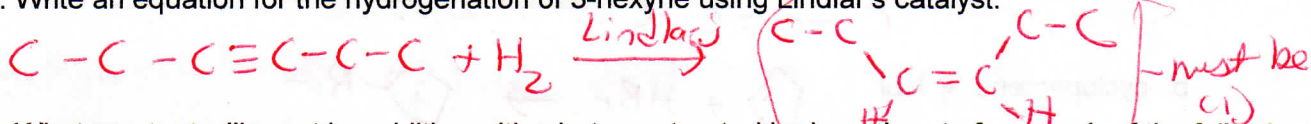
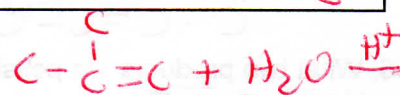
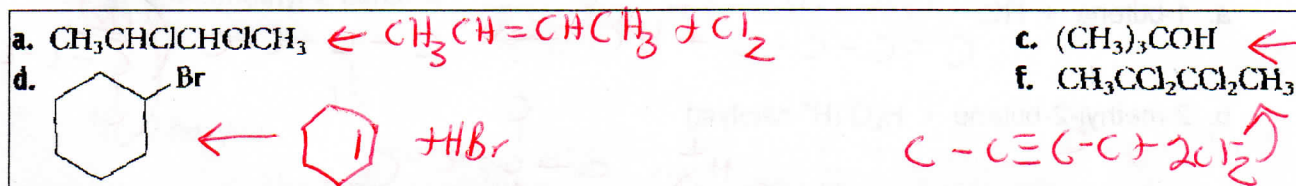


63. Write an equation for the hydrogenation of 3-hexyne using Lindlar's catalyst.



64. What reactant will react by addition with what unsaturated hydrocarbon to form each of the following?



65. Does a carbon with four single bonds have

- A.  $sp^3$ ,  $sp^2$  or  $sp$  orbitals around it?  
 B. Any p orbitals around it? - NO

66. What is an  $sp^3$  orbital? - hybrid formed by compo of 1s + 3 p orbitals.  $\angle$  is  $109.5^\circ$

67. Describe the structure of a pi bond. What type of orbitals combine to make a pi bond? Where do you find pi bonds in a molecule?  
 found in double & triple bonds adjacent carbons (lateral overlap) horizontal sharing of  $e^-$  between the p orbitals on

68. What type of bond is formed between the carbon and each hydrogen in methane?

sigma

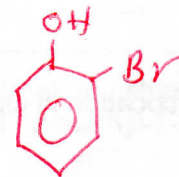
**Chapter 4 Aromatic Compounds**

69. Draw the structure of:

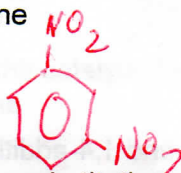
a. p-nitrotoluene



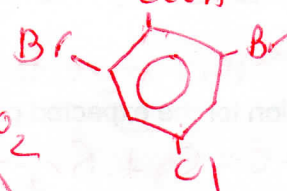
b. o-bromophenol



c. m-dinitrobenzene



d. 2,6-dibromo-4-chlorobenzoic acid

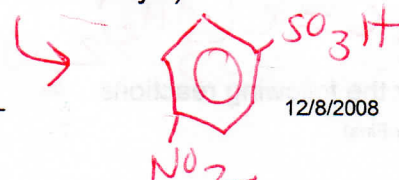


70. Indicate the main monosubstitution products:

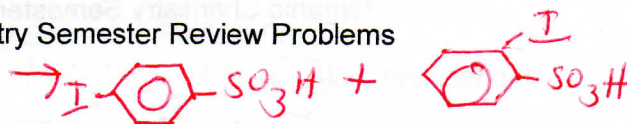
a. Nitrobenzene + chlorine (Fe catalyst)



b. Benzenesulfonic acid + HNO3 (H2SO4 catalyst)

