

Chemistry 21

Organic Chemistry I

Fall, 2009

Dr. J. F. Harwig

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PREREQUISITES

Chemistry 11 *and* Chemistry 12 completed with minimum grades of C

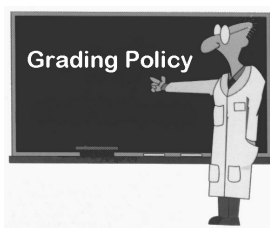
OBJECTIVES

Chemistry 21, first semester organic chemistry, is a rigorous systematic introduction to the chemistry of carbon compounds. The course provides a foundation for further work in organic chemistry (Chemistry 22/24) and biochemistry (Chemistry 31).

Chemistry 21 encompasses both modern organic chemical theory and the descriptive chemistry of the principal functional groups. Topics include bonding and structure, nomenclature, stereochemistry, structure-reactivity relationships, and synthesis and reactions of the hydrocarbons and derivatives. Emphasis is placed on application and interpretation of experimental data in determination of molecular structure and in elucidation of reaction mechanisms, and on development of practical strategies for synthetic inter-conversion among functional groups. The laboratory work focuses on techniques of synthesis, isolation, purification and analysis, both in theory and in practice.

MATERIALS and RESOURCES

- 1) Textbook: Bruice, *Organic Chemistry*, 5th Edition.
- 2) Study Guide/Solutions Manual: Bruice, *Study Guide & Solutions Manual* to accompany *Organic Chemistry*, 5th Edition.
- 3) Lab Manual: Mohrig, Hammond, Schatz and Morrill, *Modern Projects and Experiments in Organic Chemistry*, 2nd Ed. ("Miniscale and Standard Taper Microscale" version)
- 4) Experimental Techniques Manual: Mohrig, Hammond and Schatz, *Techniques in Organic Chemistry*, 2nd Ed.
- 5) Laboratory Notebook: 10 1/4 x 7 7/8 inches, 5 mm x 5 mm quad ruled, permanent binding.
- 6) Laboratory Locker Fee Card.
- 7) SMC Network Account
- 8) Scientific Calculator.
- 9) Molecular Models: Allyn and Bacon Molecular Model Set for Organic Chemistry, or similar model set.
- 10) Chemistry template: Pickett 1210i, Rapidesign R-83 or equivalent.
- 11) Protective safety goggles for lab work. Prescription eyeglasses alone and ordinary safety glasses are *not* acceptable.
- 12) Disposable rubber gloves for lab work (nitrile, *not* latex).
- 13) Lab coat/lab apron to protect clothing during lab work.



Quizzes

There will be a short (~ 20 minute) quiz most Thursdays, except for weeks in which an exam is scheduled, for a total of 6 quizzes @ 20 points. No make-ups will be permitted. One quiz score will be dropped at the end of the semester. If a quiz is missed, for any reason, that quiz will be the one dropped. If all quizzes are taken, the lowest score will be dropped. The quizzes will cover the material under study at the time. Specific topics will be announced in advance.

Exams

There will be 4 exams @ 100 points. The exams will cover the textbook, the lectures, and the laboratory sessions. No make-ups will be permitted. One exam score will be dropped at the end of the semester. If an exam is missed, for any reason, that exam will be the one dropped. If all exams are taken, the lowest score will be dropped.

Exam No.	Week	Date	Text Chapters
1	4	Thu 9/24	1, 2
2	8	Thu 10/22	3, 4, 5
3	12	Thu 11/19	6, 12, 13
4	15	Thu 12/10	7, 11

Homework

Organic chemistry is not a spectator sport. You cannot learn organic chemistry by passively reading the textbook and listening to the instructor. You learn organic chemistry by becoming actively involved in it and doing it. One of the most important aspects of active participation in the learning process is problem solving. For each chapter of the text an assignment will be made from the problems within the chapter as well as the problems at the end of the chapter. You should, **at a minimum**, work these assigned problems. Complete worked-out solutions are provided in the *Study Guide & Solutions Manual* for all of the problems. **Do not** merely look at these worked-out solutions; make a serious effort to work the problems on your own. The solutions manual should only be used to check yourself after you have finished a problem, or to seek help in getting started or if you become totally frustrated with a problem.

In addition to the minimum assigned problems, as many additional problems as possible should be attempted, from the Bruice text and from the Bruice Web site. Homework will not be collected. However, the level of learning and corresponding success in the course are related to the time and effort spent in problem solving.

