Survey of Organic Chemistry
Chemistry 326 Lecture Section
Fall 2018
Dr. Badger
Web Site: https://crbadger.uwsp.edu/rbadger/326/

Contents:

The Instructor (contents)

- Name: Dr. Robert Badger (colleagues or fellow basketball players call me Bob; students usually call me Dr. Badger or Dr. B)
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Philosophy (contents)

Chemistry 326 is the second semester a two semester organic chemistry course designed to introduce you to the properties, applications and importance of organic substances. In lecture we shall discuss - demonstrate - elucidate - illuminate material from chapters 11-30 of Smith. This necessarily means we will move at a fairly rapid pace and in some cases will not be able to discuss in sufficient detail material that may be of interest or confusing to you. I urge you to ask questions in lecture, stop by my office, or stop me in the street, if necessary, to obtain satisfactory solutions to problems you may have. I can not guarantee to have all the answers, but I will try to find them, if possible.

Format:

The course consists of three hours of lecture per week, three hours of lab per week and, at least, eight hours per week outside of class; some of the outside hours will be spent in on line and electronic notebook activities.

Audience:

Sophomores and Juniors majoring in chemistry, biochemistry or pre-professional preparation in pharmacy, medicine and other health professions. You must have achieved at least a C- or better in Chemistry 325.

Goals:

- To understand how microscopic molecular and electronic structure correlate with macroscopic physical properties and chemical reactivity.
- To understand how electron movement during chemical reactions cause atoms to move and change their bonding character.
- To understand how laboratory observations, measurements and experiments have led to the fundamental chemical concepts that describe the molecular structure and reactions of organic molecules.

Required and Supplementary Materials

REQUIRED:

Course Text: Smith, J. G., "Organic Chemistry," 5rd Edition, McGraw/Hill, 2017. Available at text rental. Chemistry majors ought to purchase this text or an equivalent one.

A black or blue ultra fine point Sharpie to be used in the lab for labeling glassware and samples.

Sapling Learning - Organic Chemistry Question Sets

$40.00 per semester online purchase.

Sapling's chemistry questions are delivered in a web browser to provide real-time grading, response-specific coaching, improvement of problem-solving skills, and detailed answer explanations. Dynamic answer modules enable one to interact with 3D models and figures, utilize drag-and-drop synthetic routes, and draw chemical structures - including stereochemistry and curved arrows.

Welcome students, we will be using Sapling Learning for our homework. To get started:

1. Go to http://saplinglearning.com and click "US Higher Ed" at the top right.
2.
    a. If you already have a Sapling Learning account, log in and skip to step 3.
    b. If you have Facebook account, you can use it to quickly create a SaplingLearning account. Click the blue button with the Facebook symbol on it (just to the left of the username field). The form will auto-fill with information from your Facebook account (you may need to log into Facebook in the popup window first). Choose a password and timezone, accept the site policy agreement, and click "Create my new account". You can then skip to step 3.
    c. Otherwise, click "create account”. Supply the requested information and click "Create my new account". Check your email (and spam filter) for a message from Sapling Learning and click on the link provided in that email.
3. Find your course in the list (listed by subject, term, and instructor) and click the link.

4. Select your payment options and follow the remaining instructions.
5. Work on the Sapling Learning training materials. The activities, videos, and information pages will familiarize you with the Sapling Learning user environment and serve as tutorials for efficiently drawing molecules, stereochemistry, etc. within the Sapling Learning answer modules. These training materials are already accessible in your Sapling Learning course.

* Once you have registered and enrolled, you can log in at any time to complete or review your homework assignments.

* During sign up - and throughout the term - if you have any technical problems or grading issues, send an email to support@saplinglearning explaining the issue. The Sapling support team is almost always more able (and faster) to resolve issues than your instructor.

* To optimize your Sapling Learning experience, please keep your internet browser and Flash player up to date and minimize the use of RAM-intensive programs/websites while using Sapling Learning.

