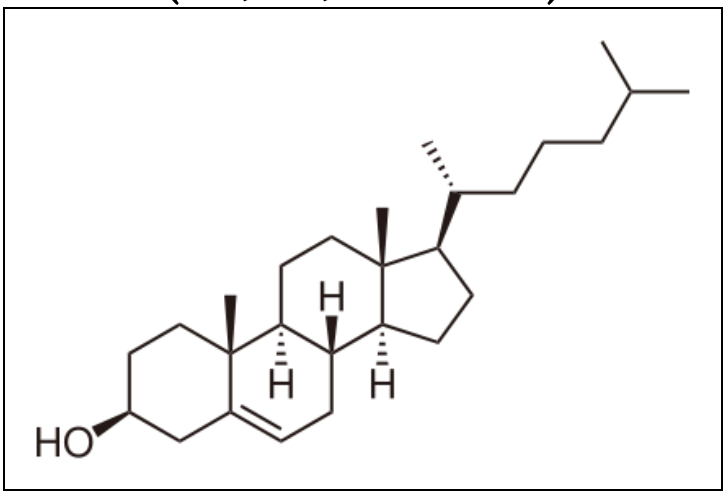
Houston Community College System

Organic Chemistry II

2425

Sample EXAM # 2A
(16,17, and 18)



Cholesterol- is a lipid found in the cell membranes of all animal tissues, and it is transported in the blood plasma of all animals.

CHEM 2425 Sample EXAM # 2A (Chapters 16-18)

Directions- Please write your correct answer next to each question number in space provided.

_____1. Which of the following would you expect to have the highest boiling point?

A. isopropyl alcohol B. t-butyl alcohol C. diethyl ether D. n-butanol

_____2. Which of the following would be the highly miscible with (=most soluble in) water?

A. CH_3- CH_2 – CH_2 – CH_2OH B. CH_3 – CH(OH) – CH_2- CH_3

C. CH_3 – $C(CH_3)_2$ – CH_2OH D. CH_3 – $C(CH_3)_2$ (OH)

_____3. What reagents are typically required to accomplish allylic bromination of an alkene?

A. Br_2+HBr B. NBS/CH_2Cl_2 C. Br_2+CCl_4 D. Br_2+$FeBr_3$

_____4. Which of the following are only meta directing strongly deactivating group(s)?

I. –CH_3 II. –CHO III. –OH IV. – NO_2

A. I and IV B. II and IV C. I, II, and III D. only IV

_____5. What is the product of refluxing methylethyl ether with HI in acidic solution?

A. ethanol and methyl iodide B. methanol and ethyl iodide
C. ethanol and methyl alcohol D. iodoethane and methanol

_____ 6. Which of the following is the electrophile that attacks the aromatic ring during nitration?

A. NO_2 B. HNO_3^+ C. NO_3^- D. NO_2^+

_____7. Which of the following functional group represents the benzyl group?

A. C_6H_5O – B. C_6H_5 – C. $C_6H_5CH_2$ – D. $C_6H_{11}CH_2$–

_____8. Which of the following is (bromomethyl)ethyl ether?

A. CH_3CH_2 – O – CH_2Br B. CH_3 – O –CH_2Br
C. CH_3 – O - CH_2 -CH_2- Br D. CH_3CH_2 – O- CH_2CH_2Br

_____9. 2-Methoxypentane is classified as _____ .

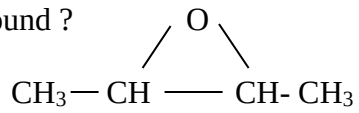
A. a symmetrical ether B. a secondary alcohol C. an epoxide D. an ether

_____10. The following reaction classifies as _____ .

R-CHO → R- CH_2OH

A. an oxidation B. a reduction C. hydration D. tautomerization

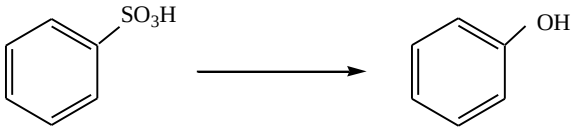
_____ 11. What is the incorrect name for the following compound ?



