CHEMISTRY 121
College Chemistry 2

Instructor: Dr. Becky Chak
Office: Fisher 342A
Phone: 370-3374
Email: bchak@uvic.ca
Office hours: Tuesday & Thursday 5:30 - 6:15 pm or appointment by E-mail.

Prerequisite

Chem 120

Lectures and Labs

- Lecture: Thursday 6:30 - 9:20 pm (F310)
- Lab: Tuesday 6:30 - 9:20 pm (F356)

Course Structure

1. Schedule lectures;
2. Weekly Laboratory work as described in the laboratory manual;
3. Problem Sets on each section of the course[1];
4. Three Term Tests[2] (50 minutes each to be written during lecture period on February 6, March 6 & **during lab period on March 25**);
5. Final Examination (Three-hour); on **all material** in the course.

Note

1. Practice problems will be given periodically throughout the course. These are questions chosen from each chapter. They **will not be marked.** Solutions will be posted outside my office. Students should attempt them to keep pace with the material and seek assistance from the instructor should questions arise.
2. Test 1 will be on Organic Chemistry; Test 2 will be on Kinetics and Chemical Equilibrium; Test 3 will be on Thermochemistry and Chemical Thermodynamics.

Course Materials

- *CHEMISTRY: the Central Science* 9th Edition", *Brown, Lemay, and Bursten*
- *The Essentials of Organic Chemistry, George, Field and Hambley*
- *Chemistry 121 Lab Manual, Camosun College (Safety Glasses and lab coat recommended)*

Course Mark

The total percentage of the course mark will be made up as follows:

Laboratory 25%
Three Tests 30%
Final Exam 45%

Important Note

1. You must hand in a **minimum** of 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 are encouraged to write the tests. If it is advantageous to the student, the theory mark will be solely derived from the final examination.
4. **Missed Final Examination** will be **COUNTED AS ZERO** unless a medical or other satisfactory reason is provided in writing to the instructor within 14 days of the date of the examination.

Letter Grades

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

Important Dates

- February 6 (Thursday): Test 1 (50 minutes)
- February 13 and 14: Reading Break
- March 6 (Thursday): Test 2 (50 minutes)
- March 10 (Monday): Last Day to Withdraw
- March 25 (Tuesday): Test 3 in Lab (50 minutes)
- April 11 - 12: Last Day of class for Winter 2003
- April 14 - 17& 22 - 25: Exam Period for Winter 2003

Tentative Lecture Plan

1. **January 7, 9, 16, 23: Organic Chemistry (11 lectures)**
   - 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, chemical reactivity and nomenclature.
   - Chirality, enantiomers, Cahn-Ingold-Prelog nomenclature.
   - Biological compounds (e.g., amino acids, proteins, carbohydrates) and synthetic polymers.
   - ***Text: Chapter 25 + The Essentials of Organic Chemistry***

2. **January 30, February 6: Kinetics (5 lectures)**
   - Reaction rates, measuring reaction rates, factors influencing reaction rates.
   - Rate laws, types of rate laws, determining the rate law, method of initial rates.
   - Integrated rate laws, zero order, first order and second order, 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.
   - ***Text: Chapter 14***

3. **February 6: Test 1 (50 minutes)**
   - Examinable topic: Organic Chemistry

4. **February 20: Chemical equilibrium (3 lectures)**
   - 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.
   - ***Text: Chapter 15***

5. **February 27, March 6, 13: Thermochemistry and Chemical Thermodyamics (8 lectures)**
   - Nature of energy, first law of thermodynamics, enthalpy, enthalpy of reaction.
   - Calorimetry, bomb calorimeter.
   - Hess's law, enthalpy of formation.
   - Spontaneous processes, reversible and irreversible processes.
   - Entropy and 2^{nd} law of thermodynamics, molecular interpretation of entropy.
   - 3^{rd} law of thermodynamics and absolute entropies, calculating entropy changes.
   - Gibbs free energy, standard free energy.

- Free energy and temperature and equilibrium, free energy and work, driving non-spontaneous processes.
- ***Text: Chapters 5 and 19***

6. March 6: Test 2 (50 minutes)

- Examinable topic: Kinetics and Chemical Equilibrium

7. March 20, 27: Acids and Bases (6 lectures)

- 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.
- Relating structure to acid/base strength, acid/base properties of salts.
- Lewis acids and bases, common ion effect, buffers, Henderson-Hasselbalch equation.
- Solubility equilibria, formation of complex ions.
- ***Text: Chapters 16 and 17***

8. March 25 (Thursday): Test 3 (50 minutes)

- Examinable topic: Thermochemistry and Chemical Thermodynamics

9. April 3: Electrochemistry (3 lectures)

- Review of redox reactions, balancing redox equations.
- Galvanic cells, electrical energy, standard electrode potentials, cell emf, free energy and electrical work.
- Nernst equation, dry cell, lead storage battery.
- NiCad battery, fuel cells, corrosion, electrolysis, commercial electrolytic processes.
- ***Text: Chapter 20***