Recommended:

- Molecular models (**strongly recommended**) can be purchased from the bookstore or over the internet. They range in price from about $10 to $40 or more. I particularly like the Indigo Instruments MolyMod kit. It is flexible and contains enough pieces to meet your current and future chemistry course needs. Another option would be to visit A113, our computer lab, and experiment with GausView a molecular modeling program. A somewhat less expensive possibility would be to purchase some gumdrops and toothpicks. In any event, make sure you have access to some models before the first exam.
- Laboratory Text: Anne B. Padias *Making the Connections: A How-To Guide for Organic Chemistry Lab Techniques*, 2nd ed.; Hayden/McNeil, Plymouth, MI, 2011. For purchase in the bookstore.
- I expect you to be able to solve all of the problems presented in the book paying especial attention the ones I have indicated in the study guide for each chapter. A student study guide and solutions manual for these problems is available for purchase in the bookstore, in the LRC reserve room and on the internet. I will be happy to discuss any of these problems in class or my office, but will not post answers since the solution manual is available.
  Janice Gorzynski Smith and Erin Smith Berk, *Student Study Guide/Solutions Manual to accompany "Organic Chemistry", 3rd Edition*, McGraw/Hill, 2011.

Lecture:

Attendance records will be maintained and extended absences will be reported to the Dean of Students. Attendance, in itself, will have no direct effect on your grade, but your performance on exams, and problem sets will undoubtedly suffer.

Lab:

Laboratory attendance is mandatory, since you will not be able to perform experimental work anywhere else.

Absences:

The student is responsible for all missed material.

Grading (contents)

Generally, final grades will be based on total points and will be assigned on the following curve:

grade	Percent points possible	Course Exercise	Course point allocations
A	93	Three Hour exams	300 pts.
A-	90-93	Twelve Problem Sets	120 pts.
B+	87-90	Laboratory	155 pts
B	83-87	Final exam	150 pts.
B-	80-83	Total	755 pts.
C+	77-80		
C	73-77	Lab points breakdown	
C-	70-73	Electronic Lab Notebook	75 pts.
D+	67-70	Post Labs and samples	40 pts.
D	60-70	Prelabs (four)	40 pts.
F	60		

I reserve the right to alter this curve depending on the overall performance of the class. I will under no circumstances raise this curve.

Exams (contents)

Exams are closed book and will be given during the Friday class hour indicated on the attached schedule(last page). Questions will be taken mainly from the lecture and assigned text. It has become my policy to include one or more problems from each chapter on exams. Thus, by diligently working the problems, you are assured of being able to successfully answer at least two or three questions correctly on exams. The more problems you solve the better your exam results will be. I have made sample exams available via the Chemistry 326 home page. These samples will give you an idea of the depth and type of questions I will ask.

Typically the exams will consist of five types of questions: 1) multiple choice similar to the problem sets; 2) short, fill in the blank questions, typically nomenclature questions; 3) three or four short reaction or structure drawing questions; 4) two of three longer essay questions, typically explain in some detail the mechanism of a reaction or formation of a particular product, for which partial credit will be given; and 5) define, describe and possibly explain questions.

Materials you may bring: pencils, pens, erasers, calculators and one side of one 3 x 5 inch index card containing any information you feel may help you on the exam.

Materials I will provide: the exam, a periodic chart, and scratch paper.

Please note the excerpt from UWSP 14 below. I am concerned about academic misconduct. It is my policy that anyone guilty of academic misconduct will receive an F for the course grade. I intend to initiate some or all of the following measures to protect your intellectual property:

- **Assigned exam seats** On exam day I may project a list of assigned seats and you will be required to sit in your assigned seat or, if and as space allows, a seat that is completely isolated from others.
- **Unique exam** I may create two or more different exams on different colored paper. You must have a different colored exam than your neighbor to the left and right.
- **Video tape** I may video tape the exam to assist in preventing academic misconduct.
- **Your assistance** During the exam please take every precaution to protect your intellectual property - the answers you have placed on your exam. Keep your eyes on your paper or the periodic chart at the front of the class.

