

**Phillips**  
**CHE 256 Organic Chemistry II**  
**Test 1 Review Sheet**

**General details**

- Although this test will focus on the material from chapters 9, 10, 11, 12, elements from previous chapters will be included as fundamentals.
- 10 questions, mixture of multiple choice and short answer
- 2 questions directly from homework problems
- You will have one **bonus** question – a synthesis question, similar to the ones that we did in class today (Friday)
- 1-2 NMR questions, similar to those worked in class, where you are expected to take NMR information regarding proton (1) chemical shift; (2) multiplicity; (3) peak area and relate this information to discerning molecular structure
- You **will** be provided with the following resources: periodic table, pKa table, and 3 extra sheets of paper.
- You are allowed to bring models **preassembled** for the test. I suggest a cyclohexane and butane, with lots of extra atoms of various colors.

**Specific details**

- Chapter 10 radical reactions
  - Be able to relate bond dissociation energies to the relative stability of radicals produced; place radicals in order of increasing or decreasing stability, and be able to discuss the mechanisms by which radicals are stabilized: induction, resonance, and hyperconjugation
  - Know the difference between homolytic and heterolytic bond cleavages and be able to draw proper arrows, show products, and reactants
  - Be able to discuss the chain reaction in chlorination and bromination reactions; identify the initiation, propagation, and termination steps and provide examples if asked
  - Review the differences between free radical halogenations using chlorine atom and bromine atom; Which is more selective and why? Which is more reactive and why? How are selectivity and reactivity related?
  - Be able to provide all the mono-halogenated products of the free radical halogenation of a simple alkane; identify stereoisomers; and be able to label with R or S stereochemistry
  - Be able to discuss why the addition of HBr in the presence of peroxides gives anti-Markovnikov product, yet the normal polar addition process gives Markovnikov product; define Markovnikov's rule
  - Chapter 10 mechanisms that you must know; be able to provide starting materials, products, intermediates, show electron flow – free radical chain reaction
- Chapter 11 alcohols and ethers
  - Be able to name simple alcohols and ethers using common and IUPAC names; review names of common alkyl groups (class handout)
  - Review intermolecular forces and be able to use this information to rank molecules in increasing or decreasing physical property: boiling point, solubility, etc. . .
  - Chapter 11 mechanisms that you must know; be able to provide starting materials, products (showing stereochemistry), reagents, intermediates, and show electron flow from step to step – (1) acid-catalyzed hydration of alkenes; (2) SN1 reactions; (3) SN2 reactions
  - Chapter 11 reactions that you need to be able to predict the reactants, products, reagents, and identify the key intermediates/transition states. You do not need to know the detailed mechanisms step by step, but should be able to correctly identify the key intermediate

which controls stereochemistry or regiochemistry of the addition step – (1) oxymercuration – demercuration; (2) hydroboration – oxidation.

- A big focus of this chapter was in the conversion of the poor leaving group OH to a good leaving group to facilitate a reaction: (1)  $\text{H}^+$ ,  $\text{H}_2\text{O}$ ; (2)  $\text{PBr}_3$  or  $\text{PCl}_3$ ; (3)  $\text{SOCl}_2$  were all used for this purpose; be able to predict products and product stereochemistry
- You will have a Williamson ether synthesis problem, discussed on page 489 in text
- Know the common reagents that produce epoxides as products
- Be able to provide products, showing correct stereochemistry and regiochemistry for the acid and base-catalyzed reactions of epoxides – remember these are  $\text{S}_{\text{N}}1$ -like and  $\text{S}_{\text{N}}2$ -like, so are on the must know list
- Chapter 12 alcohols from carbonyl compounds
  - Be able to identify the nucleophile, electrophile and show proper use of arrows for nucleophilic addition to carbonyl compounds
  - Be able to identify when an oxidation or reduction has occurred and assign oxidation states to molecules based on the number of C-O versus C-H bonds
  - $\text{LiAlH}_4$  and  $\text{NaBH}_4$  are reducing agents (both deliver  $\text{H}^-$  to  $\text{C}=\text{O}$ ) but have different reactivity; which one is used for all types of functional groups? And which one is not? aldehydes, ketones, esters, and acids; be able to predict products of reduction reactions using these two reagents with  $\text{C}=\text{O}$
  - Make a list of the oxidizing agents provided in chapter 12 and be able to recognize them and provide products and reagents for their reactions. 1 will stop at the aldehyde stage, which one? No mechanisms of oxidations.
  - Chapter 12 mechanisms that you must know; be able to provide starting materials, products (showing stereochemistry), reagents, intermediates, and show electron flow from step to step – (1) reduction of  $\text{C}=\text{O}$  compounds using  $\text{H}^-$  agents, including aldehydes, ketones, esters, and acids; (2) addition of Grignard and organo lithium agents to  $\text{C}=\text{O}$
  - Know how to prepare Grignard and alkyl lithium reagents – understand solvent choice, and be able to provide reagents and products if asked
  - Grignards and alkyl lithium agents possess a  $\text{C}^-$  or nucleophilic carbon, which make them very reactive in reactions with other electrophilic carbons such as in epoxides or as a strong base with any proton source. Be able to design a synthesis of a small organic molecule using these new reactions.