

CAMOSUN COLLEGE
School of Arts & Science
Chemistry/Geoscience Department

Chem 120-03 (Winter 2005) Course Outline

Instructor Information

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Office hours: Mon, Wednesday & Friday: 12:30 - 1:30 pm; Monday: 5 - 5:30 pm;

Wednesday: 5:45 - 6: 15 pm or appointment by E-mail.

CALENDAR DESCRIPTION

For both university and technology students, this course starts with atomic structure and periodic properties and leads to a discussion of chemical bonding, molecular structure, intermolecular structure, intermolecular forces and their role in environmental issues. The experiments include chemical synthesis and analysis by titration and spectroscopy.

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

Chem 110 or Chemistry 12

Credits: 4

Intended Learning Outcomes

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

1. Utilize nomenclature rules to name ionic and covalent compounds.
2. Demonstrate an understanding of stoichiometry by balancing chemical equations and performing mathematical calculations involving chemical reactions.
3. Describe the electronic structure of any atom in the periodic table and apply it to explain many of the physical and chemical properties of the elements.
4. Utilize simple bonding theories to explain why elements combine to form the compounds they do and also to explain many of the properties of compounds.
5. Apply knowledge of intermolecular interactions to rationalize many important physical properties of bulk matter in the gas, liquid and solid phases.
6. Use standard chemistry lab equipment, including burettes, pipettes, Büchner filters, and volumetric glassware in the correct manner.
7. Perform many standard laboratory procedures, such as titrations, preparation of standard solutions, the preparation, isolation, and purification of compounds, as well as use spectrophotometers to make analytical measurements.

Required Course Materials

- CHEMISTRY: the Central Science 9th Edition", Brown, Lemay, and Bursten
- Chemistry 120 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.

Recommended Course Materials

- Solutions to Exercises in "CHEMISTRY: the Central Science 9th Edition" by Brown, Lemay, and Bursten.
- ***Note: the above material is also available on a two-hour loan in the Library Reserve Room for Chem 120 and 121.***

Chem 120 (06) Winter 2005 Course Description (continued)

Course Structure

1. Lecture: Wednesday 6:30 - 9:20 pm (F334);
2. Lab¹: Monday 6:30 - 9:20 pm (F356);
3. Problem Sets on each section of the course (see p. 5);
4. **TWO Term Tests² (two hours each; to be written during lab period on February 7, March 7);**
5. Final Examination (Three-hour in the week of April 18 - 23, 25 -26) on **all material** in the course.
6. Estimated out-of-class work: at least 6 hours/week

Note

1. If no experiment is schedule for that week, the laboratory period may be used for lectures, tutorials or tests.
2. Additional information will be given before the scheduled tests.

Basis of Student Assessment

Laboratory (8 experiments)	20%
Test 1	20%
Test 2	20%
Final Exam	40%

Important Note

1. You must hand in a **minimum** of SIX lab reports (i.e., 75 % of the lab work) 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).
4. Any missed test will result in its weight being automatically redistributed to the final exam. If it is advantageous to the student, the theory mark will be solely derived from the final examination (see p.3 "how your marks will be calculated...")
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 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 %		

Important Dates

- January 24: Tuition fees due for Winter term 2005
- February 10 - 11: Reading Break
- February 7 (Monday): Test 1
- March 7 (Monday): Test 2
- March 14 (Monday): Last Day to Withdraw...
- 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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How your marks will be calculated for students that pass both the lab & lecture portions (i.e. achieve 50% in the lab & 50% in the lecture):

1. For students completed both tests & final exam:

$(0.20)(\% \text{ lab score}) + 0.20 (\% \text{ test 1 score}) + 0.2 (\% \text{ test 2 score}) + 0.40(\% \text{ exam score}) = Q1 \%$
$(0.20)(\% \text{ lab score}) + 0.20 (\% \text{ test 1 score}) + 0.60(\% \text{ exam score}) = Q2 \%$
$(0.20)(\% \text{ lab score}) + 0.20 (\% \text{ test 2 score}) + 0.60(\% \text{ exam score}) = Q3 \%$
$(0.20)(\% \text{ lab score}) + 0.80 (\% \text{ exam score}) = Q4 \%$
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:

$(0.20)(\% \text{ lab score}) + 0.20 (\% \text{ test 1 score}) + 0.60 (\% \text{ exam score}) = Q1 \%$
$(0.20)(\% \text{ lab score}) + 0.80 (\% \text{ exam score}) = Q2 \%$
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:

$(0.20)(\% \text{ lab score}) + 0.20 (\% \text{ test 2 score}) + 0.60(\% \text{ exam score}) = Q1 \%$
$(0.20)(\% \text{ lab score}) + 0.80 (\% \text{ exam score}) = Q2 \%$
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:

$(0.20)(\% \text{ lab score}) + 0.80 (\% \text{ exam score}) = Q \%$
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Tentative Lecture Plan & Relevant Sections from the text

1. January 10 (Monday): Introduction & Lab Safety (2 hours)

2. January 12, 19, 26: Review of selected topics (9 hours)

- Atoms and Subatomic Particles, the Rutherford Model of the atom; Atomic weights & isotopes.
- Avogadro's Number, Mole & Molar Mass; Molecular Weight & Formula Weight; Empirical & Molecular Formulas; Chemical Analysis of Mixtures.
- Balancing Chemical Equations; Stoichiometric calculations, Limiting Reagents, Percent Yield.
- Common types of chemical reactions; Properties of aqueous solution: strong & weak electrolytes, solubility of ionic compounds with water, precipitation reactions, writing net ionic equations.
- Reactions in Solution; solution concentration expressions, dilution, solution stoichiometry.
- Acid-Base Reactions: definition, Neutralization & Titrations.
- Oxidation-Reduction Reactions: oxidation numbers, oxidizing & reducing agents, redox titrations.
- **Text: Ch. 2 (2.3, 2.4), Ch. 3 (3.3 - 3.7), Ch. 4 (4.1 - 4.6)**

3. February 7 (Monday): Test 1 (2 hours in lab period)

- Examinable topics: Review materials (selected sections from Text Ch. 2 - 4)

4. January 31 (Monday), February 2, 9: Electronic Structure of Atoms (9 hours)

- Light & Electromagnetic Radiation; Quantum Theory; Photoelectric effect & the dual properties of light.
- Atomic Line Spectra & Bohr's Model. de Broglie's equation, Heisenberg Uncertainty Principle.
- Quantum Mechanical View of an atom: Schrodinger Equation, wavefunction & atomic orbitals; Quantum Numbers & Atomic orbitals, Shapes of atomic orbitals.
- Many-electron atoms; electron spins; Pauli Exclusion Principle; Hund's Rule. Electron configurations of elements & ions.
- **Text: Chapter 6**

5. February 16, 21(Monday): Periodic Properties of the Elements (6 hours)

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- Periodic Table: Historical development, Groups, metals, non-metals, metalloids.
- Atomic Properties & their periodic Trends: Effective Nuclear Charge, Atomic Size, Ionization energy, electron affinity.
- Ions & Ionic radii, common ions.
- **Text: Chapter 7(sections 7.1 - 7.6)**

6. March 7 (Monday): Test 2 (2 hours in lab period)

- Electronic Structure of Atoms & Periodic Properties (Text Ch. 6, Ch. 7.1 - 7.6)

7. February 23, March 2: Basic Concepts of Chemical Bonding (6 hours)

- Valence electrons & Lewis Symbols. Ionic & Covalent bonding.
- Lewis Structures; Octet rule; formal charges, resonance structures.
- Strength of covalent bonds: bond lengths, bond dissociation energies.
- **Text: Chapters 8**

8. March 9, 16, 23: Molecular Geometry & Bonding Theories (9 hours)

- Shapes of molecules & VSEPR model.
- Bond polarity, electronegativity, Molecular polarity, dipole moments.
- Valence bond theory: hybrid orbitals, multiple bonds, delocalised π bonds.
- Molecular orbital theory: MO diagrams for homonuclear diatomics, bond order.
- **Text: Chapter 9**

9. March 30, April 6: Gases & Selected topics on Atmospheric Chemistry (6 hours)

- Characteristics of Gases.
- The Gas Laws: Boyle's Law, Charles's Law, Gay-Lussac & Avogadro's Law.
- Ideal Gas Equation & its Applications. Stoichiometric Calculations involving gases.
- Gas Mixtures & Dalton's Law of Partial Pressures.
- Kinetic Molecular Theory of Gases: Molecular Speeds; Non-ideal Gases.
- **Text: Chapter 10 & selected sections from Ch. 18**