A. 1,2-dimethyloxide B. 2,3-epoxy butane

C. 1,2- Dimethylepoxide D. all of these

_____ 12. Which reagent(s) would accomplish the following reaction ?



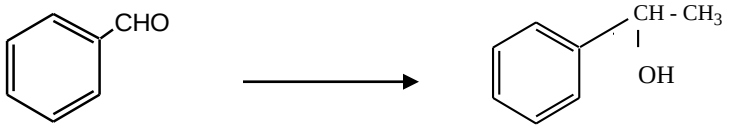
A. H_2O, H^+ B. $NaOH/H_3O^+$ C. $LiAlH_4$ D. CH_3MgBr/H_2O

_____ 13. Which of the following reagent(s) used for alkylation process of benzene?

A. $CH_3Cl/AlCl_3$ B. $CH_3MgBr/ether/H_2O$

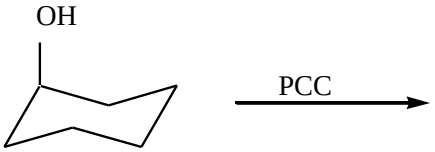
C. MnO_4^- $/H_2O$/heat D. NBS/CCl_4

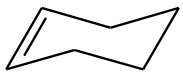
_____14. Which of the following reagent(s) provides the following conversion.

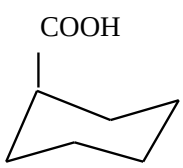


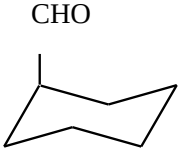
A. CH_3COOH/H^+ B. MnO_4^- / H_2O, heat C. CH_3COCl $/AlCl_3$ D. none of these

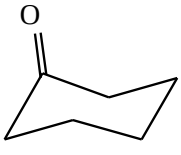
_____15. What is the product of the following reaction?



A. 

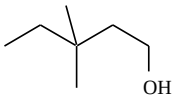
B. 

C. 

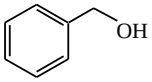
D. 

PART II - Nomenclature(20 points)

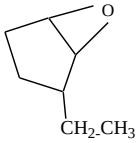
a) Write the correct IUPAC names.



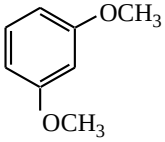
(A)



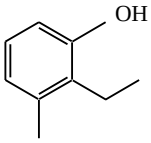
(B)



(C)



(D)



(E)

A. _____ **B.** _____

C. _____ **D.** _____

E._____

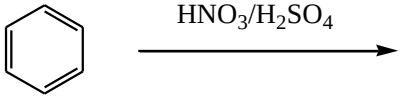
b) Write the correct structures .

tert-butylalcohol | 3-isopropyl-1-hexanol | ethylmethyldisulfide

3,4-dimethyl-1-pentanol | 2-methyltetrahydrofuran

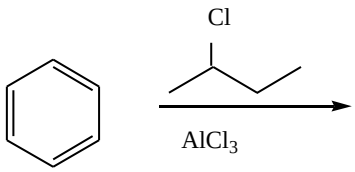
PARTT III- REACTIONS(20 points) What major product(s) would you expect from the following reactions?

a)

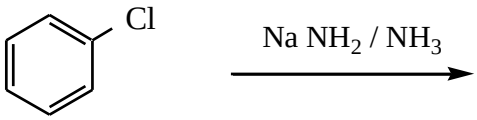


b) $SO_3 + H_2SO_4 \longrightarrow$

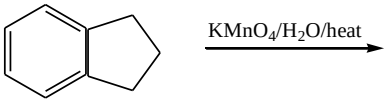
c)



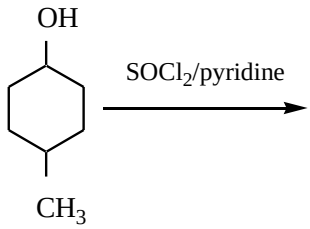
d)



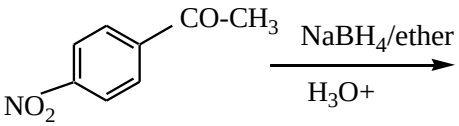
e)



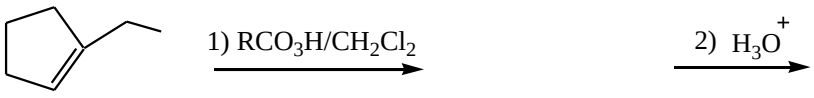
f)



g)

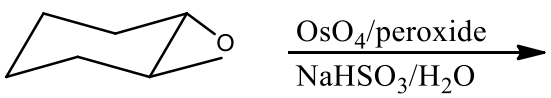


h)



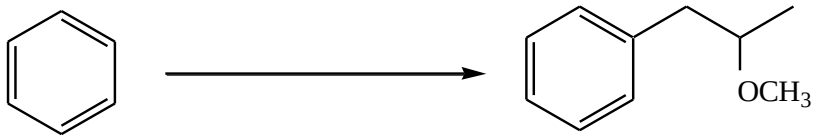
i) $CH_3\text{-}CH_2\text{-}CHO \xrightarrow[2)\ H_2O]{1)\ CH_3CH_2MgBr/ether}$

j)

