

**CAMOSUN COLLEGE**  
**School of Arts & Science**  
**Chemistry/Geoscience Department**

**Chem 120-06 (Fall 2004) Course Outline**

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**INSTRUCTOR INFORMATION**

Dr. Becky Chak

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**Office hours: Monday, Tuesday & Thursday 9:30 - 10:30 am 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**

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 9<sup>th</sup> Edition", Brown, Lemay, and Bursten
- Chemistry 120 Lab Manual, Camosun College
- Safety Glasses and lab coat recommended

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### Recommended Course Materials

- Solutions to Exercises in "CHEMISTRY: the Central Science 9<sup>th</sup> 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.*

### Course Structure

1. Lecture: Monday, Thursday 8:30 - 9:20 am (F214); Tuesday 8:30 - 9:20 am (F216)
2. Lab<sup>1</sup>: Wednesday 8:30 - 11:20 am (F354);
3. Problem Sets on each section of the course<sup>2</sup> (see p. 4);
4. **TWO Term Tests<sup>3</sup> (two hours each; to be written during lab period on Oct 20, Nov 17);**
5. Final Examination (Three-hour in the week of December 13 - 18; 20 -21); 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. Practice problems are assigned from the textbook. Students should attempt them to keep pace with the material and seek assistance from the instructor should questions arise.
3. **Test 1 will be based on Review material & electronic structure of the atom. Test 2 will be on Periodic Properties of the Elements, Chemical Bonding.** 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.

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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:**

$(0.20)(\% \text{ lab score}) + 0.20 (\% \text{ test 1 score}) + 0.2 (\% \text{ test 2 score}) + 0.40(\% \text{ exam score}) = Q1 \%$
$(0.20)(\% \text{ lab score}) + 0.20 (\% \text{ test 1 score}) + 0.60(\% \text{ exam score}) = Q2 \%$
$(0.20)(\% \text{ lab score}) + 0.20 (\% \text{ test 2 score}) + 0.60(\% \text{ exam score}) = Q3 \%$
$(0.20)(\% \text{ lab score}) + 0.80 (\% \text{ exam score}) = Q4 \%$
<b>Compare Q1, Q2, Q3 &amp; Q4, a student is assigned the highest of the four as the final course grade.</b>

**2. For students completed test 1 & final exam:**

$(0.20)(\% \text{ lab score}) + 0.20 (\% \text{ test 1 score}) + 0.60 (\% \text{ exam score}) = Q1 \%$
$(0.20)(\% \text{ lab score}) + 0.80 (\% \text{ exam score}) = Q2 \%$
<b>Compare Q1 &amp; Q2, a student is assigned the higher of the two as the final course grade.</b>

**3. For students completed test 2 & final exam:**

$(0.20)(\% \text{ lab score}) + 0.20 (\% \text{ test 2 score}) + 0.60(\% \text{ exam score}) = Q1 \%$
$(0.20)(\% \text{ lab score}) + 0.80 (\% \text{ exam score}) = Q2 \%$
<b>Compare Q1 &amp; Q2, a student is assigned the higher of the two as the final course grade.</b>

**4. For students who completed only the final exam:**

$(0.20)(\% \text{ lab score}) + 0.80 (\% \text{ exam score}) = Q \%$
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**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**

- September 21: Tuition Fees due for courses for Fall 2004
- October 20 (Wednesday): Test 1 (approximately 120 minutes)
- November 9: Last Day to Withdraw courses for Fall 2004
- November 17 (Wednesday): Test 2 (approximately 120 minutes)
- December 10: Last Day of class for Fall 2004
- December 13 -18, 20 -21: Exam Period for Fall 2004

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**Tentative Lecture Plan & Relevant Sections from the text**

**1. September 7: Introduction (1 hour)**

**2. September 9, 13, 14, 16, 20, 21, 23: Review of selected topics (7 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. September 27, 28, 29, 30, October 4, 5, 7: Electronic Structure of Atoms (8 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**

