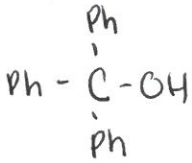
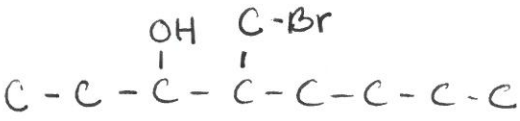
Name: KEY

Organic Worksheet:
Review Chap 7 Alcohols

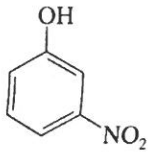
1. You must be able to name the following compounds:
   a. Alcohols (7 Questions)
      1. Draw triphenylmethanol



      2. Draw 4-(bromomethyl)-3-octanol

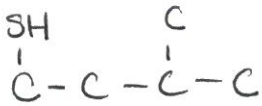


   b. Phenols (3 Questions)
      1. Name the molecule to the right.

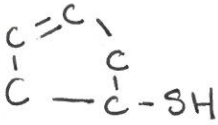


m-nitrophenol
m-hydroxynitrobenzene

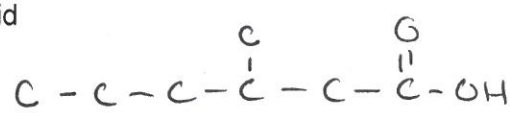
   c. Thiols (3 Questions)
      1. Draw 3-methyl-1-butanethiol (skunk scent)



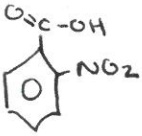
      2. Draw 3-cyclopentenethiol



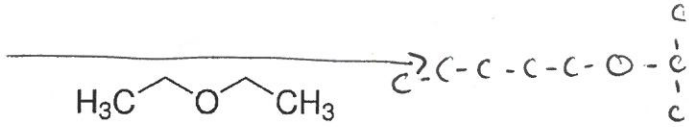
   d. Carboxylic Acids (2 Questions)
      1. Draw 3-methyl hexanoic acid



      2. Draw o-nitrobenzoic acid



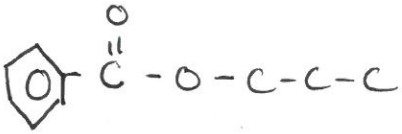
   e. Ethers (2 questions)
      1. Draw isopropyl pentyl ether



      2. Name the following ether:

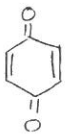
diethyl ether

   f. Esters (2 Questions)
      1. Draw propylbenzoate



      2. Draw ethylpropanoate

   g. Quinones (1 Question)
      1. Name the molecule below:

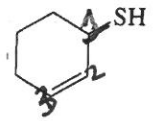
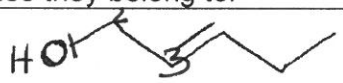
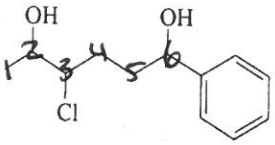
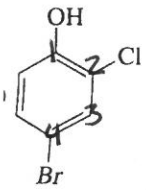


p-Benzoquinone

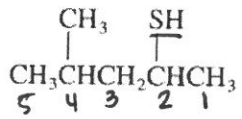
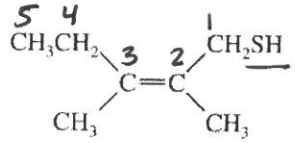
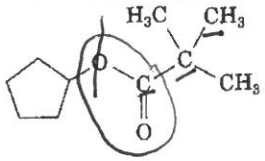
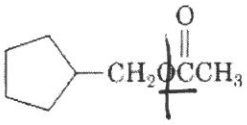
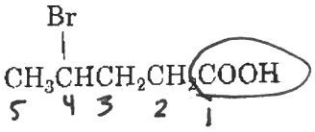
h. Name the following AND Identify what group of molecules they belong to:

Molecule	$CH_3—SH$	$CH_3CH_2CH_2CH_2—SH$	$CH_3CH{=}CHCH_2—SH$	$HS—CH_2CH_2—OH$
Name	methanthiol	1-butanthiol	2-buten-1-thiol but-2-en-1-thiol	1-hydroxy-2-ethan thiol 2-mercapto-1-ethanol
Group of molecule	thiol	thiol	thiol	thiol & alcohol

i. Name the following AND Identify what group of molecules they belong to:

Molecule		
Name	cyclohex-2-en-1-thiol 2-cyclohexen-1-thiol	3-hexen-1-ol hex-3-en-1-ol
Group of molecule	thiol	alcohol
Molecule		
Name	3-chloro-6-phenul-2,6-hexandiol	21-bromo-2-chlorophenol 4-bromo-2-chloro-1-hydroxy benzene
Group of Molecule	Alcohol	Alcohol

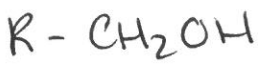
j. Name the following AND Identify what group of molecules they belong to:

Molecule				
Name	4-methyl-2-pentanthiol	2,3-dimethyl-2-penten-1-thiol or	Ester	Ester
Group of molecule	thiol	2,3-dimethyl-pent-2-en-1-thiol thiol	cyclopentyl 2,2-dimethyl propanoate	methyl cyclopentyl ethanoate
Molecule				
Name	4-bromo-1-pentanoic acid / 4-bromopentanoic acid			
Group of Molecule	Carboxylic Acid			

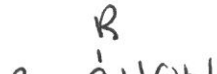
2. Find one of the common alcohols listed in notes. Using information from notes, fill in the table below.

Alcohol Chosen	Formula (Line, Skeletal, or Abbreviated)	Nickname (Common Name)	2 Uses Specific to this Alcohol
Methanol	CH_3OH	Wood Alcohol	Antifreeze, Race Car Fuel, Industrial Solvent, Starter → Formaldehyde → plastic
ethanol	CH_3CH_2OH	Grain Alcohol	gasoline, liquor, starting material for esters
2-propanol	$CH_3CHOHCH_3$	Isopropyl (Rubbing) Alcohol	Antiseptic for blood draws & vaccines

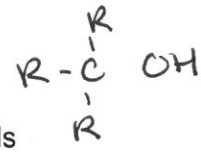
3. Classifications of Alcohols (2 Questions)
   a. Draw a primary alcohol



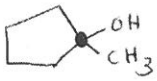
   b. Draw a secondary alcohol



   c. Draw a tertiary alcohol



   d. Classify the following alcohols

a) 

3°

b) $CH_3CH_2C(CH_3)_2CH_2OH$

1°

c) $CH_3CH_2CH(CH_3)OH$

2°

4. Solubility and Boiling Point of alcohols and phenols (2 Questions)
   a. Which of the following has the highest boiling point?
      1. $CH_3CH_2CH_2OH$ b. $CH_3CH_2CH_3$ c. $CH_2(OH)CH_2CH_2OH$

- more polar O-H to form H+ bonds (↑ energy to break)

   b. Which of the molecules listed above is the most soluble in water? C - forms H+ bonds w/ water

   c. Predict which is more soluble in water and cite evidence ~~from the~~ chapter to support your choice.
      1. chlorocyclohexane, cyclohexanol or 1,2-cyclohexanediol?

↑ The increased # of OH groups, ↑'es the H+ bonds possible with water.

5. Acids and Bases

   a. Fill in the table below regarding definitions of acids and bases.

Acid/Base Model	Definition of an ACID	Definition of a BASE
Traditional	produces H+ ions in solution	produces OH- ions in solution
Bronsted-Lowry	H+ donor	H+ accepter
Lewis	e- pair accepter	e- pair donor

b. Bronsted-Lawry (four questions)