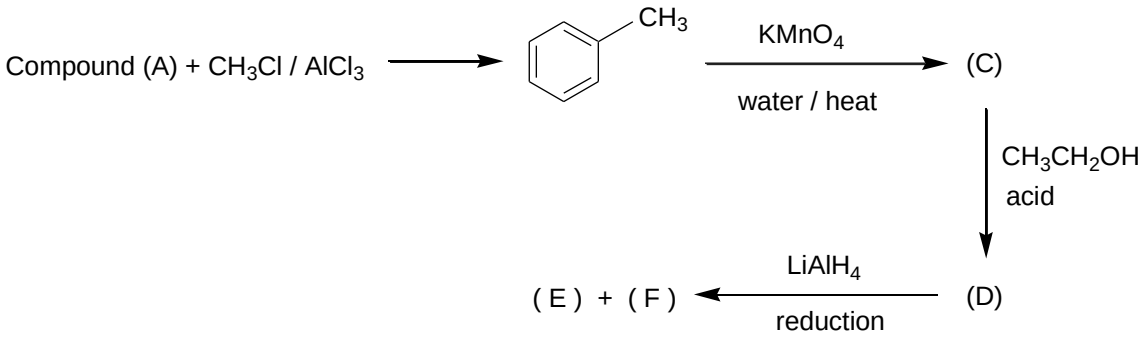


PART IV – SYNTHESIS (15 points)

a) What is the best procedure for preparing the following compound from benzene?
(requires more than one step)



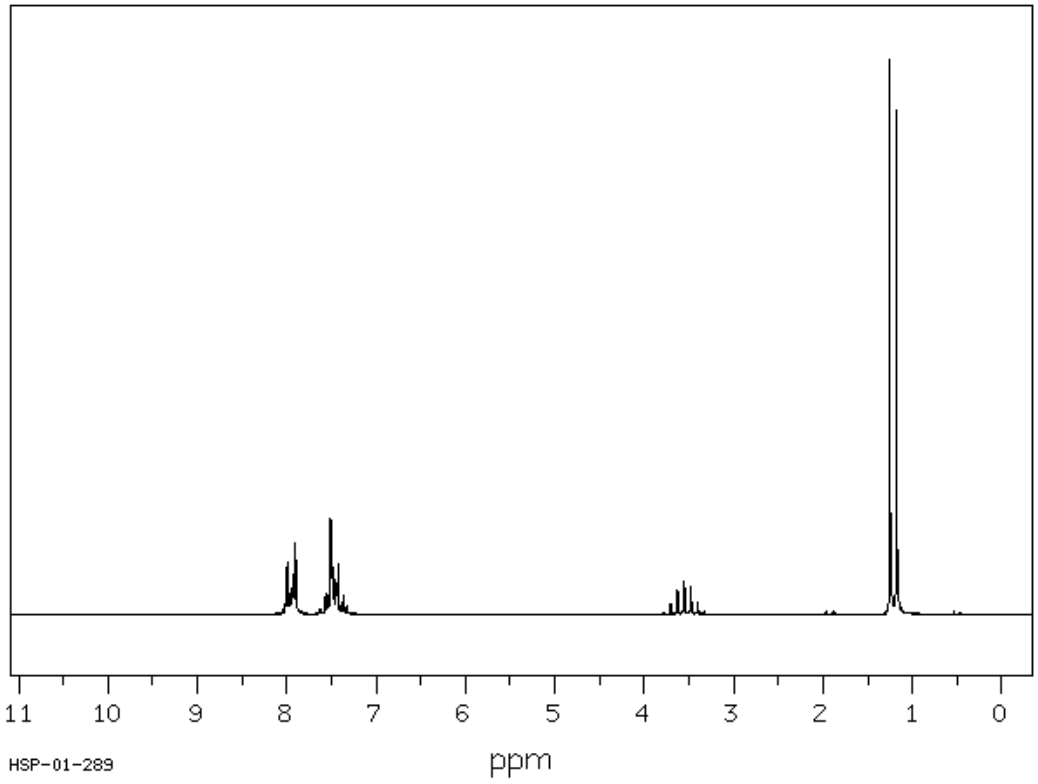
b) Identify the structures for the compounds A, C, D, E and F.



c) Illustrate the mechanism for acid catalyzed dehydration of 1-methylcyclohexanol. Be sure to use curved arrows (electron flow) for complete credit.

