

Phillips, CHE 256, Organic Chemistry II Test 3 Review Sheet

I will be available Sunday afternoon from 3-6 p.m. for last minute questions; TEC 404; Call my office phone if the outer door to the building is locked (601)266-4083

General details

- Although this test will focus on the material from chapters 16, 17, and 18, elements from previous chapters will be included as fundamentals.
- 15 questions, mixture of multiple choice and short answer
- 3 questions directly from homework problems from chapters 16-18
- You will have 1 bonus question – an NMR question, 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, IR table, pKa table, and 3 extra sheets of paper.
- You are allowed to bring models **preassembled** for the test. I suggest a few tetrahedral carbons and a butane molecule, with lots of extra atoms of various colors.
- Your test will include 1 nomenclature question, where you will be asked either to provide the name or molecular structure of several molecules relevant to chapters 16-18
- Your test will include 1 multi-step synthesis question, similar to the homework exercise that I provided. You will need to be able to choose the best combination of reagents for a given chemical transformation.

Specific details

- Chapter 16 Aldehydes and Ketones I
 - Synthesis of aldehydes – aldehydes may be prepared from the (1) oxidation of primary alcohols, (2) reduction of acyl chlorides, esters, and nitriles. Review the reagents required for these transformations. You will be asked to provide reagents, starting materials, or the products of these reactions.
 - Synthesis of ketones – ketones can be prepared from ozonolysis, Friedel-Crafts acylations, by the oxidation of secondary alcohols, and the Grignard reactions of nitriles. Review the reagents required for these transformations. You will be asked to provide reagents, starting materials, or the products of these reactions.
 - Aldehydes and ketones are susceptible to nucleophilic attack at the carbonyl carbon. There are differences in reactivity among these two functional groups related to steric and electronic factors. Be able to discuss the differences in reactivity among a series of compounds toward hydrate, hemiacetal or acetal formation.
 - Be able to define hydrate, hemiacetals, and acetals, and identify them by their structure.
 - One of your questions will result from the use of acetal formation as “protecting group” chemistry, reviewed in section 16.7c of your text.
 - Aldehydes and ketones react with primary amines to form imines and with secondary amines to form enamines. Be able to predict the products of these reactions.
 - Be able to identify a ylide reaction (e.g., Wittig reaction) and provide the reactants, products, and 4-membered ring intermediate.
- Chapter 17 Aldehydes and Ketones II
 - All the new chemistry in this chapter depends entirely on your ability to perform a keto-enol tautomerization, and understand the factors that affect the acidity of the α C-H bond to the carbonyl and how this may be used to generate a carbanion nucleophile. If given the structure of the ketone, be able to draw the tautomerization (acid or base catalyzed) between the keto and enol forms, and what impact does this tautomerization have on any stereochemistry at the α position?

- Be able to predict the products of the haloform reaction, and know which compounds would yield a positive haloform test. Remember that this reaction is used in the following chapters as one of the ways in which a carboxylic acid can be prepared.
 - The aldol reaction is a very important reaction – you will need to know the mechanism (acid and base catalyzed) of this reaction. Why is the dehydration step of the aldol addition product a thermodynamically favored event?
 - In the nucleophilic addition to α,β -unsaturated carbonyl containing compounds, nucleophilic addition can occur as a 1,2 addition or a 1,4 addition. Know which reagents prefer the 1,2 versus 1,4 pathways, and be able to provide the products of these reactions.
- Chapter 18 Carboxylic acids and their derivatives
 - Review acid/base chemistry – know the factors that can affect acid or base strength (e.g. resonance and induction)
 - Page 789-790 in your textbook provides a wonderful review of the reactions which can be used to prepare carboxylic acids; know the reagents
 - The nucleophilic addition and elimination reaction is one you will need to review carefully, as most of the chemistry of the last 3 chapters is summarized in this mechanistic description – very important that you be able to provide the mechanism of a simple addition and elimination reaction.
 - The addition and elimination mechanism can be acid or base catalyzed, know the steps where acid catalysis is important and the big differences in the acid and base catalyzed pathways.
 - A great deal of work has been done to mechanistically elucidate the addition and elimination mechanism, such as the use of isotopic labeling and stereochemical probes. Be able to describe the use of these techniques in the verification of the addition-elimination mechanism over potentially competitive processes.
 - Other reagents that you should be able to identify and know their synthetic utility: $-\text{CN}$, SOCl_2 , PCl_5 , pyridine,
 - Know the terms and reactions for transesterification, saponification, hydrolysis and their relevant functional group chemistry