**4. October 12, 14, 18, 19: Periodic Properties of the Elements (4 hours)**

- 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 - 7.7)**

**5. October 20 (Wednesday): Test 1 (2 hours in lab period)**

- Examinable topics: Review materials & Electronic Structure of Atoms (selected sections from Text Ch. 2 - 4 & 6)

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- 6. October 21, 25, 26, 28: Basic Concepts of Chemical Bonding (4 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**
  
- 7. November 1, 2, 4, 8, 9, 15, 16, 18: Molecular Geometry & Bonding Theories (8 hours)**
  - Shapes of molecules & VSEPR model.
  - Bond polarity, electronegativity, Molecular polarity, dipole moments.
  - Valence bond theory: hybrid orbitals, multiple bonds, delocalised  $\pi$  bonds.
  - Molecular orbital theory: MO diagrams for homonuclear diatomics, bond order.
  - **Text: Chapter 9**
  
- 8. November 17: Test 2 (2 hours in lab period)**
  - Examinable topics: Periodic Properties, Chemical Bonding (Text Ch. 7 & 8)
  
- 9. November 22, 23, 25, 29, 30: 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. December 2, 6, 7: 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. December 9: Review and Examination Information (1 hour)**

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

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**Problem Sets**

	<b>End-of-Chapter Exercises from the textbook, "Chemistry, The Central Science" 9<sup>th</sup> edition by Brown, LeMay &amp; Bursten.</b>
<b>Chapter 2: Atoms, Molecules, Ions</b>	2.17, 2.23, 2.86
<b>Chapter 3: Stoichiometry</b>	3.5, 3.15, 3.19, 3.29, 3.33, 3.41, 3.47, 3.49, 3.55, 3.71, 3.75, 3.77, 3.87, 3.90
<b>Chapter 4: Aqueous Reactions &amp; Solution Stoichiometry</b>	4.5, 4.11, 4.13, 4.15, 4.17, 4.29, 4.35, 4.37, 4.39, 4.41, 4.51, 4.53, 4.55, 4.57, 4.59, 4.61, 4.67, 4.69, 4.73, 4.77
<b>Chapter 6: Electronic Structure of Atoms</b>	6.3, 6.5, 6.7, 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, 6.68, 6.70, 6.77, 6.79, 6.81
<b>Chapter 7: Periodic Properties of the Elements</b>	7.3, 7.7, 7.8, 7.9, 7.15, 7.17, 7.19, 7.23, 7.25, 7.27, 7.29, 7.31, 7.33, 7.35, 7.37, 7.39, 7.41, 7.43, 7.45, 7.47, 7.49, 7.55, 7.57, 7.63, 7.73
<b>Chapter 8: Basic Concepts of Chemical Bonding</b>	8.1, 8.3, 8.5, 8.11, 8.13, 8.25, 8.29, 8.31, 8.33, 8.35, 8.37, 8.43, 8.45, 8.47, 8.49, 8.51, 8.53, 8.55, 8.57, 8.59, 8.76, 8.79, 8.81
<b>Chapter 9: Molecular Geometry &amp; Bonding Theories</b>	9.7, 9.9, 9.11, 9.13, 9.14, 9.15, 9.17, 9.19, 9.21, 9.23, 9.25, 9.27, 9.29, 9.31, 9.33, 9.35, 9.37, 9.39, 9.41, 9.43, 9.45, 9.47, 9.49, 9.51, 9.53, 9.55, 9.57, 9.59, 9.65, 9.67, 9.69, 9.72, 9.79
<b>Chapter 10: Gases</b>	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
<b>Chapter 11: Intermolecular Forces, Liquids &amp; Solids</b>	11.7, 11.9, 11.11, 11.13, 11.15, 11.17, 11.19, 11.69, 11.71, 11.73, 11.75

**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 may appear in tests.

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**CHEMISTRY 120-06**  
**General Lab Information**

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Instructor: Dr. Becky Chak

Office: Fisher 348A

Phone: 370-3472

Email: bchak@camosun.bc.ca

Office hours: Mon, Tuesday & Thursday 9:30 - 10:30 am or appointment by E-mail.