Bonus Question (10 points)

Propose a plausible structure and for a $C_{10}H_{12}O$ compound with the following NMR spectrum. Show your work for complete credit.



CHEM 2425 Sample EXAM # 2 (Chapters 16 –18) – Answers

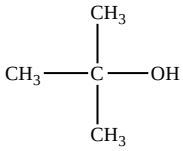
Part I: Multiple Choice

1. D	6. D	11. A
2. D	7. C	12. B
3. B	8. A	13. A
4. B	9. D	14. D
5. A	10. B	15. D

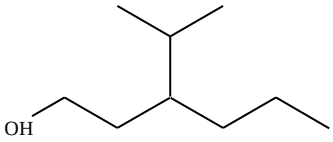
Part II: Nomenclature

a) A. 3,3-dimethylpentanol B. benzyl alcohol C. 3-ethyl-1,2-epoxycylopentane
D. m-dimethoxybenzene E. 2-ethyl-3-methylphenol

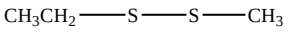
b)



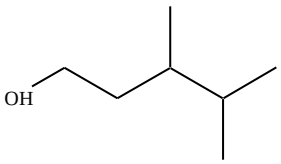
tert-butylalcohol



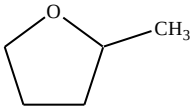
3-isopropyl-1-hexanol



ethylmethyldisulfide

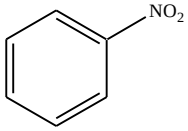


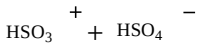
3,4-dimethyl-1-pentanol

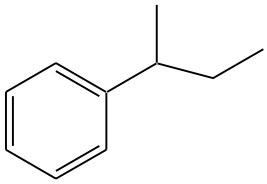


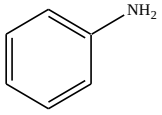
2-methyltetrahydrofuran

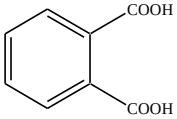
Part III: Reactions

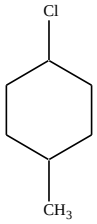
a) 

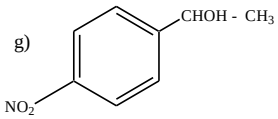
b) 

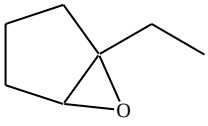
c) 

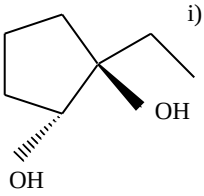
d) 

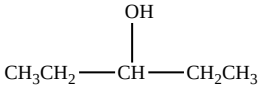
e) 

f) 

g) 

h) 

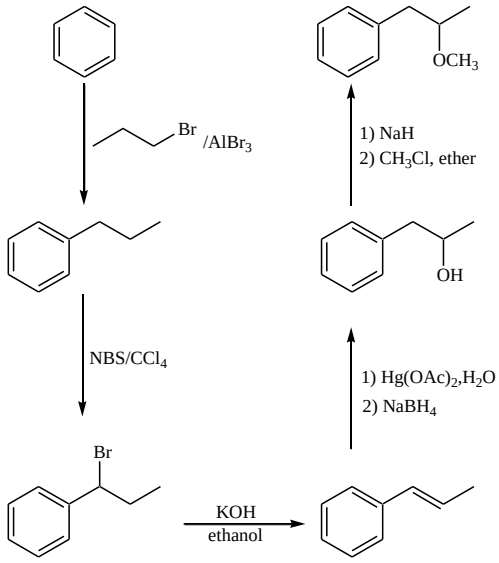
and 

i) 

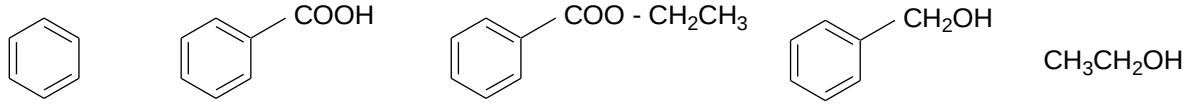
j) 

Part IV: Synthesis

a)

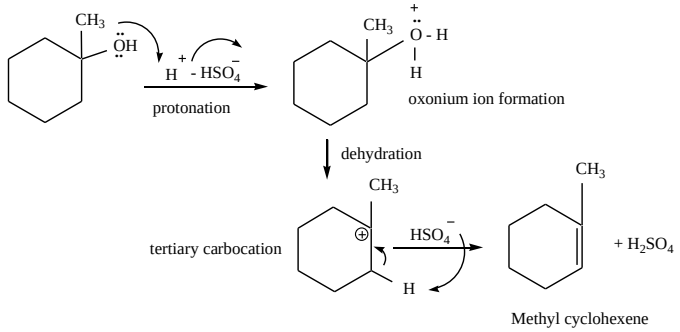


b)



