

CAMOSUN COLLEGE
School of Arts & Science
Chemistry/Geoscience Department

Chem 121-01 (Winter 2005)
Course Outline

Instructor Information

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Office hours: Mon, Wednesday & Friday: 12:30 - 1:30 pm; or appointment by E-mail.

Calendar Description

This course is a continuation of CHEM 120 and covers the following topics: chemical kinetics, equilibrium, acids and bases, thermochemistry, thermodynamics and provides an introduction to organic chemistry. The laboratory experiments provide practical experience in nearly all the areas covered in the lectures.

Pre-requisites (A requirement that must be met before entry into this course.)

CHEM 120

Intended Learning Outcomes

At the end of the course the student will be able to:

1. Utilize the specialized vocabulary and nomenclature based on the IUPAC system of organic compounds to name and draw structures for many simple organic compounds containing the common functional groups.
2. Write chemical reactions to illustrate numerous transformations between organic functional groups.
3. Draw structural and stereoisomers of organic compounds and name stereoisomers based upon the IUPAC system of nomenclature.
4. Apply the laws of thermodynamics and account for the factors that lead to spontaneous physical and chemical changes.
5. Demonstrate an understanding of the factors that influence the rate of a chemical reaction, deduce the rate of a chemical reaction from time/concentration data, and utilize rate laws to perform kinetic calculations.
6. Explain how and why reactions attain equilibrium positions and perform calculations pertaining to equilibrium systems.
7. Describe various acid-base theories and apply these theories to acid-base reactions in aqueous solution.
8. Perform experiments in the areas of preparative organic, preparative inorganic, physical and analytical chemistry and use the various associated pieces of laboratory equipment.

Required Course Materials

- *CHEMISTRY: the Central Science 9th Edition*, Brown, Lemay, and Bursten
- *Chemistry 121 Lab Manual*, Camosun College.
- **Students are required to bring their own safety glasses and wear them at ALL times in the lab.** Prescription glasses are accepted in the lab but not sunglasses. Lab coat is recommended.

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Recommended Course Materials

- *Solutions to Exercises in "CHEMISTRY: the Central Science 9th Edition" by Brown, Lemay, and Bursten.*
- *The Essentials of Organic Chemistry, George, Field and Hambley*
- **Note: the above materials are also available on a two-hour loan in the Library Reserve Room for Chem 120 and 121.**

Course Structure and Schedule

1. Lecture: Monday, Wednesday & Friday 11:30 am - 12:20 pm (F216);
2. Lab: Monday 2:30 pm - 5:20 pm (F354);
3. Problem Sets on each section of the course (see p. 5);
4. **TWO Term Tests¹ (two hours each; to be written during lab period on February 14, March 14);**
5. Final Examination (Three-hour in the week of April 18 - 23, 25 -26) on **all material** in the course.

Note

1. Test 1 will be on Organic Chemistry; Test 2 will be on Thermochemistry & Chemical Thermodynamics. Additional Information will be given before scheduled tests and examination.

Basis of Student Assessment

Laboratory (7 experiments)	20%
Test 1 (Organic Chemistry)	20%
Test 2 (Thermochemistry & Chemical Thermodynamics)	20%
Final Exam (on all the material)	40%

Important Note

1. You must hand in a **minimum** of SIX lab reports and score a **minimum** of 50% on lab marks to be permitted to write the final examination.
2. You must obtain a passing grade in both the lecture and laboratory portion of the course in order to pass the course.
3. Students must write each test as scheduled. No one is allowed to write late and there will be NO make-up test (NO EXCEPTIONS). Any missed test will result in its weight being automatically redistributed to the final exam.
4. If it is advantageous to the student, the theory mark will be solely derived from the final examination (see "how your marks will be calculated...." on p.3)
5. **Missed Final Examination** will be **COUNTED AS ZERO** unless a medical or other satisfactory reason is provided in writing to the instructor within 3 working days of the date of the examination.