1. What characteristics does a Bronsted-Lowry base possess?

   Must have the ability to bond with H^+

2. Which of the following would you expect to be Bronsted-Lowry bases? Why? (Support your choice with evidence from the chapter)

   a. SO_3^{-2} ← (base → has the ability to take H^+)
   - no H^+ to give

   b. Ag+

3. What is the conjugate base for each of the following acids?

   a. HCl → Cl^-

   b. H_3PO_4 → $H_2PO_4^-$

   c. NH_4^+ → NH_3

   d. H_2O → OH^-

4. What is the conjugate acid for the following?

   a. OH^- → H_2O

   b. PO_4^{-3} → HPO_4^{-2}

   c. H_2O → H_3O^+

   d. O_2^{-2} → HO_2^-

5. Decide whether water is functioning as an acid or a base in the following reactions.

   1. Label the conjugate acid/base pairs.

   a. $H_3PO_4 + H_2O \rightarrow H_2PO_4^- + H_3O^+$

   ACID BASE

   b. $F^- + H_2O \rightarrow HF + OH^-$

   BASE ACID

c. Lewis Acid (4 Questions)

1. Label the following as Lewis acids or bases:

A. Zn^{+2} ACID

B. $(CH_3)_3B$ ACID

C. $CH_3\overset{\overset{\ddot{O}}{\|}}{C}CH_3$ BASE

6. Acid Strength (4 Questions)

a. Which is more acidic?

1. Cyclohexanol or 2-chlorocyclohexanol? - halogens ↑ acidity

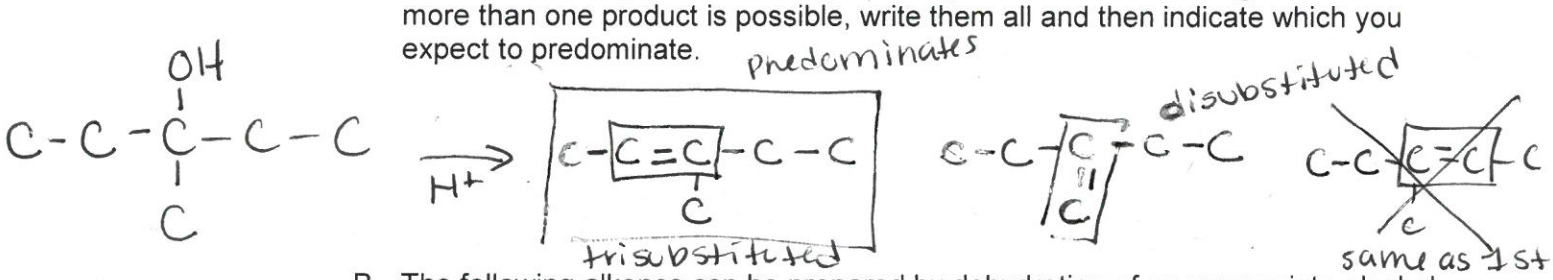
2. 1-chloroethanol or 2-chloroethanol?

↑ more polar groups concentrated in one spot on 1 carbon

b. Rank from highest to lowest acidity:
   1. O-chlorophenol
   2. 3-chloro-2-hexanol
   3. 3-methyl-2-hexanol
   4. phenol
   5. hexane
   6. o-methylphenol

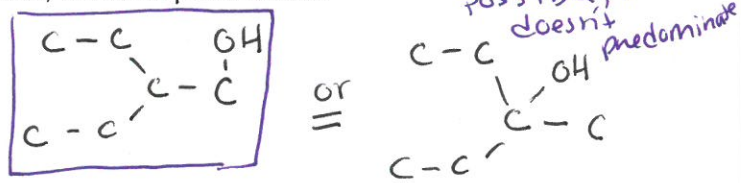
1 > 4 > 6 > 2 > 3 > 5

7. Reactions
   1. Dehydration
      A. What alkenes might be formed by the dehydration of the following alcohols? If more than one product is possible, write them all and then indicate which you expect to predominate.

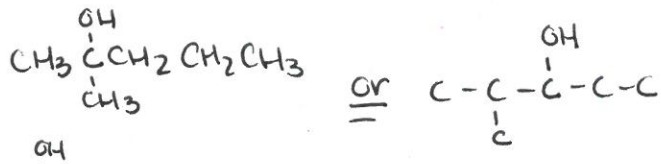


      B. The following alkenes can be prepared by dehydration of an appropriate alcohol. Show the structure of the alcohol in each case. If the alkene can arise from dehydration of more than one alcohol, show all possibilities.

