

### Information for Students

**Organic chemistry** is that branch of natural science that studies the structure, properties, reactivity, and preparation ("synthesis") of compounds containing carbon ("organic" compounds). This includes those compounds that make up living matter (nucleic acids, proteins, carbohydrates, etc.) and those that modulate biological function (hormones, vitamins, medicines, etc.).

The course develops an intellectual framework termed the "electronic theory of organic chemistry" that allows one to rationalize and predict the structure, properties, reactivity, and preparation of organic compounds on the basis of the electronic configuration of their molecules.

In this manner, a limited set of concepts relating to the behavior of electrons within a molecule allow one to approach organic chemistry as an exercise in logic, not one in memory.

*Indeed, the objective of CHEM 203 is to enable the rationalization and the prediction of the reactivity of alkanes, alkenes, alkynes, alkyl halides, Li and Mg organometallics, alcohols, ethers, epoxides, and some carbonyl compounds, including carbohydrates, through the electronic theory of organic chemistry.*

The material to be discussed in the course is covered in chapters 1 – 16 of the recommended textbook (see p. 2).

## Responsibility

You are in this class because you wish to become scientists, medical doctors, or possibly engineers. You have set very high professional goals indeed for yourselves, and I applaud your courageous choice.

But to attain such lofty objectives, you have to master organic chemistry, and to do that you must exercise an extreme degree of personal responsibility and discipline.

Apply yourselves tenaciously; approach your learning with eagerness, maturity, independence, curiosity and enterprise; do not fall behind; do the problems in the book and all the homework assignments.

**The subject is difficult, the work is hard, but the rewards are extraordinary.**

**Instructor:** Marco A. Ciufolini, A331 Chemistry Building.

**Office Hours:** by appointment only. Please e-mail me (ciufi@chem.ubc.ca) to arrange a meeting. Sporadic drop-ins OK.

**Course website:** [http://groups.chem.ubc.ca/chem203/Chem\\_203.html](http://groups.chem.ubc.ca/chem203/Chem_203.html)

**Suggested Textbook:** *Organic Chemistry*, Seventh Edition, by Brown, Foote, Iverson, and Anslyn; Brooks-Cole, available at the UBC Bookstore

**Other Useful Materials:**

- Molecular Model Set: you are strongly advised to obtain a set of inexpensive molecular models. These will greatly facilitate your study of organic chemistry.
- Study Guide and Solutions Manual for Brown, Foote and Iverson

You are encouraged to consult other introductory organic chemistry textbooks [available at the Barber Learning Center (QD 251.2)] to supplement classroom notes and to access additional problems related to the C203 curriculum.

**Lectures:** MWF 1:00 pm in room B150, Chemistry Building.

It is to your advantage to come class because hearing the presentation of this difficult subject matter will greatly help you in your study. The students who consistently attend the lectures are the ones who generally do best and earn the higher grades for the course.

**Laboratory:** The person in charge of the laboratory component of the course is Dr. Jay Wickenden. Please see Dr. Wickenden for any question re. the lab.

**Mark Distribution:**

Lecture component		75%
Midterm 1: Thu, Oct 6, 2016, 7:00-8:30 PM, rm. B250	18.75%	
Midterm 2: Thu, Nov 3, 2016, 7:00-8:30 PM, rm B150	18.75%	
Final Exam	37.50%	
Laboratory component		25%
Total		100%

**note:** B150 is **our usual classroom**; B250 is just one floor upstairs

**Deferred exam policy:** The large diversity of reasons that may induce a student to request a deferred exam force me to evaluate each request individually. In any event, requests for deferred examinations will be considered only if:

- the student submits a request for a deferred exam in ADVANCE of the scheduled date of the test;
- a valid reason is presented in support of the request.

Valid reasons include: health (sickness) and family (weddings, funerals) issues, religious holidays, academic distress (more than 3 tests on the same day).

The only option available to those students who fail to serve advance notice of their absence at a scheduled exam is to have the fraction of the final grade of the missed test transferred to that of the successive exam.

**Exam material:** The midterm exams (both of which will be held on a Thursday) will cover all the material discussed in class from day 1 through the previous Friday. The final exam will cover all the material presented in the course.