Letter Grades

A+	95 - 100 %	B+	80 - 84 %	C+	65 - 69 %	F	0 - 49 %
A	90 - 94 %	B	75 - 79 %	C	60 - 64%		
A-	85 - 89 %	B-	70 - 74 %	D	50 - 59 %		

How your marks will be calculated for students that pass both the lab &

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lecture portions (i.e. achieve 50% in the lab & 50% in the lecture):

1. For students completed both tests & final exam:

$(0.2)(\% \text{ lab score}) + 0.2 (\% \text{ test 1 score}) + 0.2 (\% \text{ test 2 score}) + 0.4(\% \text{ exam score}) = Q1 \%$
$(0.2)(\% \text{ lab score}) + 0.2 (\% \text{ test 1 score}) + 0.6(\% \text{ exam score}) = Q2 \%$
$(0.2)(\% \text{ lab score}) + 0.2 (\% \text{ test 2 score}) + 0.6(\% \text{ exam score}) = Q3 \%$
$(0.2)(\% \text{ lab score}) + 0.8 (\% \text{ exam score}) = Q4 \%$
Compare Q1, Q2, Q3 & Q4, a student is assigned the highest of the four as the final course grade.

2. For students completed test 1 & final exam:

$(0.2)(\% \text{ lab score}) + 0.2 (\% \text{ test 1 score}) + 0.6 (\% \text{ exam score}) = Q1 \%$
$(0.2)(\% \text{ lab score}) + 0.8 (\% \text{ exam score}) = Q2 \%$
Compare Q1 & Q2, a student is assigned the higher of the two as the final course grade.

3. For students completed test 2 & final exam:

$(0.2)(\% \text{ lab score}) + 0.2 (\% \text{ test 2 score}) + 0.6(\% \text{ exam score}) = Q1 \%$
$(0.2)(\% \text{ lab score}) + 0.8 (\% \text{ exam score}) = Q2 \%$
Compare Q1 & Q2, a student is assigned the higher of the two as the final course grade.

4. For students who completed only the final exam:

$(0.2)(\% \text{ lab score}) + 0.8 (\% \text{ exam score}) = Q \%$
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Important Dates

- January 24: Tuition fees due for Winter term 2005
- February 10 - 11: Reading Break
- February 14 (Monday): Test 1
- March 14 (Monday): Last Day to Withdraw...
- March 14 (Monday): Test 2
- March 25 & 28: Easter Holidays. No classes.
- April 15 (Friday): Last Day of class for Spring 2005
- April 18 - 23, 25 - 26: Exam Period for Spring 2005

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Tentative Lecture Plan

- 1. January 10: Introduction (1 hour)**
- 2. January 12, 14, 17, 19, 21, 24, 26, 28, 31, February 2, 4: Organic Chemistry (11 hours)**
 - Hydrocarbons: alkanes, alkenes, alkynes and aromatics.
 - Nomenclature. Structural isomerism, stereoisomers, *Z/E* nomenclature.
 - Chemical properties of hydrocarbons. Addition reactions to alkenes and Markovnikov's rule. Aromatic substitution.
 - Function groups chemistry including alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, amines, amides and alkyl halides. Synthesis, properties and chemical reactivity.
 - Chirality, enantiomers, Cahn-Ingold-Prelog nomenclature.
 - Overview of structures of biological compounds (e.g., amino acids, proteins, carbohydrates) & organic polymers.
 - BLB Ch. 25 (25.1 - 25.11; skip p. 998 -999: Mechanisms of addition reactions in alkenes); Ch. 12 (p. 456 - 458);**
 - Essentials of Organic Chemistry: Ch. 1 (p.1 - 32; p. 36 - 41; exclude Mechanisms of addition reaction in alkenes and alkynes; mechanisms of aromatic substitution reaction); Ch. 2 (p. 56 - 58, p. 65 - 70; p. 75 - 76; p. 79 - 82; p. 89 - 91; p. 104 - 107; p. 110 - 112, p. 148 - 151; p. 154 - 156; exclude the formation of alkoxides)**
- 3. February 7, 9, 14, 16, 18: Thermochemistry (5 hours)**
 - Nature of energy, first law of thermodynamics, enthalpy, enthalpy of reaction.
 - Calorimetry, bomb calorimeter.
 - Hess's law, enthalpy of formation, bond dissociation energies, fuels.
 - BLB Chapter 5, Chapter 8 (p.302 - 304)**
- 4. February 14 (Monday): Test 1 (2 hours during the lab period)**
 - Examinable topic: Organic Chemistry
- 5. February 21, 23, 25, 28, March 2, 4: Chemical Thermodynamics (6 hours)**
 - Spontaneous processes, Entropy and probability, and temperature.
 - Entropy and 2nd law of thermodynamics, molecular interpretation of entropy.
 - 3rd law of thermodynamics and absolute entropies, calculating entropy changes.
 - Free energy changes for reactions, free energies of formation.
 - Free energy and temperature, Free energy and chemical equilibrium, free energy and reaction composition.
 - BLB Chapter 19**
- 6. March 7, 9, 11, 14, 16, 18: Kinetics (6 hours)**
 - Reaction rates, Rate laws, determining the rate law, method of initial rates, order of reaction.
 - Integrated rate laws for first and second order reactions, half-life.
 - Temperature and rate, models for chemical kinetics, collision theory, activated complex theory. Arrhenius equation, Arrhenius parameters.
 - Reaction mechanisms, rate-determining step, deducing the rate law from the mechanism.
 - Catalysis, enzymes, industrial catalysis, ozone depletion.
 - BLB Chapter 14 (skip p.552 - 554)**
- 7. March 14 (Monday): Test 2 (2 hours during the lab period)**
 - Examinable topics: Thermochemistry & Chemical Thermodynamics
- 8. March 21, 23, 30, April 1: Chemical equilibrium (4 hours)**