UWSP 14.03 ACADEMIC MISCONDUCT SUBJECT TO DISCIPLINARY ACTION. (contents)

Academic misconduct is an act in which a student:

1. Seeks to claim credit for the work or efforts of another without authorization or citation;
2. Uses unauthorized materials or fabricated data in any academic exercise;
3. Forges or falsifies academic documents or records;
4. Intentionally impedes or damages the academic work of others;
5. Engages in conduct aimed at making false representation of a student's academic performance; or
6. Assists other students in any of these acts.
7. Examples of academic misconduct include, but are not limited to:

- cheating on an examination
- collaborating with others in work to be presented, contrary to the stated rules of the course
- submitting a paper or assignment as one's own work when a part or all of the paper or assignment is the work of another
- submitting a paper or assignment that contains ideas or research of others without appropriately identifying the sources of those ideas
- stealing examinations or course materials
- submitting, if contrary to the rules of a course, work previously presented in another course
- tampering with the laboratory experiment or computer program of another student
- knowingly and intentionally assisting another student in any of the above, including assistance in an arrangement whereby any work, classroom performance, examination or other activity is submitted or performed by a person other than the student under whose name the work is submitted or performed.

Homework (contents)

The most efficient way to learn new material is to practice applying it. To this end, I will give 12 multiple choice problem sets (one for each chapter) worth 10 points each which will be submitted via the internet. While you are encouraged to discuss these problems with the instructor and classmates you must ultimately provide your own answers.

Lab (contents)

The lab grade is broken down into four parts:

Electronic Lab Notebook(70 pts.)

Grading:

The guiding principle in writing up an experiment is to record all the details which would enable another person to understand what was done and to repeat the entire experiment exactly without prior knowledge. An important first step to this process is a table of physical data, such as chemical names, chemical formulas, reported melting point where boiling point, expected mass/moles that will be used or produced. This page should also include balanced chemical reactions produced using ChemDraw or other structure drawing program. Thus, in addition to a written account of the work done, including notes on any special apparatus used, details of all volumes, weights, temperatures, times, chromatographic procedures (for instance TLC were GLC) and conditions and results, etc., must all be recorded. The writing up of all laboratory work must be done at the time of the work, in your electronic lab notebook; a loosely notebook is not suitable. It is important that numerical results such as yields, melting points and boiling points, etc., are entered directly into the notebook and not on scratch paper. The latter are liable to be lost and your use encourages untidy practical habits. Spectral data, such as proton and carbon NMR spectra and infrared spectra should be annotated and pasted directly into a graphics pane of a notebook page. Digital data files can be attached directly to that page to make it easier to retrieve and examine the spectra. Pictures of experimental apparatus and other analyses can also be placed in the notebook. (paraphrased from Kanare, H. M. **Writing the Laboratory Notebook;**, American Chemical Society: 1985 and Furniss et al, **Vogel's Textbook of Practical Organic Chemistry,** 5th ed., Wiley, 1989, p. 32.)

Five points for each lab period, are allocated for keeping the notebook up to date which means you must make at least one notebook entry each day describing what you have done. I will periodically scan through your notebook and comment on what you have posted. The 'guiding principle' stated above will be the rubric used to evaluate your records. Basically you will start each lab period with five points. If you do a good job recording your work, you will receive the five points.

Laboratory Maintenance(1 point for each day I have to clean up)

I will inspect all workstations at end of each lab period to see that your benchtop, sink, and common equipment are in good working order. White solids and unidentifiable liquids on your benchtop will result in loss of points. Paper towels, broken glass and other water insoluble solids found in the sink may result in loss of points for all students in the lab. Improperly or unlocked equipment drawers will result in loss of points. Everyone will lose one maintenance point every time I am required to clean up the balances or chemical hoods. Please speak with me if you are unsure how to clean up a particular spill.

