Chemistry 1120 Exam 1 Study Guide

Chapter 3

3.1 a) Know that alcohols contain a hydroxy (-OH) group. Determine the IUPAC name for a given structure by determining the longest chain.b) Determine the number of hydrogen atoms needed to complete the structure of a cyclical alcohol or phenol. Determine the IUPAC names of cyclical alcohols or phenols.

- Master Tutor Section 3.1
- Review Section 3.1 in the Concept Summary
- Review Examples 3.1, 3.2 and Learning Checks 3.1, 3.2, 3.3
- For practice, do Exercises 3.4, 3.8, and 3.10

3.2 Given the name or structure of an alcohol, identify it as a primary, secondary, or tertiary alcohol.

- Master Tutor Section 3.2
- Review Section 3.2 in the Concept Summary
- Review Learning Check 3.4
- For practice, do Exercise 3.14

3.3 Show how hydrogen bonding can occur between alcohol molecules or between an alcohol and water molecule. Know that water solubility increases as the number of (-OH) groups on an alcohol increases, or the number of carbon atoms decreases. Know that boiling points increases as the number of (-OH) groups on an alcohol increases, or the number of carbon atoms increases.

- Master Tutor Section 3.3
- Review Section 3.3 in the Concept Summary
- Review Learning Checks 3.5 and 3.6
- For practice, do Exercises 3.18 and 3.20

3.4 a) For dehydration reactions involving alcohols, know that an H_2SO_4 catalyst at 140°C will produce an ether and at 180°C it will produce an alkene. Identify the major alkene product formed in a dehydration reaction involving H_2SO_4 180°C. b) For oxidation reactions involving alcohols, know that primary alcohols will produce carboxylic acids, secondary alcohols will produce ketones, and tertiary alcohols will not react. Identify carboxylic acid and ketone structures.

- Master Tutor Section 3.4
- Review Section 3.4 in the Concept Summary
- Review Example 3.3 and Learning Checks 3.7-3.12
- For practice, do Exercises 3.22, 3.24, 3.26, and 3.28

3.5 Recognize uses for glycerol, ethanol and 2-propanol (isopropyl alcohol). Know that ethanol can be made through fermentation. Know the structure of 2-propanol (isopropyl alcohol).

- Master Tutor Section 3.5
- Review Section 3.5 in the Concept Summary
- Review Learning Check 3.13
- For practice, do Exercise 3.36

3.6 Recognize the structure of phenol as an aromatic alcohol that can hydrogen bond with another phenol. Know phenol can be used as a disinfectant and is used to make the antioxidants BHA and BHT.

- Master Tutor Section 3.6
- Review Section 3.6 in the Concept Summary
- Review Learning Check 3.14
- For practice, do Exercise 3.8

3.7 Identify the structure of an ether and a heterocyclic ring. Determine the IUPAC name of an ether when given a structure or a common ether name.

- Master Tutor Section 3.7
- Review Section 3.7 in the Concept Summary
- Review Learning Check 3.16
- For practice, do Exercises 3.42 and 3.44

3.8 Recognize that ethers are similar to alkanes in their lack of chemical reactivity. Apply how hydrogen bonding makes ethers slightly water soluble and have lower boiling points than comparable alcohols.

- Master Tutor Section 3.8
- Review Section 3.8 in the Concept Summary
- Review Learning Check 3.17
- For practice, do Exercises 3.48 and 3.50

3.9 Know thiols contain a sulfhydryl (-SH) group and have a foul smell. Predict the disulfide (R-S-S-R) structure formed when a thiol undergoes oxidation. Predict the structure formed when a thiol reacts with a heavy metal ion (ie. Hg²⁺).

- Master Tutor Section 3.9
- Review Section 3.9 in the Concept Summary
- Review Learning Checks 3.18, 3.19, and 3.20
- For practice, do Exercise 3.52

3.10 Skip this section. It won't be covered on the exam.

Key Reactions: Be sure to put these into your exam note sheet.

Chapter 4

4.1 a) Identify carbonyl, aldehyde and ketone functional groups. Recognize -al name endings for aldehydes and -one for ketones. Know the structure of acetone. b) Given a ketone containing structure, determine its IUPAC name. Determine the correct IUPAC name when given an incorrect one. c) Given an aldehyde containing structure, determine its IUPAC name. Determine the correct IUPAC name when given an incorrect one.

- Master Tutor Section 4.1
- Review Section 4.1 in the Concept Summary
- Review Examples 4.1, 4.2 and Learning Checks 4.1, 4.2
- For practice, do Exercises 4.4, 4.6, 4.8, and 4.12

4.2 Know aldehydes and ketones cannot hydrogen bond with other aldehydes and ketones. Identify how aldehydes and ketones can hydrogen bond with water and alcohols. Predict the relative water solubilities and boiling points of aldehydes, ketones, alcohols, alkanes and alkenes based on hydrogen bonding characteristics.