Laboratory Experiments

Laboratory experience is one of the most important aspects of an organic chemistry course. Almost all aspects of organic laboratory work, from experimental theory and techniques to notebook keeping and report writing, are new to most students and different from most laboratory experience in general chemistry. A total of 9 experiments @ 20 points will be performed. Make-ups will not be possible. One lab score will be dropped at the end of the semester. If a lab is missed, for any reason, that lab will be the one dropped. If all labs are completed, the lowest score will be dropped.

Full details of the laboratory work will be presented in separate handouts distributed at the laboratory orientation session.

Final Exam [Thursday, December 17, 8:00-11:00, SCI 157]

The final exam is worth 240 points and is comprehensive.

*** Summary ***

3 of 4 exams @ 100 points = 300 points

5 of 6 quizzes @ 20 points = 100 points

8 of 9 lab experiments @ 20 points = 160 points

final exam @ 240 points = 240 points

Total = 800 points

*** Grading Scale Table ***

Course Grade	Point Range	Percent of Total Points Possible
A	720 – 800	90.0 - 100
B	624 - 719	78.0 - 89.9
C	520 - 623	65.0 - 77.9
D	400 - 519	50.0 - 64.9
F	< 400	< 50

The table above shows the *minimum guaranteed* grade ranges. At the end of the course some slight downward curving of these ranges is possible, if appropriate - - *but don't count on it.*

ADDITIONAL COURSE REQUIREMENTS

Attendance

Successful completion of this course requires full participation in all class activities, including lecture sessions and laboratory periods. Regular attendance in lecture and laboratory is both expected and required. Excessive absences will result in being dropped from the course. Punctuality is also important - plan to arrive in class on time. Remember to allow for parking problems, etc. Students who arrive late not only miss important material, but also disrupt the class.

Withdrawal

Be aware of college regulations and deadlines regarding dropping classes: for tuition refund – Sunday, September 13; to avoid a W on transcript – Monday, September 21; for a guaranteed W – Monday, October 26; and for a W with instructor approval of extenuating circumstances – Monday, November 23. If you want to drop the course, *it is your responsibility to notify the instructor*, otherwise you could inadvertently end up with an "F" on your transcript.

Code of Academic Conduct

The Academic Honor Code of Santa Monica College will be strictly enforced in this course, and academic dishonesty in any form will not be tolerated. This includes, but is not limited to, cheating on exams, changing answers on graded assignments, copying of lab reports, and falsification of lab data.

SOME ADVICE ON SUCCESS IN THIS COURSE

Organic chemistry opens a whole new world of knowledge and experience, and represents a new way of thinking about chemistry. The study of organic chemistry involves not only learning a seemingly endless amount of information, but also processing that information in an efficient manner. Most beginning students find organic chemistry to be challenging, and many find it to be quite difficult, at least initially. Even students who have done well in general chemistry, where the approach is largely mathematical, sometimes find themselves struggling in organic chemistry, where the approach is primarily conceptual. Organic chemistry is a highly organized and very precise discipline. Learning organic chemistry is like learning a new language. It involves sorting facts, analyzing problems, looking for patterns and reasoning by analogy.

The keys to success in organic chemistry are not much different from those in any other chemistry course: active participation in the learning process, consistent daily effort, keeping up rather than catching up, and maintaining a positive attitude. In short, success is no secret and no accident - it involves hard work, for which there are no shortcuts. Organic chemistry is an intense and demanding 5 unit course for which you will spend 9 hours per week in class. You should expect to spend *at least* 10-15 hours per week on your own time outside of class if you want to complete the course successfully, with a good grade and a strong base of knowledge and skills needed for continuing in chemistry or other science courses.

Read the appropriate sections of each chapter *before* you come to the lecture on those sections. Take good comprehensive notes during lecture. Then, as soon as possible after each lecture, re-read the same sections in the text, along with the notes you took. Have pencil in hand to work on the problems relating to those topics. As you go along, make a list of your questions to bring to class and to office hours, or to submit on eCompanion.

"The successful mastery of organic chemistry requires a lot of hard work and consistent studying. It is not a subject that can be crammed. Many students make the mistake of trying to memorize the text. An understanding of the basis of chemical transformations is what is really needed. It is true that facts must be learned, but you will be overwhelmed by them unless you develop an ability to see relationships."