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- Equilibrium condition, K_c , K_p , heterogeneous equilibria, reaction quotient, relation between K_p and K_c .
- Calculating unknown equilibrium concentrations and/or equilibrium constants.
- LeChatelier's principle, the Haber process.
- **BLB Chapter 15**

9. April 4, 6, 8, 11, 13: Acids and Bases and Aqueous Equilibria (5 hours)

- Nature of acids and bases, Arrhenius and Bronsted-Lowry models, conjugate acids and bases.
- Autoionization of water, the pH scale, strong and weak acids, strong and weak bases, K_a and K_b .
- pH calculations for strong acid and base solution, weak acid and base solutions.
- Acid/base properties of salts; Common ion effect, Buffers, Henderson-Hasselbalch equation.
- **Chapter 16 (sections 16.1 - 16.9) and Chapter 17 (sections 17.1 - 17.2)**

10. April 15: Review & Examination Information

Note: Due to time constraints, we may not be able to cover all the topics listed above.

Problem Sets

	End-of-Chapter Exercises from "Chemistry, The Central Science" 9th edition by Brown, LeMay & Bursten.
Chapter 25: Organic Chemistry Chapter 12: Modern Materials	25.7, 25.8, 25.11, 25.12, 25.13, 25.14, 25.15, 25.16, 25.17, 25.18, 25.19, 25.20, 25.21, 25.22, 25.23, 25.27, 25.28, 25.29, 25.30, 25.35, 25.36, 25.37, 25.38, 25.39, 25.40, 25.41, 25.42, 25.43, 25.44, 25.45, 25.46, 25.47, 25.48, 25.49, 25.51, 25.57, 25.59, 25.60a, 25.69, 25.72, 25.73, 25.74, 25.75, 25.76, 25.78, 25.79, 25.80, 25.81, 25.83, 12.11, 12.13, 12.14, 12.15, 12.17, 12.18, 12.20 eMedia Exercises ¹ : 25.100, 25.101
Chapter 5: Thermochemistry	5.11, 5.13, 5.14, 5.17, 5.18, 5.19, 5.20, 5.21, 5.22, 5.25, 5.27, 5.28, 5.29, 5.30, 5.31, 5.32, 5.33, 5.34, 5.35, 5.36, 5.37, 5.39, 5.40, 5.41, 5.42, 5.43, 5.44, 5.45, 5.46, 5.47, 5.49, 5.50, 5.51, 5.52, 5.55, 5.56, 5.57, 5.58, 5.59, 5.60, 5.61, 5.62, 5.63, 5.67, 5.68, 5.69, 5.71, 5.73, 5.74, 5.75, 5.78, 5.85, 5.100, 5.111 eMedia Exercises : 5.115, 5.116, 5.119
Chapter 19: Chemical Thermodynamics	19.1, 19.2, 19.3, 19.5, 19.6, 19.15, 19.16, 19.17, 19.18, 19.19, 19.20, 19.21, 19.22, 19.23, 19.24, 19.25, 19.27, 19.28, 19.29, 19.30, 19.31, 19.32, 19.37, 19.38, 19.39, 19.40, 19.41, 19.42, 19.43, 19.44, 19.45, 19.46, 19.47, 19.49, 19.50, 19.51, 19.52, 19.53, 19.54, 19.55, 19.56, 19.59, 19.61, 19.63, 19.65, 19.66, 19.67, 19.68, 19.73, 19.76, 19.77, 19.80, 19.81, 19.99 eMedia Exercises : 19.101, 19.102
Chapter 14: Chemical Kinetics	14.1, 14.5, 14.6, 14.7, 14.8, 14.9, 14.10, 14.11, 14.12, 14.13, 14.14, 14.15, 14.16, 14.17, 14.19, 14.20, 14.21, 14.22, 14.23, 14.24, 14.25, 14.26, 14.27, 14.28, 14.29,