**Chem 120-06: Fall 2004 Tentative Laboratory Schedule**

Date	Chem 120 Experiment	Lab Report Due Date <sup>1</sup>
September 8	<b>No Lab.</b> Introduction: laboratory safety, format of lab report, etc. <b>Attendance is Mandatory</b>	
September 15	Expt 2: Part B: The density of a Liquid Expt. 3: Part A: Combination of Copper and Sulfur ( <b>Group A</b> ) <sup>2</sup>	<b>September 29</b>
September 22	Expt 2: Part B: The density of a Liquid Expt. 3: Part A: Combination of Copper and Sulfur ( <b>Group B</b> ) <sup>2</sup>	<b>September 29</b>
September 29	<b>No Lab. Lecture</b>	
October 6	Expt. 4: Spectroscopic Determination of Nickel	October 13
October 13	Expt. 5: Colorimetric Determination of Iron	<b>October 18</b>
<b>October 20</b>	<b>No Lab. Test 1</b>	
<b>October 27</b>	Expt 6: Determination of Copper Using A.A. Spectroscopy	<b>November 3</b>
November 3	Expt 8: Molecular Shapes & VSEPR Theory	<b>Report due end of lab</b>
November 10	Expt. 7: Determination of Total Hardness of Water	November 24
November 24	Expt. 9: Preparation of $K_3[Fe(ox)_3]$	December 1
December 1	Expt 10: Analysis of $K_3[Fe(ox)_3]$	<b>Report due end of lab</b>
<b>December 8</b>	<b>No Lab. Exam Info &amp; Review</b>	

**Pre-laboratory Preparation**

<sup>1</sup> Lab report will be considered late if handed in after 11:30 am on the date specified.

<sup>2</sup> For safety reasons, the class is divided into Groups A & B for Expt. 3. Group A students attend the lab on Sept 15; Group B students attend the lab on Sept 22. No class for students that are not doing the lab for that week.

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- Your success in the laboratory depends on your ability to thoroughly pre-plan each laboratory period. Before coming to the lab, read and think about the procedure of the experiment. Write a flow chart for the procedure of the experiment.

### Pre-lab assignment

1. You have to **complete and hand in the pre-lab assignment at the beginning of each experiment.**
2. Students who don't hand in the pre-lab assignment will receive a mark of **ZERO** for the pre-lab of that experiment.

### Laboratory Data

- **Before leaving the laboratory**, students must have their data written neatly in **pen** and initialised by the instructor.

### Laboratory Report

6. For experiments with **short data reports**, **worksheets** will be provided by the instructor before the experiment. Students are required to complete the worksheet **neatly in pen** (except for Calculations, which may be done in pencil). **The original raw data with the instructor's initial must be stapled to the back of the report.** You lose 1 mark if the pages of your report are not stapled together.
7. For experiments with **full reports**, detail format will be given by the instructor in the lab.

### Late Report

1. For every day the report is late, you lose 1 (one) mark. **No lab report will be accepted after 11:30 am, December 8, 2004.**
2. If a student does not hand in the lab report, a mark of ZERO will be given for that experiment.
3. 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 take the final examination.

### Absences

1. A grade of **ZERO** will be given automatically for a missed experiment without valid excuse.
2. Students who are legitimately absent for medical or compassionate reasons must provide support documentation to the instructor in charge (Becky Chak) **within 7 days** from the date you are absent. You may be asked to write a make-up report.

### Assessment in the Laboratory Course

- Your lab grade will be based on your laboratory reports. Bonus marks (~ 1 % of the total lab marks) may be awarded to those with prefect lab attendance, hand in every lab report on time and are safety conscious in the lab.