- Master Tutor Section 4.2
- Review Section 4.2 in the Concept Summary
- For practice, do Exercise 4.18

4.3 a) Recognize that the Benedict's and Tollen's tests are used to identify the presence of aldehydes. Know a positive Benedict's test produces a red-brown Cu_2O precipitate, and the Tollen's test produces a mirror-like Ag deposit.

b) Apply an understanding that the hydrogenation of an aldehyde or a ketone with H₂ and Pt catalyst will produce a primary alcohol or a secondary alcohol, respectively.

c) Differentiate and identify acetal and hemiacetal structures.

d) Differentiate and identify ketal and hemiketal structures.

e) Predict reactants and products of an aldehyde or a ketone reacting with an alcohol to form an acetal or ketal, respectively.

- Master Tutor Section 4.3
- Review Section 4.3 in the Concept Summary
- Review Examples 4.3, 4.4, 4.5 and Learning Checks 4.3-4.7
- For practice, do Exercises 4.22, 4.24, 4.26, 4.28, 4.31, 4.34, 4.42, 4.46

4.4 Recognize the characteristics, uses, and properties of formaldehyde and acetone.

- Master Tutor Section 4.4
- Review Section 4.4 in the Concept Summary
- For practice, do Exercise 4.52

Key Reactions: Be sure to put these into your exam note sheet.

Chapter 5

5.1 a) Using the longest carbon chain, provide correct IUPAC names for carboxylic acids, or vice versa.

b) Know the structure of benzoic acid. Give IUPAC names as derivatives of benzoic acid.

- Master Tutor Section 5.1
- Review Section 5.1 in the Concept Summary
- Review Example 5.1 and Learning Check 5.1
- For practice, do Exercises 5.6 and 5.8

5.2 a) Determine the relative (ie. highest/lowest) boiling points of alkanes, alkenes, alcohols, aldehydes, ketones and carboxylic acids, or within a group of carboxylic acids.

b) Determine the relative (ie. highest/lowest) water solubilities or hydrogen bonding cap abilities of alkanes, alkenes, alcohols, aldehydes, ketones and carboxylic acids, or within a group of carboxylic acids. Identify hydrogen bonding characteristics and dimer formation in carboxylic acids.

- Master Tutor Section 5.2
- Review Section 5.2 in the Concept Summary
- For practice, do Exercises 5.10 and 5.16

5.3 Recognize that in neutral or high (basic) pH, carboxylic acids will dissociate to form a weak acid (low pH). Identify reactants and

products formed when a strong base (ie. KOH, NaOH) reacts with a carboxylic acid.

- Master Tutor Section 5.3
- Review Section 5.3 in the Concept Summary
- Review Learning Checks 5.2 and 5.3
- For practice, do Exercises 5.24 and 5.26

5.4 a) Give the names or structures for the salt that is formed when a carboxylic acid reacts with a strong base.

b) Know the uses of calcium or sodium propanoate sodium benzoate, sodium stearate, and zinc-10-undercylenate.

- Master Tutor Section 5.4
- Review Section 5.4 in the Concept Summary
- Review Example 5.2 and Learning Check 5.4
- For practice, do Exercises 5.28, 5.30, and 5.32

5.5 Know an ester is produced when an alcohol and carboxylic acid react and identify the ester linkage. Predict the products or reactants involved in an esterification reaction.

- Master Tutor Section 5.5
- Review Section 5.5 in the Concept Summary
- Review Examples 5.3, 5.4 and Learning Checks 5.5, 5.6
- For practice, do Exercises 5.36 and 5.38

5.6 Give the name of the ester formed when given the names of the alcohol and carboxylic acid reacted. Provide the IUPAC name for a given ester structure.

- Master Tutor Section 5.6
- Review Section 5.6 in the Concept Summary
- Review Example 5.5 and Learning Check 5.7

• For practice, do Exercises 5.46 and 5.50

5..7 a) Know that hydrolysis of an ester with an acid (H⁺) breaks the ester linkage to form an alcohol and a carboxylic acid. Predict the products or reactants involved in a hydrolysis reaction.

b) Know that the saponification of an ester with a strong base (OH-) breaks the ester linkage to form an alcohol and a carboxylic acid salt. Predict the products or reactants involved in a saponification reaction.

- Master Tutor Section 5.7
- Review Section 5.7 in the Concept Summary
- Review Learning Checks 5.8, 5.9
- For practice, do Exercise 5.54

5.8 Recognize that esters can be made from carboxylic acids or phosphoric acid, reacting with an alcohol. Identify the ester linkage in a phosphate ester. Know the products of the hydrolysis of a phosphate ester are phosphoric acid and an alcohol.

- Master Tutor Section 5.8
- Review Section 5.8 in the Concept Summary
- For practice, do Exercise 5.56

Key Reactions: Be sure to put these into your exam note sheet.