10. **April 10: Review**

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

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Chem 121-03 Laboratory Schedule

Date	Chem 121 Experiment	Lab Report Due Date[1]
January 7	**No Lab.** Lecture and Introduction: laboratory safety, format of lab report, etc.	
January 14	Expt. 1: The Preparation of Xylene Sulphonic Acid -- **Group A**	January 28
January 21	Expt. 1: The Preparation of Xylene Sulphonic Acid -- **Group B**	January 28
January 28	Expt. 2: Preparation of standard & Analysis of an unknown	February 4
February 4	Expt. 3: The Preparation of Benzoic Acid -- **Group A**	**March 4**
February 11	No Lab. Reading Break	
February 18	Expt. 3: The Preparation of Benzoic Acid -- **Group B**	**March 4**
February 25	Expt 4: Preparation and Isolation of Banana Oil	**March 4**
March 4	Expt. 6: The Rate of Bromination of Acetone	March 11
March 11	Expt. 7: pH measurement and the determination of pK_a of acetic acid	March 18
March 18	Expt. 8: The gravimetric determination of chloride ions	March 25
March 25	**No lab. Test 3**	
April 1	Expt. 9: Synthesis of Copper (I) Chloride	April 8

[1] Lab report will be considered late if handed in after 9:20 pm on the date specified.

April 8	No Lab. Lecture	

Pre-laboratory Preparation

6. Your success in the laboratory depends on your ability to thoroughly pre-plan each laboratory period.

7. Before coming to the lab, read and think about the procedure of the experiment.

8. Write a flow chart for the procedure of the experiment. Typically, they consist of drawing out the reaction sequence.

9. Complete the pre-lab assignment.

Pre-lab assignment

1. You have to 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 Report

5. A "full" laboratory report should be neat and tidy. It should be written (or typed) on one side of single-lined paper, in **ink.** Calculations may be done in pencil. **The original raw data with the instructor's initial must be attached to the back of the report.** Make sure to staple the pages of your report together, including any rough data sheets. You **lose 1 mark** if the pages of your report are not stapled together.

6. If your "full" report does not follow the format given on p.4, marks will be deducted.

7. For a number of experiments (Expts 3, 4, 7 & 9), short data reports are sufficient. Data sheets will be provided by the instructor before the experiment.

Late Report

1. For every day the report is late, you lose 1 mark. Once graded reports are returned to students, any late report will be corrected but will not get a grade.

2. You must hand in a **minimum** of 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 pre-lab preparation, safety awareness and tidiness in the lab, lab attendance: **7/90**
- laboratory reports: **83/90**.

Lab Reports Evaluation: (83/90)

Experiment No.	**Pre-lab assigment**	**Calculations & Results**	**Report**	**Total**
Expt. 1: The preparation of Xylene Sulphonic Acid	/3	/3	/4	/10
Expt. 2: The Analysis of an Unknown Acid	/4	/4	/2	/10
Expt. 3: The Preparation of Benzoic Acid	/3	/5		/8
Expt. 4: The Preparation and isolation of Banana Oil	/3	/5		/8
Expt. 6: The Rate of Bromination of Acetone	/3	/7	/5	/15
Expt. 7: pH measurements and the Determination of pK_a of Acetic Acid	/5	/5		/10
Expt. 8: The Gravimetric Determination of Chloride	/4	/3	/3	/10
Expt. 9: Synthesis of Copper (I)	/3	/9		/12

chloride				

Format of A "Full" Lab Report

Name:
Date: "date the report was submitted"
Lab Partner's name:

"Experiment number and Title of the experiment"

Objective/Theory:

- State what is to be done in the experiment and how it will be done. (Be brief and concise. Use **no more than five sentences**, include chemical equation(s) of all reactions involved and/or mathematical expressions).

Procedure:

- Give reference to the procedure, with any changes noted. For example, you can write the following: Please refer to Chem 121 lab manual, Winter 2003 Edition, Camosun College.

Data:

- Put experimental data and observations made during the course of the experiment **in neat tables**.
- Remember to put a title for each table.
- Report unknown numbers, concentrations of solutions, masses of reactants and products. Remember to write down the units for your measurements.
- Remember to staple the raw data recorded with the instructor's initial at the end of your lab report.

Calculations, Graphs and Results:

- In this section, you will interpret and rationalize the data you have obtained.
- Show all calculations you did. However, if you perform 3 or 4 titrations using the same two solutions, then you only need to show the calculation for one trial.
- If you are not using a computer to graph data, use graph paper.
- If you obtain a product, calculate the **percentage yield**. Provide a description of the product. In cases where you have not obtained the results you were hoping for, provide a brief explanation.

Conclusion:

- **In no more than two sentences**, state what you have achieved by doing the experiment.
- **Answers to Questions:** In cases where questions are asked at the end of the experimental procedures, provide the answers in this section.

References:

- Acknowledges credit to other authors and sources of information.