(A) (C) (D) (E) (F)

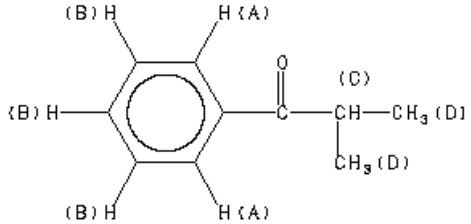
c)



Bonus Question

D.U. = (#C) – (#H /2) + 1 = (10) – (12 /2) + 1 = 5 (1 db and benzene ring) **isobutyrophenone**

Assign.	Shift(ppm)
A	7.95
B	7.67 to 7.31
C	3.543
D	1.216



HOUSTON COMMUNITY COLLEGE

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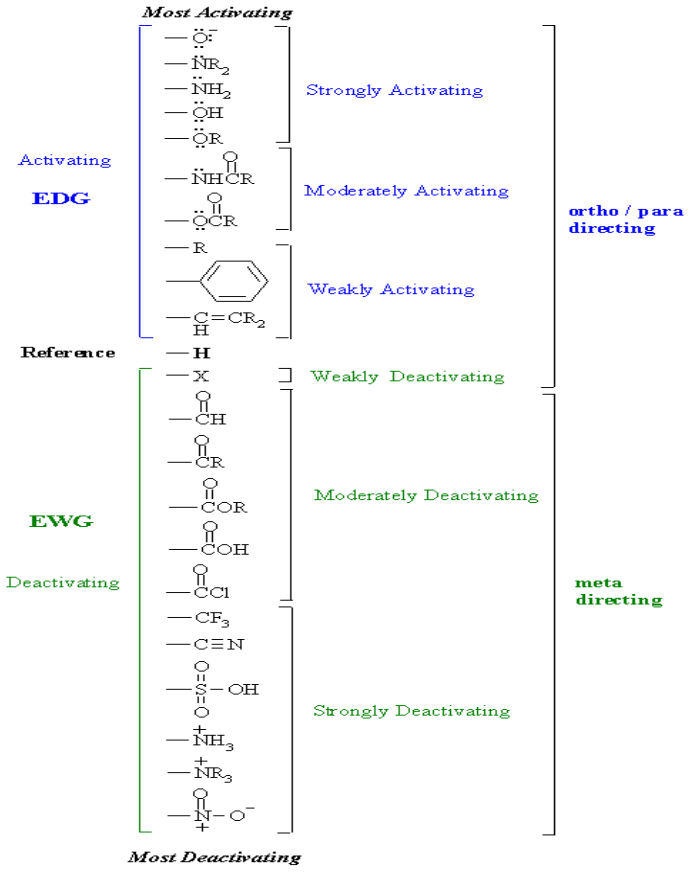
2425

Sample EXAM # 2B (16,17, and 18)



CHEM 2425 Sample EXAM # 2B (Chapters 16, 17, and 18) **NAME_____**

Score:

Part I - Multiple choice questions (45 points)

Directions- Please write your correct answer next to each question number in space provided.

____1. Under what reaction conditions does the electrophilic chlorination of aromatic compounds usually occur?

A) Cl_2, $AlCl_3$ B) Cl_2, H_2O C) Cl_2, CCl_4 D) NaCl, H_2O E) NaCl, CH_3OH

_____2. In electrophilic aromatic substitution reactions the nitro group is:

A) a m-director since it destabilizes the meta sigma complex more than the ortho, para.
B) a m-director since it destabilizes the meta sigma complex less than the ortho, para.
C) an o,p-director since it stabilizes the ortho, para sigma complex more than the meta.
D) an o,p-director since it stabilizes the ortho, para sigma complex less than the meta.
E) none of the above.