Prelabs (four)(40 pts.)

The multiple choice prelabs will consist of 10 or more questions that you will be able to answer by reading the lab procedure, the recommended pages in Padias and material in your lecture text that pertain to reactions being performed. There will undoubtably be some questions you can not answer without help from me. Please do not hesitate to ask and I will point you in the correct direction to answer the questions. This multiple choice component will be worth 5 points. The remaining 5 points will be allocated to a materials and reactions page that must be posted in your electronic notebook before the project begins. You may use laboratory time to answer these questions and prepare the materials page.

Samples and sample characterization(60 pts)

You will be submitting four samples for evaluation. Five points are allocated for submission of the physical sample itself and the remaining 10 are allocated to the presentation and analysis of physical data (mp, bp, mass, percent yield) and spectral data (ir, proton and carbon nmr) in your notebook. Missing data will cost you points. You must get all data into your notebook as soon as possible after making the measurements.

Schedules (contents)

Chemistry 326 - Tentative Lecture Schedule - Fall 2018

Modified on Monday, September 3, 2018 at 3:22 PM.					
Exams will be held on the Exam days during the lecture hour.					
Problems sets will be due on problem days by midnight.					
Reading assignments in Smith.					
September					
Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Reading Assign.**
3	4	5	6	7	Chap 11 & Chap 13
10	11	12	***13 Prob 1***	14	Chap 12
17	18	19	***20 Prob 2***	21	Chap 16
24	***25 Prob 3***	26	27	28 Exam 1	Chap 17
October					
Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Reading Assign.**
1	2	3	***4 Prob 4***	5	Chap 18
8	9	10	***11 Prob 5***	12	Chap 20
15	16	17	***18 Prob 6***	19	Chap 21
22	23	24	***25 Prob 7***	26	Chap 19
29	***30 Prob 8***	31			Chap 22
November					
Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Reading Assign.**
	Prob 8		1	2 Exam 2	Chap 22
5	6	7	***8 Prob 9***	9	Chap 23
12	13	14	***15 Prob 10***	16	Chap 23
19	20	21	22	23	Chap 24
26	27	28	***29 Prob 11***	30	Chap 25
December					
Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Reading Assign.**
			Prob 11		Chap 25
3	***4 Prob 12***	5	6	7 Exam 3	Chap 28
10	11	12	13	14	Chap 15
17 Chem 329 10:15 AM - 12:15 PM	18	19	20 Chem 326 8:00-10:00 AM	21	

Chemistry 326 - Tentative Lab Schedule - Fall 2018

Multiple choice prelabs must be submitted by midnight on the specified due date. Materials page and reactions are due in your notebook 24 hours before your lab section is scheduled to begin a given project. Post labs are due by midnight on the date specified. The readings below refer to experiment web pages under the lab menu on the chem 326 web site(https://crbadger.uwsp.edu/rbadger/326/).

Week	Starting Date	Experiment	Reading Assignment pp
1	Sept. 5-10	Check-in	Check-in
	Sept. 11	***Benzoin Prelab is due***	
2	Sept. 12-17	Reduction of Benzoin	
3	Sept. 19-24	Reduction of Benzoin	
4	Sept. 25-Oct. 1	Reduction of Benzoin	
	Oct. 2	***Acetylferrocene Prelab is due***	
5	Oct. 3-8	Preparation of Acetylferrocene	
	Oct. 12	***Benzoin Postlab is due***	
6	Oct. 10-15	Preparation of Acetylferrocene	
7	Oct. 17-22	Preparation of Acetylferrocene	
	Oct. 23	***Triphenylmethanol Prelab is due***	
8	Oct. 24-29	Preparation of Triphenylmethanol	
	Nov. 2	***Acetylferrocene Postlab is due***	
9	Oct 31 - Nov 5	Preparation of Triphenylmethanol	
10	Nov. 7-12	Preparation of Triphenylmethanol	
	Nov. 13	***Esterification Prelab is due***	
11	Nov. 14-19	Fischer Esterification	
	Nov. 30	***Triphenylmethanol Postlab is due***	
12	Nov. 26-29	Fischer Esterification	
13	Dec. 3-6	Fischer Esterification	
14	Dec. 10-13	Check-out	
	Dec. 20	***Esterification Postlab is due***	