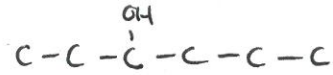
1. CH_3CH_2 $C{=}CH_2$ CH_3CH_2



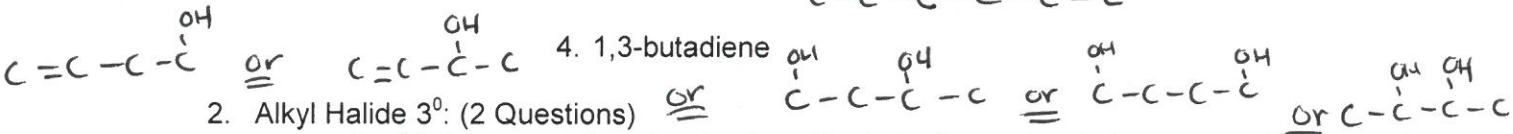
2. $CH_3C{=}CHCH_2CH_3$ CH_3



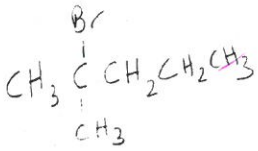
3. 3-hexene

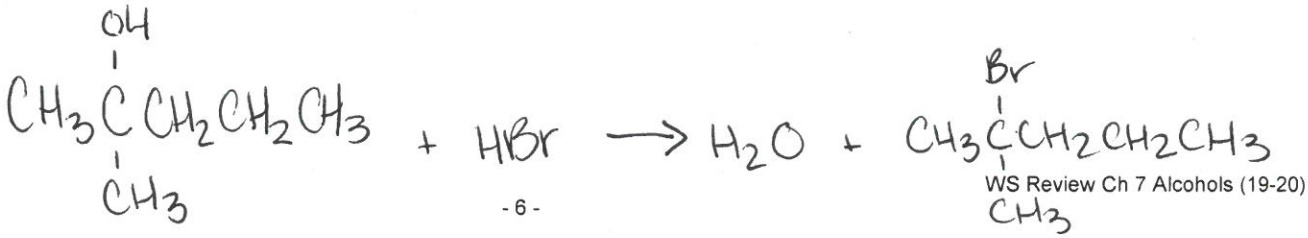


4. 1,3-butadiene



   2. Alkyl Halide 3°: (2 Questions)
      A. Write an equation showing how the following molecule is prepared from an alcohol:





3. Alkyl Halide 2^0 and 1^0: (2 Questions)

A. Write an equation for the reaction of phenol with PCl_3

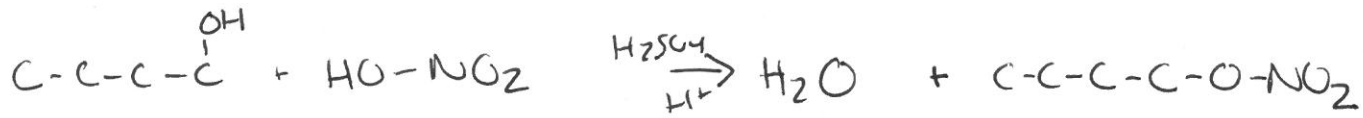
B. Write an equation for the monobromination of phenol.

Doesnt occur.

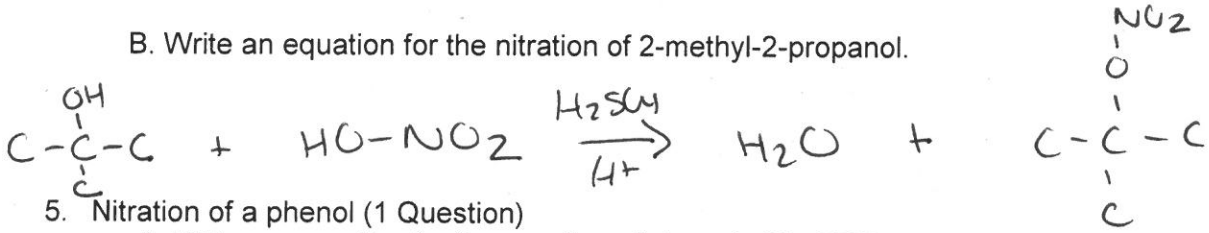
phenol does not undergo these rxns.