_____3. Rank the following groups in order of increasing activating power in electrophilic aromatic substitution reactions:

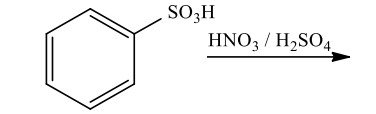
I) $-OCH_3$ II) $-OCOCH_2CH_3$ III) $-CH_2CH_3$ IV) -Br

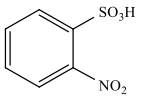
A) I>II>IV>III B) IV>III>II>I C) II>I>IV>III D) III>I>II>IV E) none of these

_____4. In electrophilic aromatic substitution reactions a bromine substituent:

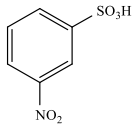
A) is a deactivator and a m-director. B) is a deactivator and an o,p-director.
C) is an activator and a m-director. D) is an activator and an o,p-director.
E) none of the above

_____5. Provide the structure of the major mononitration product of the compound below.

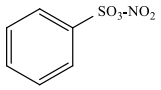




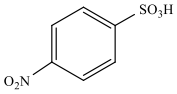
A)



B)



C)

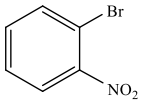


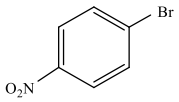
D) E) two of these

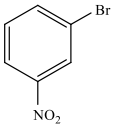
_____6.) In electrophilic aromatic substitution reactions, a $-CO_2H$ substituent on the aromatic ring is:

A) a deactivator and a m-director. B) a deactivator and an o,p-director.
C) an activator and a m-director. D) an activator and an o,p-director.
E) none of the above.

_____7. Provide the major organic product that results when benzene is treated with the following sequence of reagents: 1) Br_2, $FeBr_3$ 2) HNO_3, H_2SO_4.







A) B) C) D) No reaction E) A and B these

_____8. Treatment of tetrahydrofuran with excess HBr results in the formation of what major organic product?

A) 1-bromobutane B) 1,2-dibromobutane C) 1,4-dibromobutane
D) 1-bromopentane E) 1,5-dibromopentane

_____9. Why are alcohols unreactive toward nucleophilic substitution reactions?

A) The hydroxide ion, a relatively strong base, is a very poor leaving group.
B) The hydroxide ion, a relatively weak base, is a very poor leaving group.
C) The hydroxide ion, a relatively weak base, is a very good leaving group.
D) The hydroxide ion, a relatively strong base, is a very poor leaving group.
E) Two of these

_____10.) What is the major organic product which results when tetrahydrofuran is reacted with excess HBr?

A) 1,2-dibromobutane B) 1,3-dibromobutane C) 1,4-dibromobutane
D) 4-bromobutan-1-ol E) 3-bromobutan-1-ol

_____11. Arrange the following alcohols in order of increasing boiling point:

I. $(CH_3)_3COH$ II. $CH_3(CH_2)_4OH$ III. $(CH_3)_3CCH_2OH$ IV. $(CH_3)_2CHCH_2CH_2OH$.

A) I<II<III<IV B) I<III<IV<II C) III<II<IV<I D) II<IV<III<I E) III<I<II<IV

_____12. 2-Methylbutan-1-ol is classified as _____.

A) a primary alcohol B) a secondary alcohol C) a tertiary alcohol
D) a phenol E) an enol

_____13. Which of the following is the best way to synthesize t-butyl ethyl ether?

A) treatment of t-butyl bromide with sodium ethoxide
B) treatment of ethyl bromide with sodium t-butoxide
C) heating a mixture of ethanol and t-butanol in sulfuric acid
D) treating t-butyl bromide with $Hg(OAc)_2$
E) treating t-butanolwith $Hg(OAc)_2$

_____14. What class of organic compound is the major product of the acid catalyzed reaction of an alcohol with a carboxylic acid?

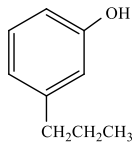
A) ether B) ester C) thiol D) nitrile E) sulfonate ester

_____15. Which of the following reagents is the best choice for oxidizing a primary alcohol to an aldehyde?

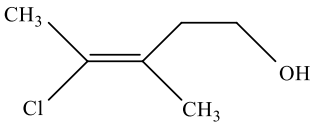
A) H_2CrO_4 B) pyridinium chlorochromate C) $Na_2Cr_2O_7$, H_2SO_4
D) $KMnO_4$ E) $LiAlH_4$

PART II - Nomenclature(20 points)

b) Write the correct IUPAC names.



(A)



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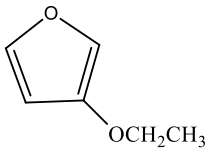
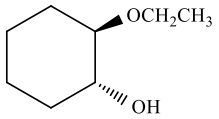
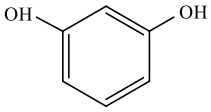


(C)



(D)



(E)

A. _____ **B.** _____

C. _____ **D.** _____

E._____

b) Write the correct structures.