Learning Goals (contents)

Chapter 11 Alkynes

1. Be able to name alkynes and draw structures from their names.
2. Be able to explain why terminal alkynes are more acidic than alkanes or terminal alkenes.
3. Be able to generate acetylides from terminal alkynes.
4. Be able to synthesize alkynes from reaction of acetylides with alkyl halides.
5. Be able to synthesize alkynes via elimination reactions.
6. Be able to predict the products of reaction between alkynes and hydrogen, HCl, HBr, HI, Cl_2, Br_2, Cl_2/H_2O, or Br_2/H_2O .
7. Be able to predict and explain the products formed via '***hydration*** ' of alkynes with 1) BH_3/ 2) basic H_2O_2.

Suggested problems: pages 421-425

25, 27, 28, 29, 30, 37, 41, 45, 46, 48, 49, 53, 57, 58, 61, 67

Last update:

Chapter 13 Mass Spectrometry and Infrared Spectroscopy

1. Be able to integrate IR and NMR to determine structure.
2. Given the structure of a molecule, be able to predict important features of its IR and NMR spectra.
3. Be able to identify functional groups (alkane, alkene, alkyne, aromatic, alcohols, amines, aldehydes, ketones, carboxylic acids, carboxylic esters, and amides) present in a molecule from characteristic band frequency, intensity and shape.
4. Be able to predict stretching frequencies and band shapes for a given structure.
5. Be able to identify conjugated systems from their IR frequencies.

Spectroscopy Tutorials

Suggested problems: Pages 521-526

26, 31, 33, 48, 50, 58

Last update:

Chapter 14 Nuclear Magnetic Resonance Spectroscopy

1. Be able to determine the number of different hydrogens and carbons given the molecular structure.
2. Be able to predict the number of signals and approximate chemical shifts from the molecular structure in both ^1H and ^{13}C spectra.
3. Be able to predict which nuclei will be magnetically coupled.
4. Be able to predict the number of peaks and coupling constants expected from

magnetically coupled systems.
5. Be able to use the integral trace of an ^{1}H spectrum to determine the relative number of hydrogens.
6. Be able to integrate data from NMR (proton and carbon-13) and IR to determine the structure of organic compounds.

Suggested problems: Pages 561-567

34, 35, 36, 40, 41, 42, 44, 46, 49, 50, 51, 54, 58, 59, 63, 65, 68

Last update:

Chapter 12 Oxidation and Reduction

1. Be able to identify whether the organic reactant in a reaction has undergone oxidation or reduction.
2. Be able to identify the common reduction reactions of carbon-carbon multiple bonds.
3. Be able to determine the stereoselectivity of the common reduction reactions of carbon-carbon multiple bonds.
4. Be able to use the common reduction reactions of carbon-carbon multiple bonds in synthetic processes.
5. Be able to identify the common reduction reactions of alkyl halides and expoxides with lithium aluminum hydride.
6. Be to identify the common oxidation reactions of alkenes, alkynes and alcohols.

Suggested problems: pages 487-493

29, 30, 32, 36, 38, 42, 43, 47, 49, 50, 53, 61, 62, 63, 65, 67, 69

Suggested problems: Pages

Last update:

Chapter 16 Conjugation, Resonance and Dienes

1. Be able to draw simple pi molecular orbitals for isolated dienes and conjugated dienes.
2. Be able to draw resonance structures for allyl and conjugated systems.
3. Be able to evaluate the relative stability of resonance structures.
4. Be able to draw mechanisms that explain 1,2 and 1,4 electrophilic additions to conjugated dienes.
5. Be able to draw the products and stereochemistry of Diels-Alder reactions of dienes.
6. Be able to discuss and identify the products of kinetic control.
7. Be able to discuss and identify the products of thermodynamic control.