4. Nitration of an alcohol (1 Question)

A. Write the equation for the Nitration of butanol

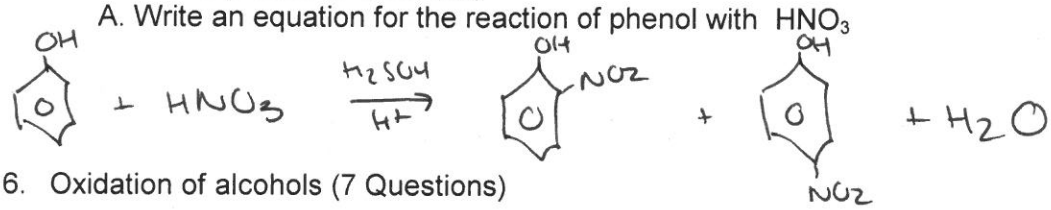


B. Write an equation for the nitration of 2-methyl-2-propanol.



5. Nitration of a phenol (1 Question)

A. Write an equation for the reaction of phenol with HNO_3



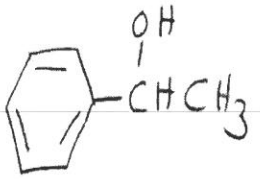
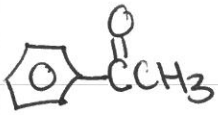
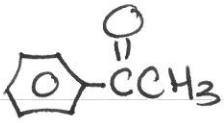
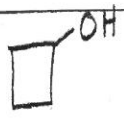
6. Oxidation of alcohols (7 Questions)

Reagent	Function/Purpose	Ending product of a Primary Alcohol.	Ending product of a Secondary Alcohol.	Ending product of a Tertiary Alcohol.
Jones	completely oxidize 1° alcohols	Carboxylic acid	Ketone	X no oxidation
PCC	partially oxidize 1° alcohols	aldehyde	Ketone	X. rxns occur

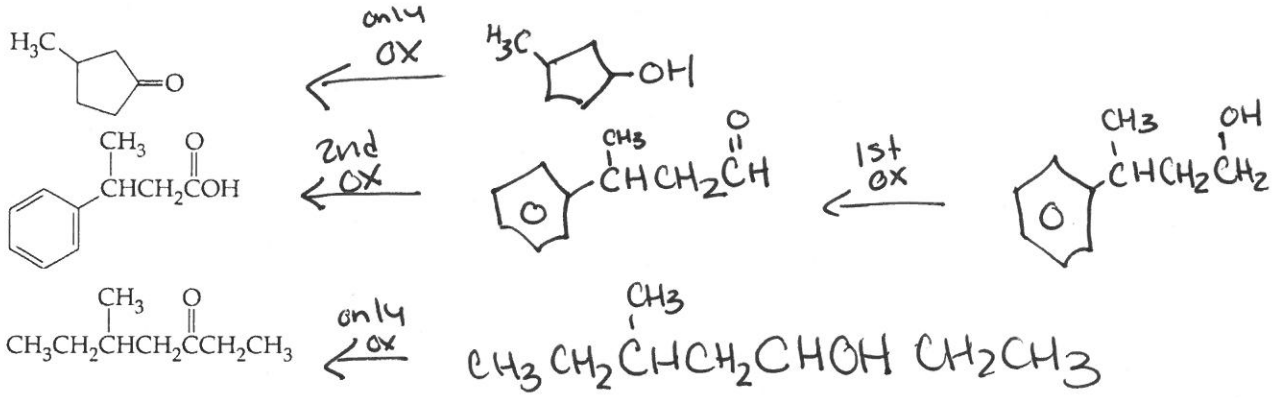
7. Products of oxidation.

