 1.7 (integration 2), a sextet at δ 1.4 (integration 2) and a triplet at δ 0.9 (integration 3). What is the structure of the compound? Assign the protons to the signals in the NMR spectrum.

The compound is



6. (11 points) The fungus responsible for Dutch Elm disease is spread by European bark beetles when they burrow into the tree. The aggregation pheromone emitted by the bark beetles is 4-methyl-3-heptanol. Suggest a synthesis of this compound from the indicated starting materials



from 1-propanol and 2-pentanol

4-methyl-3-heptanol