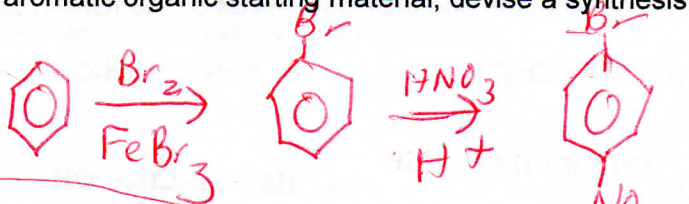


c. Iodobenzene + H<sub>2</sub>SO<sub>4</sub> + SO<sub>3</sub>

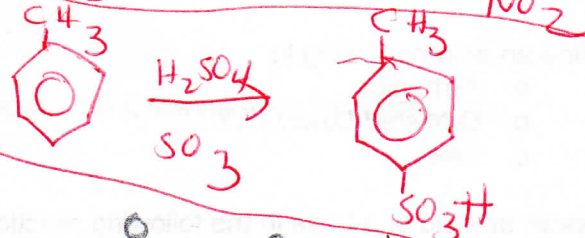


71. Using benzene or toluene as the only aromatic organic starting material, devise a synthesis for the following:

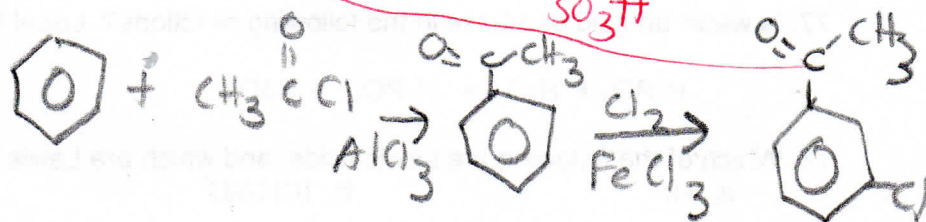
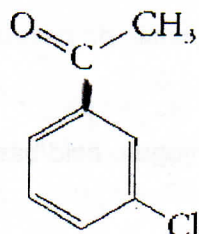
d. P-bromonitrobenzene



e. P-methylsulfonic acid

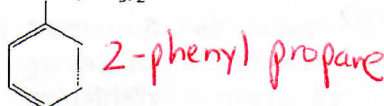


f.

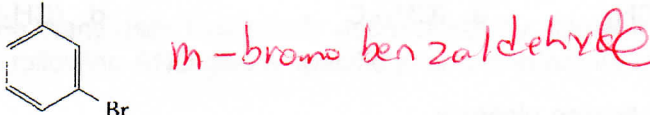


72. Name:

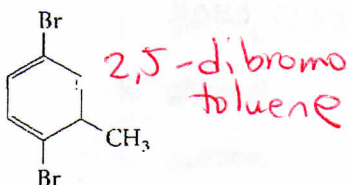
a. CC(C)c1ccccc1



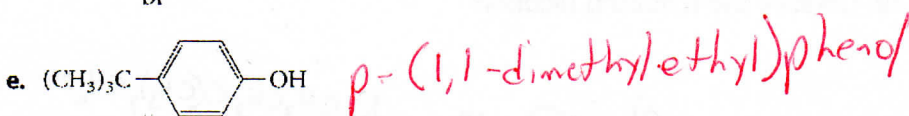
b. O=Cc1ccc(Br)cc1



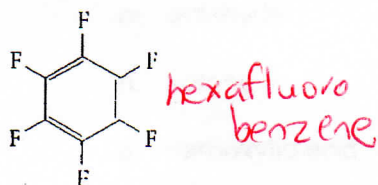
d.



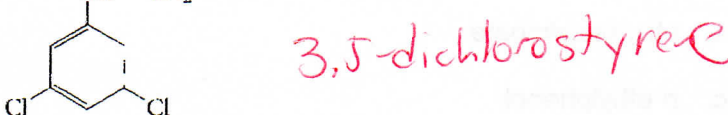
e. CC(C)(C)c1ccc(O)cc1



g.

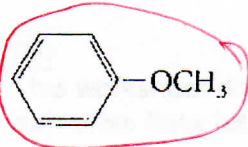


h. C=Cc1cc(Cl)cc(Cl)c1

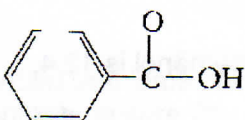


73. Which compound is more reactive toward electrophilic substitution (for example nitration)?

a.



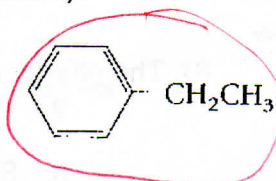
or



b.



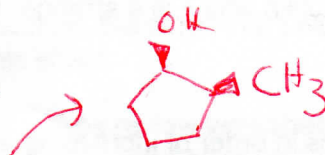
or



**Chapter 7: Alcohols, Phenols & Thiols**

74. Write an abbreviated formula for:

a. Cis-2-methylcyclopentanol



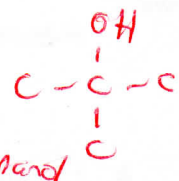
b. 2-methyl-2-propen-1-ol







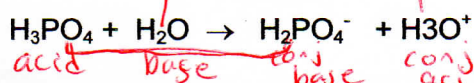
75. Name the alcohols and their derivatives by the IUPAC system:

- a.  $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{OH}$  <sup>3 2 1</sup>  
3-bromopropanol
- b.  $\text{CH}_2=\text{CHCH}_2\text{CH}_2\text{OH}$  <sup>4 3 2 1</sup>  
3-butene-1-ol
- c.  $(\text{CH}_3)_3\text{COH}$    
2-methylpropan-2-ol
- d.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{SH}$  <sup>4 3 2 1</sup>  
1-butanethiol
- e.  $\text{HS-CH}_2\text{CH}_2\text{OH}$   
2-mercaptoethanol

76. Define an acid according to:

- a. Arrhenius *contains ionizable H*
- b. Bronsted-Lowry *-donates H<sup>+</sup>*
- c. Lewis *-accepts e<sup>-</sup> pair*
- or 2-hydroxyethane-1-thiol*

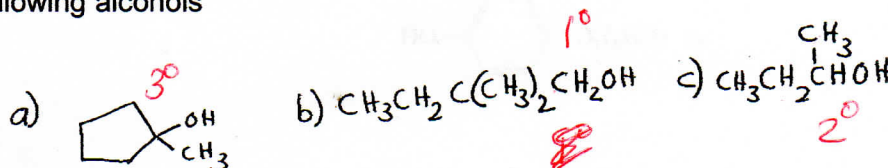
77. Is water an acid or a base in the following reactions? Label the conjugate acid/base pairs.



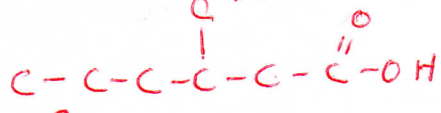

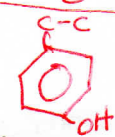
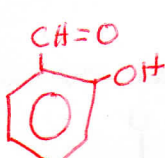
78. Which of the following are Lewis acids, and which are Lewis bases?

- a.  $\text{H}^-$  *base*
- b.  $(\text{CH}_3)_3\text{B}$  *A*
- c.  $\text{Mg}^{2+}$  *A*
- d.  $\text{CH}_3\text{OCH}_3$  *B*
- e.  $(\text{CH}_3)_3\text{C}^+$  *A*
- d.  $(\text{CH}_3)_2\text{C}=\text{O}$  *B*

79. Classify the following alcohols



80. Draw the structure for:

- d. 3-methyl hexanoic acid 
- e. ethylpropanoate 
- c. *p*-ethylphenol 
- d. *o*-hydroxyacetophenone 

81. The  $\text{pK}_a$  for ethanol is 15.9 and for 2,2,2-trifluoroethanol is 12.4.

- g. Which is the stronger acid? *2,2,2-trifluoroethanol*
- h. Based on its name, explain why it is a stronger acid. *Has 3 F which stabilize the neg charge after H<sup>+</sup> gives off*

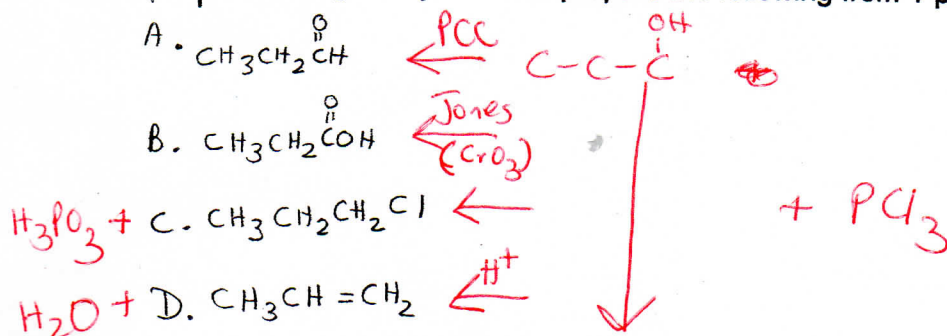
82. Rank the following five compounds in order of increasing acid strength:

- 2-chloroethanol, *2* *highest* *5* *3* *1* *4* *lowest*  
*lowest* *highest*  
2-chloroethanol, *p*-chlorophenol, *p*-methylphenol, ethanol, phenol

83. Name the following molecule. Then write an equation showing its formation.



84. Write an equation showing how you would prepare the following from 1-propanol:



85. Alcohols & their derivatives have many uses biologically and industrially. Draw a specific example or general formula for each of the following AND give a specific example in nature or a use industrially/commercially:

- alcohol
- glycol
- glycerol
- quinine
- aldehyde
- ketone
- carboxylic acid
- thiol

**NOTE:**

- This worksheet does **not** contain problems on all concepts that will be on the final. **Review objective lists** for each chapter to ensure you are ready for all possible topics.
- Chapter 15 Lipids** will also be on the final, but since that unit was completed just prior to the final, no practice problems are included on this sheet.
- Chapter 7 Alcohols & Phenols** had a large review worksheet previously. Use it for review of Chapter 7. Also review the **Reaction Summary Sheet** for Chapter 7.