Isobutylmethyl ether

p- chlorophenol

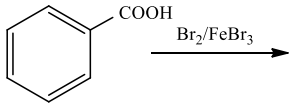
Diethyldisulfide

Methyloxirane

cis-3-ethyl-1,2-epoxycyclopentane

PARTT III- REACTIONS(20 points) What major product(s) would you expect from the following reactions?

a)



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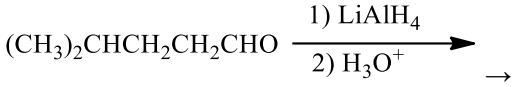

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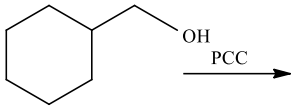

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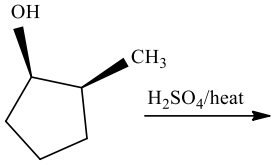
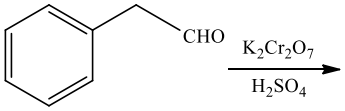
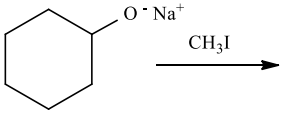


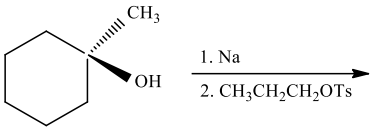
e)



f)



g)



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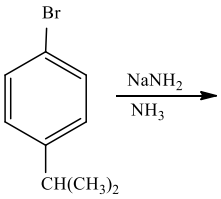
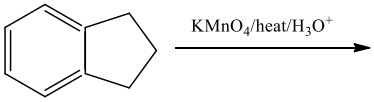
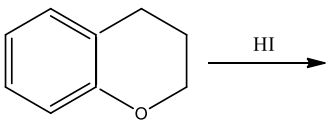


i)

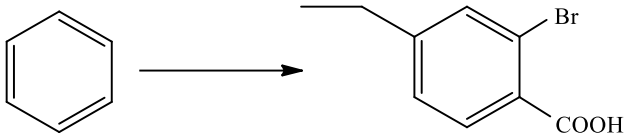


j)

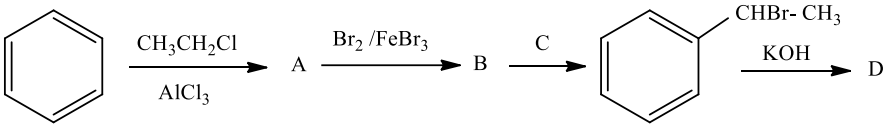


PART IV – SYNTHESIS (15 points)

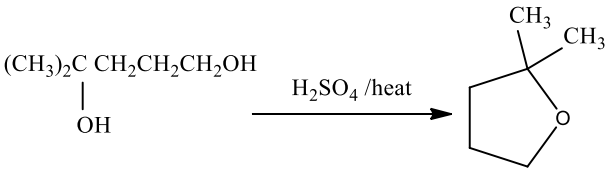
a) Provide a series of synthetic steps by which 3-bromo- 4- ethylbenzoic acid can be prepared from benzene.



b) Identify the structures for the compounds A, B, C, and D.



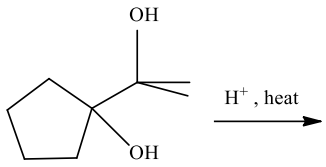
c) Provide a detailed, stepwise mechanism for the following reactions.



Bonus Question (10 points)

a) Propose a structure for the ether of formula $C_4H_{10}O$ with the following ^1H NMR signals:
δ 1.13 (doublet, 6H), 3.30 (singlet, 3H), 3.65 (septet, 1H) (ppm).

b) Propose a detailed, step-by-step mechanism for the reaction pathway shown below.