10. April 11 (Monday): Intermolecular forces, Liquids & Solids (3 hours)

- General Properties of Liquids & Solids.
- Intermolecular forces; Types of solids.
- **Text: Chapter 11 (sections 11.1 - 11.2, 11.8)**

11. April 13: Review and Examination Information

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

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Problem Sets

	End-of-Chapter Exercises from the textbook, "Chemistry, The Central Science" 9th edition by Brown, LeMay & Bursten.
Chapter 2: Atoms, Molecules, Ions	2.17, 2.23, 2.29, 2.31, 2.37, 2.39, 2.41, 2.43, 2.47, 2.49, 2.86
Chapter 3: Stoichiometry	3.5, 3.13, 3.15, 3.19, 3.29, 3.33, 3.41, 3.47, 3.49, 3.55, 3.57, 3.71, 3.75, 3.87, 3.90, 3.97
Chapter 4: Aqueous Reactions & Solution Stoichiometry	4.5, 4.11, 4.13, 4.15, 4.17, 4.23, 4.25, 4.27, 4.29, 4.35, 4.37, 4.39, 4.41, 4.42, 4.51, 4.53, 4.57, 4.59, 4.61, 4.67, 4.69, 4.73, 4.75, 4.77, 4.80a, b, c, e, 4.89, 4.91
Chapter 6: Electronic Structure of Atoms	6.3, 6.5, 6.7, 6.9, 6.13, 6.15, 6.17, 6.19, 6.25, 6.27, 6.29, 6.31, 6.33, 6.35, 6.39, 6.41, 6.43, 6.45, 6.47, 6.49, 6.51, 6.55, 6.57, 6.58, 6.59, 6.61, 6.63, 6.65, 6.67, 6.68, 6.70, 6.77, 6.79, 6.81
Chapter 7: Periodic Properties of the Elements	7.3, 7.7, 7.8, 7.9, 7.11, 7.13, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21, 7.22, 7.23, 7.24, 7.25, 7.26, 7.27, 7.28, 7.29, 7.30, 7.31, 7.32, 7.33, 7.34, 7.35, 7.36, 7.37, 7.38, 7.39, 7.40, 7.41, 7.42, 7.43, 7.44, 7.45, 7.47, 7.49, 7.55, 7.57, 7.63, 7.73, 7.80, 7.84, 7.85
Chapter 8: Basic Concepts of Chemical Bonding	8.1, 8.2, 8.3, 8.4, 8.11, 8.12, 8.13, 8.14, 8.15, 8.16, 8.18, 8.25, 8.26, 8.29, 8.30, 8.31, 8.32, 8.33, 8.34, 8.35, 8.36, 8.38, 8.43, 8.44, 8.45, 8.46, 8.47, 8.48, 8.49, 8.50, 8.51, 8.52, 8.53, 8.55, 8.56, 8.57, 8.58, 8.59, 8.60, 8.76, 8.77, 8.79, 8.80, 8.81, 8.82, 8.91, 8.93
Chapter 9: Molecular Geometry & Bonding Theories	9.7, 9.8, 9.9, 9.10, 9.11, 9.12, 9.13, 9.14, 9.15, 9.17, 9.18, 9.19, 9.20, 9.21, 9.22, 9.23, 9.24, 9.25, 9.26, 9.27, 9.29, 9.30, 9.31, 9.32, 9.33, 9.34, 9.35, 9.36, 9.37, 9.38, 9.39, 9.40, 9.41, 9.42, 9.43, 9.44, 9.45, 9.46, 9.47, 9.48, 9.65, 9.67, 9.69, 9.71, 9.72, 9.74, 9.77
Chapter 10: Gases	10.1, 10.15, 10.19, 10.23, 10.25, 10.27, 10.33, 10.39, 10.41, 10.47, 10.49, 10.51, 10.53, 10.55, 10.59, 10.63, 10.65, 10.67, 10.73, 10.79, 10.83, 10.90, 10.98, 10.100a, 10.103, 10.105
Chapter 11: Intermolecular Forces, Liquids & Solids	11.1, 11.7, 11.8, 11.9, 11.10, 11.11, 11.12, 11.13, 11.15, 11.16, 11.17, 11.19, 11.20, 11.21

Note:

1. Learning and mastering chemistry concepts require doing problems. Students should attempt all the end-of-chapter exercises and seek assistance should questions arise.
2. Short answers to the above problems are available at the end of the text. 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**.
3. Some of the assigned problems will be in the tests and the final examination.

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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