**Magnet Biochem Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ # \_\_\_\_\_**

**Review: Unit 4 Test**

**Chapter 14 – Organic Compounds with Oxygen and Sulfur (Alcohols, Ethers, Thiols)**

**Chapter 15- Introduction to Chirality and Stereoisomers (\*Sections 15.1 and 15.2 only)**

***Definitions and Applications to Master for Unit 4 Test:***

* + **Alcohols**
  + **Ethers**
  + **Thiols**
  + **Primary Alcohols**
  + **Secondary Alcohols**
  + **Tertiary Alcohols**
  + **Intermolecular hydrogen bonding**
  + **Dehydration Reactions**
  + **Oxidation Reactions**
  + **Hydrogen halide rxns**
  + **Ch 15:R,S Enantiomers (Intro only)**

***Basic Concepts***

* + Draw and describe a primary, secondary, and tertiary alcohol
  + Alcohols are “bent” in shape and tetrahedral about the oxygen atom
  + Alcohols hydrogen bond with one another and thus have higher boiling and melting points that similar molecular weight hydrocarbons
  + The most important physical property of an alcohol is the polarity of the –OH group
  + Low molecular weight alcohols will dissolve in polar solvents (water) – high molecular weight alcohols will dissolve in organic solvents but will not be water soluble
  + Loss of water from an alcohol is known as dehydration (an **elimination reaction**). Does this require a catalyst?
  + **Zaitsev’s Rule:** The major product in a elimination reaction is the one that has more alkyl groups directly attached to the newly formed C=C bond
  + Primary alcohols oxidize into aldehydes which then further oxidize into carboxylic acids
  + Secondary alcohols oxidize into ketones
  + Tertiary alcohols **do not oxidize**
  + Ethers are “bent” in shape and tetrahedral about the oxygen atom just like alcohols
  + Ethers have stronger intermolecular forces than hydrocarbons but much weaker intermolecular forces than alcohols thus boiling points are lowest for hydrocarbons, higher for ethers, and much higher for alcohols
  + Low molecular weight ethers will dissolve in polar solvents (water) – high molecular weight ethers will dissolve in organic solvents but will not be water soluble (just like alcohols)
  + Thiols are classified as primary, secondary, or tertiary following the same rules as alcohols
  + Thiols are reduced; disulfides are oxidized
  + Boiling and melting points for thiols are much lower than alcohols
  + Thiols have little hydrogen bonding; nonpolar and thus are always water insoluble!
  + Know priorities of groups when distinguishing R and S enantiomers

***Nomenclature***

* Alcohols:
  + Suffix = **-ol**
  + Longest carbon chain must contain the carbon bonded to the –OH group – this is given the lowest possible number
  + All other rules of nomenclature then apply
  + If the –OH group is bonded to a ring, that is automatically carbon #1 – do not put “1” in the name
  + What are diols and triols?
* Ethers:
  + Simple ethers are given common names
    - Alphabetize the two alkyl groups and add the word “ether” ex: Ethyl methyl ether
    - If two identical alkyl groups name as a “di-“ compound ex: Dimethyl ether
  + More complex ethers can be given alkoxy group names ex: 4-ethoxyoctane where 4 refers to the position on the octane chain that has the –OCH2CH3 (ethoxy group) bonded to it
* Phenyl group = Benzene ring attached to a parent compound; Phenol= benzene with -OH
* Thiols:
  + Named like alcohols, but end in –thiol
  + All other nomenclature rules apply

Review Questions:

1. Draw the following alcohols: A) isobutyl; B) sec-butyl; C) tert-butyl; D) n-butyl

2. Explain the following properties of alcohols. Explain trends. 1. Polarity; 2. Boiling Point; 3- Solubility

3. Explain how thiols compare with alcohols regarding conditions above; B- Compare ethers to alcohols

XI. Complete the following:

1. Oxidation of 1st degree alcohol 🡪
2. Ox of 2 degree 🡪
3. Ox of 3 degree 🡪
4. Dehydration (elimination) of alcohol 🡪
5. Alcohol with HX 🡪
6. Draw a symmetrical ether and name it
7. Draw an unsymmetrical ether and name
8. What must be reduced to yield a prim alcohol?
9. What does the oxidation of 2 thiols yield?
10. Which functional group is the most oxidized?
11. Hydrate: 1-butene
12. Draw phenol
13. What are London (van der Waals) forces and which group has them?
14. Define: enantiomer, chiral carbon, stereocenter, racemic mixture. How are R and S configurations assigned? (\*Be able to apply concepts to examples).