CHEM 2425 Sample EXAM # 2B (Chapters 16 –18) – Answers

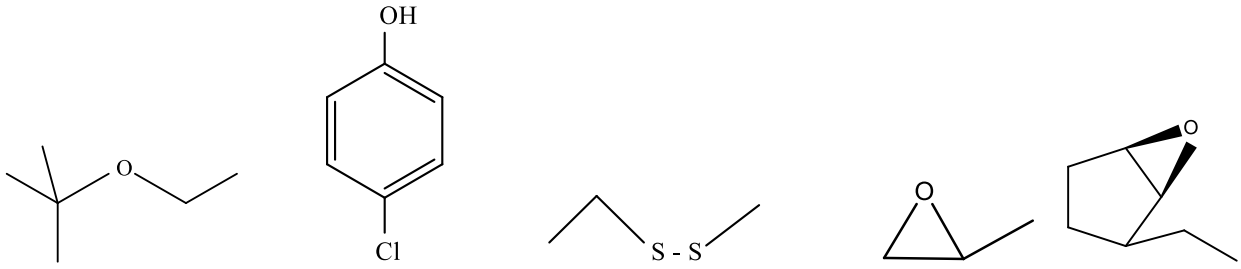
Part I: Multiple Choice

1. A	6. A	11.B
2. B	7. E	12. A
3. B	8. C	13. A
4. B	9. A	14. B
5. B	10. C	15. B

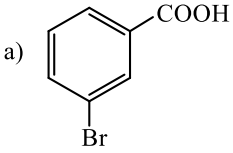
Part II: Nomenclature

a) A. m- Ethylphenol B.(E)-4-chloro-3-methylpent-3-en C. 3-Ethoxyfuran
D. 2-Ethoxy-1-hydroxycyclohexane E.1,3-dihydroxybenzene (or Benzene-1,3-diol)

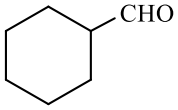
b)

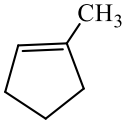


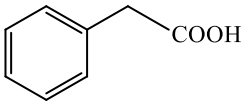
Part III: Reactions

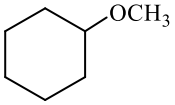
a) 

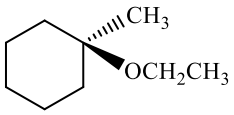
b) $(CH_3)_2CHCH_2CH_2CH_2OH$

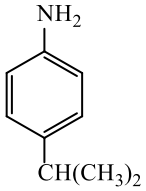
c) 

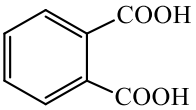
d) 

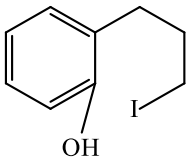
e) 

f) 

g) 

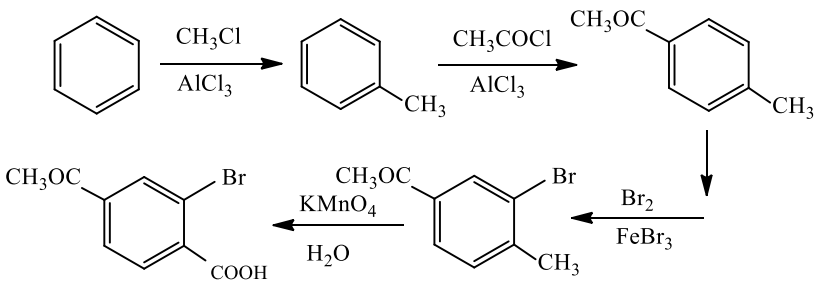
h) 

i) 

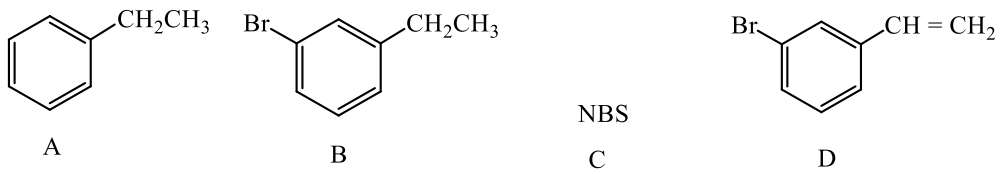
j) 

Part IV: Synthesis

a)

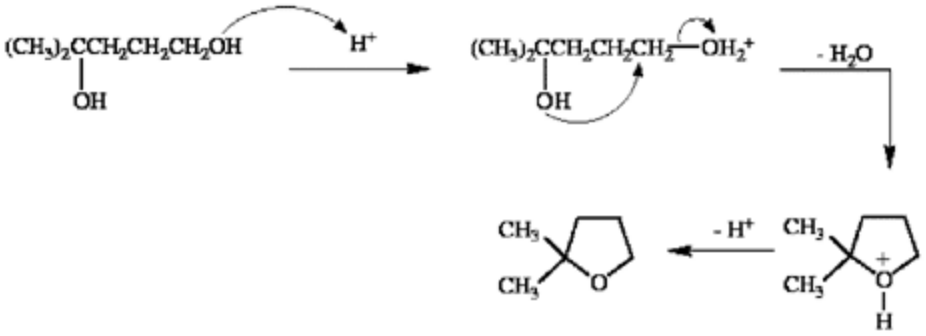


b)



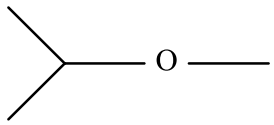
A B C D

c)



Bonus Question

a)



b)