Suggested problems: pages 634-640

29, 30, 32, 34, 35, 39, 41, 43, 49, 50, 56, 58, 71

Last update:

Chapter 17 Benzene and Aromatic Compounds

1. Be able provide common names for aromatic molecules.
2. Be able to draw the Kekule structures for benzene.
3. Be able to predict/explain proton and carbon nmr chemical shifts for aromatic systems.
4. Be able to draw the bonding molecular orbitals for benzene and cyclobutadiene.
5. Be able to identify non-aromatic, anti-aromatic and aromatic systems.
6. Be able state the principle requirments for aromatic systems.
7. Be able to identify heterocyclic aromatic systems and specify the electon pairs that are part of the aromatic system (furan and pyrole).
8. Be able to identify charged aromatic systems such as the cylopentadienyl anion and the tropilium cation.

Suggested problems: pages 668-640

End of chapter: 23, 27, 28, 30, 32, 33, 34, 40, 43, 46, 48, 53, 55/p>

Last update:

Chapter 18 Electrophilic Aromatic Substitution

1. Be able to predict products of the reaction of benzene, mono and di substituted benzenes with:
    1. $Br_2/AlBr_3$
    2. H_2SO_4/SO_3
    3. HNO_3/H_2SO_4
    4. $R\text{-}Cl/AlCl_3$
    5. $R\text{-}C{=}OCl/AlCl_3$
2. Be able to draw mechanisms for the above reactions including all resonance structures for reactive intermediates.
3. Be able to explain activating/deactivating effects based upon mechanisms of electrophilic aromatic substitution.
4. Be able to explain ortho-para and meta directing effects of substituients.
5. Be able to design syntheses that use the reactions above to prepare compounds.
6. Be able to predict and explain reactions of benzylic positions in aromatic compounds.

Suggested problems: pages 721-727

End of chapter: 34, 35, 38, 41, 45, 46, 47, 48, 49, 54, 60, 63, 64, 74

Last update:

Chapter 20 Introduction to Carbonyl Compounds

1. Be familiar with the reduction of carbonyl compounds, α, β unsaturated compounds acid chlorides, esters, carboxylic acids, and amides. Review the oxidation of aldehydes with CrO_3, $Na_2Cr_2O_7$, $K_2Cr_2O_7$, $KMnO_4$ and Ag_2O/NH_4OH.
2. Be able to prepare and describe Grignard reagents and their common reactions.
3. Be able to prepare and describe organolithium reagents and their common reactions.
4. Be able to prepare and describe Gilman (organocuprates) reagents and their common reactions.
5. Be able to prepare and describe lithium and sodium acetylides and their common reactions.
6. Be able to use silyl groups to protect alcohols in synthetic schemes.

Suggested problems: pages 808-815

End of chapter: 36, 37, 38, 41, 46, 49, 51, 55, 56, 59, 62, 63, 69, 73

Last update:

Chapter 21 Aldehydes and Ketones - Nucleophilic Addition

1. Be able to name/draw structures of ketones and aldehydes.
2. Be able to interpret NMR, IR and mass spectra of ketones and aldehydes and determine their structures from spectral data.
3. Be able to predict reaction products of ketones and aldehydes with:
   - Grignard reagents
   - organolithium reagents
   - Wittig Reagents (phosphorus ylides)
   - hydrogen cyanide
   - ammonia and amines
   - water
   - alcohols and glycols
   - hydrogen/catalyst
   - sodium borohydride
   - lithium aluminum hydride

   Assume that aqueous acid workup will be used as appropriate for some of these reactions.
4. Draw mechanisms for the above reactions.