**Studying:** This course covers a great deal of **difficult** material. It is important not to fall behind, because each new topic is tightly connected to previously introduced concepts. I urge you to review your class notes immediately after each lecture and clear up ambiguities while the material is still fresh in your mind.

Promptly rewriting "raw" class notes in a manner that facilitates retrieval of information will help you immensely in mastering organic chemistry. You will be able to identify problem areas shortly after the material was presented in the lecture and immediately take corrective action (see the instructor, ask a TA, read the book ....).

We will study many important chemical reactions in this class. It is essential to retain and understand these transformations. An excellent method to do this is to create a card index of chemical reactions. Each time you encounter a new reaction, make a 3x5 card for it. On the front of the card, write the name of the reaction and draw a chemical equation that shows an example. On the back of the card, write the mechanism (curved arrows and all). Review this card file every now and then and you will be amazed to see how fast you'll learn the material.

**Homework:** It is essential that you do all the problems in the textbook while studying individual chapters. This is the only way to learn this difficult subject. Answers are found in the study guide, but you should make a very good effort indeed to come up with your own solutions before consulting the answer book.

A homework assignment that reflects material covered during the prior several lectures will be posted on the course website every two weeks or so. Again, you must strive to solve all the proposed exercises before the answers are posted.

The first homework assignment will be available on the course website on the first day of class. This homework is designed to assist you in reviewing the course prerequisites, which are outlined in the next section.

**Prerequisites:** CHEM 203 is an advanced university course, and it assumes that you are thoroughly familiar with fundamental concepts of introductory chemistry. You should thoroughly review the following material:

### Structure & Bonding

single and multiple bonds,  $\sigma$  and  $\pi$  bonding, VSEPR, electronegativity, polarized bonds, formal charges, oxidation states

### Elementary organic chemistry

alkanes and their nomenclature, conformational analysis, eclipsed and staggered conformers of ethane, syn, gauche, and anti conformers of *n*-butane, conformations of cyclohexane.

### Stereochemistry

molecular chirality, stereogenic (sometimes improperly described as "asymmetric") carbons, R and S notation, stereoisomers (enantiomers, diastereomers), meso forms.

The first three chapters of the CHEM 203 textbook provide an excellent overview of the above concepts. You are responsible for doing a thorough review of the material covered in these chapters, which **will not** be discussed in class. Working out all the problems will greatly assist you in learning.

**Chapter 1** *Covalent Bonding and Shapes of Molecules*. All sections. This chapter contains basic information about structure, bonding, resonance, and functional groups (subject matter that Chemistry 203 students have encountered before).

**Chapter 2** *Alkanes and Cycloalkanes*. All sections *except* 2.4B and 2.7B. Essentially all of the material presented in this chapter was covered in first-year chemistry.

**Chapter 3** *Stereoisomerism and Chirality*. All sections *except* 3.8B,C. Essentially all of the material presented in this chapter was covered in first-year chemistry, especially: (a) stereoisomers (b) enantiomers (c) chirality (d) chirality centers (e) stereogenic centers (f) optical activity (g) specific rotation (h) *R* and *S* convention for designation of configuration of chirality centers (i) diastereomers (j) *meso* compounds (k) racemic compounds and their resolution into two enantiomers (l) Fischer projections.

First-year chemistry courses briefly introduced the following concepts, which are central to CHEM 203:

Thermodynamics: Changes in enthalpy ( $\Delta H$ ) and free energy ( $\Delta G$ ); relationship between  $\Delta G^\circ$  and equilibrium constant for a reaction (Gibbs equation):  $\Delta G^\circ = -n RT \ln (K_{eq})$

Kinetics: reaction rates, rate law, order of a reaction, activation barrier, activation energy, Arrhenius equation.

Acid-base equilibria: dissociation constant ( $K_a$  and  $pK_a$ ) A portion of this material will be discussed in some depth in CHEM 203, but you are expected to thoroughly review pertinent notes from first year courses.

**The Language of Organic Chemistry:** Like any other area of human endeavoring, organic chemistry requires a language of its own to express complex, subtle concepts in a clear and concise fashion. Of course, all new terms introduced in class will be clearly defined and their use will be thoroughly exemplified, but you may find it useful to review organic chemical terminology by consulting the glossary of terms at the end of the textbook (G.1-G.14). There, you will find definitions of many terms used in organic chemistry.

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