¹ EMedia Exercises are answered by using the movies and simulations available on the student Companion Website <http://www.prenhall.com/brown>
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	14.30, 14.31, 14.32, 14.33, 14.34, 14.35, 14.37, 14.38, 14.39, 14.43, 14.44, 14.45, 14.46, 14.49, 14.50, 14.53, 14.54, 14.55, 14.56, 14.57, 14.58, 14.59a-c, 14.61, 14.63, 14.65, 14.66, 14.75, 14.76, 14.77, 14.78, 14.80, 14.82, 14.84
Chapter 15: Chemical Equilibrium	15.1, 15.3, 15.4, 15.7, 15.8, 15.9, 15.10, 15.11, 15.12, 15.13, 15.14, 15.15, 15.19, 15.20, 15.21, 15.22, 15.23, 15.24, 15.25, 15.26, 15.27, 15.28, 15.29, 15.30, 15.31, 15.32, 15.33, 15.35, 15.36, 15.37, 15.39, 15.40, 15.41, 15.42, 15.43, 15.44, 15.45, 15.47, 15.48, 15.49, 15.52, 15.53, 15.57, 15.66
Chapter 16: Acid-Base Equilibrium	16.5, 16.6, 16.7, 16.8, 16.9, 16.10, 16.11, 16.12, 16.13, 16.14, 16.15, 16.16, 16.19, 16.20, 16.21, 16.23, 16.27, 16.29, 16.30, 16.33, 16.34, 16.35, 16.36, 16.41, 16.43, 16.45, 16.47, 16.49, 16.51, 16.55, 16.63, 16.65, 16.67, 16.68, 16.69, 16.71, 16.73, 16.75, 16.99, 16.100
Chapter 17: Aqueous Equilibria	17.1, 17.3, 17.4, 17.5, 17.9, 17.13, 17.15, 17.16, 17.17, 17.19, 17.21, 17.22

Note:

1. Learning and mastering chemistry concepts require doing problems. Students should attempt all relevant end-of-chapter exercises and seek assistance should questions arise. Detailed solutions are available in the *Solutions Manual* for the text, which can be purchased in the bookstore and also available on a two-hour loan in the **Library Reserve Room for Chem 120 & 121**.
2. Some of the assigned problems may appear in tests and the final examination.

Recommended Materials or Services to Assist Students to Succeed Throughout the Course

There are a variety of services available for students to assist them throughout their learning. This information is available in the College Calendar, Registrar's Office or the College web site at
<http://www.camosun.bc.ca>

There is an Academic Conduct Policy **which includes plagiarism**. It is the student's responsibility to become familiar with the content of this policy. The policy is available in each School Administration Office, Registration, and on the College web site in the Policy Section.

www.camosun.bc.ca/divisions/pres/policy/2-education/2-5.html