A. What products would you obtain from the oxidation of the following alcohols?

B. If no reaction occurs, write "NR".

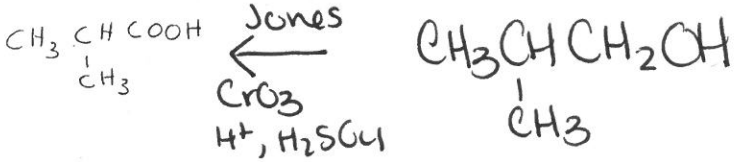
Molecule	Product w/Jones Reagent	Product w/PCC
a)  2°		
b) $CH_3CH(CH_3)CH_2OH$ 1°	$CH_3CH(CH_3)C(=O)H$	$CH_3CH(CH_3)C(=O)H$
c) 3-methyl-3-pentanol 3° $C-C-C(OH)(C)-C-C$	X no H attached	X
d)  2°		

8. What molecules would you oxidize to obtain the following compounds?



9. You decide the reaction:

A. Write an equation starting with an alcohol that would produce the following molecule



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

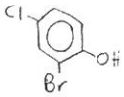
A. $CH_3CH_2\overset{O}{\overset{\|}{C}}H \xleftarrow{PCC} CH_3CH_2CH_2OH$

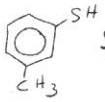
B. $CH_3CH_2\overset{O}{\overset{\|}{C}}OH \xleftarrow[CrO_3/H^+, H_2SO_4]{Jones} CH_3CH_2CH_2OH$

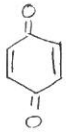
C. $CH_3CH_2CH_2Cl + H_2O \longleftarrow HCl + CH_3CH_2CH_2OH$

D. $CH_3CH=CH_2 + H_2O \xleftarrow{H^+} CH_3CH_2CH_2OH$

8. Functional Group Identification (6 Questions)
   a. Identify the following molecules as an alcohol, phenol, glycol, glycerol, quinone, aldehyde, ketone, carboxylic acid, ether, thiol or thiophenol

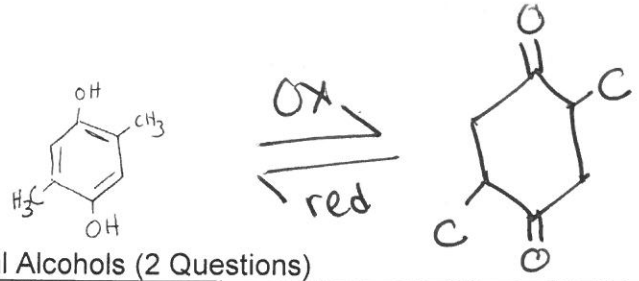
- $CH_3CH_2CH_2COOH$ or $CH_3CH_2CH_2\overset{O}{\overset{\|}{C}}OH$ carboxylic acid
- $CH_3CHBrCH_2OCH_3$ ether
- $CH_2OHCHOHCH_2OH$ alcohol
- $CH_3CH_2CH_2CHO$ or $CH_3CH_2CH_2CH{=}O$ aldehyde
- $CH_3CH(SH)CH_2CH_3$ thiol
- $CH_3\overset{O}{\overset{\|}{C}}CH_2CH(CH_3)_2$ ketone
- $CH_2\underline{OH}CH_2CH_3$ alcohol
- $CH_3CH\underline{OH}CH\underline{OH}CH_2CH_3$ alcohol
- 

phenol
- 

thiophenol
- 
1,4-quinone

9. Oxidation of Quinones: (1 Question)
   a. If the following molecule is oxidized to a quinone, draw the final product:

next page



10. Special Alcohols (2 Questions)

Types		Definition	Examples
Glycol		2 adjacent -OH groups	OH OH C-C-C-C
Glycerol	Subtypes	3 adjacent -OH	OH OH OH C-C-C
	1). Triglyceride	glycerol + 3 fatty acids	(saturated + unsaturated fats)
	2). Phospholipid	glycerol + 2 fatty acids + 1 phosphate	(lipid bilayer)
	3). Nitroglycerin	glycerol + 3 NO_2	C-C-C O O O NO2 NO2 NO2

11. Oxidation of thiols (1 Question)

- Oxidize two molecules of ethanthiol

C-C-SH

↓

ox

↓

C-C-S-S-C-C