Suggested problems: pages 858-866

End of chapter: 40, 41, 42, 43, 44, 46, 47, 55, 56, 59, 61, 62, 64, 67, 72, 75, 76, 80

Last update:

Chapter 19 Carboxylic Acids

1. Be able to provide IUPAC and common names for carboxylic acids containing up to 10 carbon atoms.
2. Be able to provide IUPAC and common names for dicarboxylic acids containing up to 6 carbon atoms.
3. Be able to prepare carboxylic acids from primary alcohols and alkyl substituted benzene rings.
4. Be able to predict and explain the relative acidity of carboxylic acids, phenols, and alcohols.
5. Be able to predict reaction products with sodium bicarbonate, sodium hydroxide and strong mineral acids.
6. Be able to recognize an α-amino acid.
7. Be able to define the isoelectric point for amino acids and be aware that the pI is usually the average of the pK_a of the carboxylic acid and the ammonium ion.

Suggested problems: pages 757-763

End of chapter: 28, 29, 30, 31, 32, 33, 36, 38, 41, 48, 50, 55, 58, 63, 67, 69

Last update:

Chapter 22 Carboxylic Acid Derivatives

1. Be able to provide common and IUPAC names for simple acid derivatives discussed in the chapter.
2. Be able to explain the differences in physical properties of acids and acid derivatives.
3. Be able to interconvert acid derivatives via acyl substitution.
4. Be able to draw mechanisms for interconversion of acid derivatives.
5. Be able to predict products of acid derivatives when reacted with:
    1. H_2O acidic or basic conditions
    2. LAH
    3. Grignard reagents
    4. Organolithium reagents
    5. Alcohols
    6. Amines
6. Be able to draw mechanisms for the acid catalyzed or base promoted hydrolysis of acid derivatives.
7. Be able to draw mechanisms for the reaction of acid chlorides and acid anhydrides

with alcohols and amines.
8. Be able to synthesize acid derivatives from carboxylic acids.

Suggested problems: pages 914-922

End of chapter: 37, 38, 40, 41, 42, 43, 45, 47, 52, 54, 55, 57, 58, 62, 67, 70, 73, 76, 82

Last update:

Chapter 23 Substitution Reactions of Carbonyl Compounds at the α Carbon

1. Be able to draw mechanisms for acid and base catalyzed keto-enol tautaumerizations.
2. Be able to predict products and draw mechanisms for base promoted halogenation of ketones.
3. Be able to describe the conditions that effect kinetic or thermodynamic formation of α enolate anions.
4. Be able to predict the products and draw the mechanism of α alkylation reactions.
5. Be able to predict the products and draw the mechanisms of malonic ester synthesis.
6. Be able to predict the product and draw the mechanism of the acetoacetic ester synthesis.
7. Be able to use theses α carbonyl reactions to synthesize compounds.

Suggested problems: pages 953-960

End of chapter: 29, 31, 33, 34, 35, 39, 42, 43, 44, 45, 49, 50, 54, 59, 63, 66, 69

Last update:

Chapter 24 Carbonyl Condensation Reactions

1. Be able to predict the products and draw the mechanisms of base promoted aldol and crossed aldol condensations.
2. Be able to predict the products and draw the mechanisms of Claisen, crossed Claisen and Dieckmann condensations.
3. Be able to predict the product and draw the mechanism of Michael addition reactions.
4. Be able to use the aldol condensation, Claisen condensation, Michael addition, Robinson annelation, acetoactic ester and malonic ester reactions to synthesize compounds.