- Seyhan Ege, *Organic Chemistry*, 2nd Edition

LECTURE SCHEDULE

Week	Dates	Topics	Quiz / Exam (Thursday)
1	9/1 – 9/4	Course Introduction, Perspective and Scope Ch. 1 Electronic Structure and Bonding. Acids and Bases	-----
2	9/8 – 9/11	Ch. 1 (Continued)	Quiz 1
3	9/15 – 9/18	Ch. 2 An Introduction to Organic Compounds: Nomenclature, Physical Properties, and Representation of Structure	Quiz 2
4	9/22 – 9/25	Ch. 2 (Continued)	<u>Exam 1</u>
5	9/29 – 10/2	Ch. 3 Alkenes. Structure, Nomenclature, and an Introduction to Reactivity. Thermodynamics and Kinetics	-----
6	10/6 – 10/9	Ch. 4 The Reactions of Alkenes	Quiz 3
7	10/13 – 10/16	Ch. 4 (Continued) Ch. 5 Stereochemistry: The Arrangement of Atoms in Space; The Stereochemistry of Addition Reactions	Quiz 4
8	10/20 – 10/23	Ch. 5 (Continued)	<u>Exam 2</u>
9	10/27 – 10/30	Ch. 6 The Reactions of Alkynes. An Introduction to Multistep Synthesis	-----
10	11/3 – 11/6	Ch. 12 Mass Spectrometry, Infrared Spectroscopy, and Ultraviolet/ Visible Spectroscopy	Quiz 5
11	11/10 – 11/12	Ch. 13 NMR Spectroscopy	-----
12	11/17 – 11/20	Ch. 7 Delocalized Electrons and Their Effect on Stability, Reactivity, and pKa. More About Molecular Orbital Theory	<u>Exam 3</u>
13	11/24 – 11/25	Ch. 7 (Continued)	Quiz 6
14	12/1 – 12/4	Ch. 8 Substitution Reactions of Alkyl Halides	-----
15	12/8 – 12/11	Ch. 9 Elimination Reactions of Alkyl Halides. Competition Between Substitution and Elimination	<u>Exam 4</u>

Thu 12/17

Final Exam 8:00 - 11:00

LABORATORY SCHEDULE

<u>Dates</u> 1361 (W) or 1362 (F)	<u>Laboratory Activity</u> (M) = Miniscale (m) = microscale
<u>Week 1</u> W 9/2 or F 9/4	Laboratory Introduction, Overview and Safety Discussion of Lab Notebooks and Lab Reports Locker Check-In
<u>Week 2</u> W 9/9 or F 9/11	Lab 1: Exp. 1(m): Extraction of Caffeine from Tea
<u>Week 3</u> W 9/16 or F 9/18	Lab 2: Exp. 2(m): Purification and TLC Analysis of Caffeine
<u>Week 4</u> W 9/23 or F 9/25	Lab 3: Exp. 4(m): Synthesis of Salicylic Acid
<u>Week 5</u> W 9/30 or F 10/2	Completion of Lab 3: Melting point / C-13 NMR analysis of product Lab 4: Exp. 3(M): Synthesis of Ethanol by Fermentation of Sucrose (Begin: Preparation of fermentation mixture)
<u>Week 6</u> W 10/7 or F 10/9	Completion of Lab 4: (Distillation and analysis of product)
<u>Week 7</u> W 10/14 or F 10/16	Lecture / Problem Session: Ch. 3, 4, 5
<u>Week 8</u> W 10/21 or F 10/23	Lab 5: Exp. 6.2(M): Isolation of R-(+)-Limonene from Oranges
<u>Week 9</u> W 10/28 or F 10/30	Lab 6: Exp. 16.2(M): Stereochemistry of Bromine Addition to <i>Trans</i> -Cinnamic Acid
<u>Week 10</u> W 11/4 or F 11/6	Lecture / Problem Session: Ch. 11 Radicals. Reactions of Alkanes Lab 7: Exp. 8.1(m): Radical Chlorination Reactions
<u>Week 11</u> Week of 11/9	<u>No Lab</u> (Veterans Day)
<u>Week 12</u> W 11/18 or F 11/20	Lab 8: Spectroscopy - NMR / IR Unknowns [Handout]
<u>Week 13</u> Week of 11/23	<u>No Lab</u> (Thanksgiving)
<u>Week 14</u> W 12/2 or F 12/4	Lecture / Problem Session: Ch. 8, 9
<u>Week 15</u> W 12/9 or F 12/11	Lab 9: Exp. 10(m): E2 Elimination of 2-Bromoheptane Locker Check-Out