Suggested problems: pages 987-994

End of chapter: 28, 30, 31, 32, 38, 42, 43, 45, 47, 49, 51, 52, 60, 65, 66, 71

Last update:

Chapter 25 Amines

1. Be able to name simple amines.
2. Be able to explain/predict the relative boiling points of amines.
3. Be able to explain/predict the relative basicities of amines.
4. Be able to draw the products formed when amines react with strong acids.
5. Be able to prepare amines via substitution and reduction reactions.
6. Be able to predict the products when amines reaction with aldehydes, ketones, acid chlorides and acid anhydrides.
7. Be able to predict the products formed when amines (primary, secondary and tertiary aliphatic and aromatic) react with nitrous acid.
8. Be able to exploit the synthetic utility of primary aromatic amines in synthetic processes.
9. Be able to explain and predict the products of Hoffman elimination.

Suggested problems: pages 1041-1048

End of chapter: 35, 36, 37, 38, 39, 40, 41, 43, 48, 49, 51, 52, 55, 61, 65, 72, 74

Last update:

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Chapter 28 Carbohydrates

1. Know the meaning of: carbohydrate, monosaccharide, oligosaccharide, polysaccharide, disaccharide, trisaccharide.
2. Know the meaning of: aldose, ketose, triose, tetrose, pentose, hexose, glyceraldehyde, dihydroxyacetone.
3. Know the meaning of: D- or L-sugar, Fischer projection formula, Haworth formula, epimer.
4. Know the meaning of: (α and β configurations, anomer, furanose and pyranose forms, mutarotation.
5. Know the meaning of: glycosidic bond, reducing and nonreducing sugar, aldaric acid, aldonic acid.
6. Draw the Fischer projection formula for a simple monosaccharide.
7. Tell whether two structures are epimers or anomers.
8. Given the acyclic formula for a monosaccharide, draw its cyclic structure in either the pyranose or furanose form and either (α or β configuration.
9. Given the formula for a monosaccharide, draw the formula for its glycoside with a given alcohol or with a given additional monosaccharide.
10. Draw the cyclic structures (Haworth projection and conformational structure) for (α-D- and β-D-glucose and the corresponding methyl glycosides.

1. Be able to draw the Fischer projection of D-glucose from memory.
2. Be able to draw the Haworth projection or chair conformation(all substituents equatorial) of beta-D-glucose.
3. Given the Fischer projection of a keto or aldohexose, be able to draw the Haworth projection of the alpha or beta epimers of furanose or pyranose rings.
4. Be able to name mono and disaccharides and draw structures from names.
5. Be able to draw the mechanism for base catalyzed epimerization and enediol rearrangement of aldoses.
6. Be able to predict whether a carbohydrate will mutarotate.
7. Be able to predict whether a carbohydrate is a reducing sugar.
8. Be able to draw and identify glycidic linkages.
9. Be aware of the oxidation (with Ag_2O/NH_4OH or HNO_3) and reduction products of the aldohexoses.

Omit sections: 28.10, 28.10A, 28.10B, 28.10C, 28.11

Suggested problems: pages 1147-1151

End of chapter: coming soon

Last update:

Chapter 15 Radical Reactions

1. Be able to draw initiation, propagation and termination elementary steps for free radical halogenation.
2. Be able to draw Lewis structures and describe the characteristics of free radical reactive intermediates.
3. Be able to utilize bond dissociation energies to evaluate energy changes in the elementary steps of free radical halogenation.
4. Be able to utilize bond dissociation energies to assist in the construction of reaction coordinate diagrams.
5. Be able to explain what is meant by the rate determining step and activation energy.
6. Be able to draw the transition state for the rate determining step in the halogenation of alkanes.
7. Explain the relative reactivity of primary, secondary and tertiary hydrogens in halogenation reactions.
8. Explain the relative stability of primary, secondary and tertiary alkyl radicals.
9. Be able to explain and draw the stereochemistry of products formed in free radical processes when a new chiral center is formed and when a chiral center is already present in the reactant.
10. Explain the free radical halogenation of allyl and benzyl systems with NBS.
11. Explain the addition of HBr to alkenes in the presence of peroxides.

Suggested problems: pages 596-603

28, 30, 31, 32, 33, 37, 38, 40, 42, 43, 45, 50, 57, 66, 70, 71, 75

Last update:

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