CAMOSUN COLLEGE
DEPT. OF CHEMISTRY & GEOSCIENCE
CHEMISTRY 110-GENERAL COLLEGE CHEMISTRY 1
FALL 2004

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Texts: "Chemistry" 4th Edition, by Ralph Burns (Prentice Hall)
Chemistry 110 Lab Manual (in-house)

*****Both texts are REQUIRED*****

Course Description:

The first part of a college level package for students in the life sciences and non-science programs. The topics comprise chemical energetics, chemical equilibrium, acids and bases, and oxidation/reduction chemistry.

Credits: 4

Mode and Hours of Delivery: 3 hour of lectures and 3 hours of labs. Duration: 15 weeks, Estimated out-of-class: at least 6 hours.

Pre-requisites: Chem11

Prior Learning Assessment Available: Yes

Intended Learning Outcomes:

At the end of this course, students will possess an enhanced ability to:

1. Identify, describe and account for the general characteristics of gases, liquids and solids - interionic and intermolecular forces; vaporization and condensation; melting and freezing; specific characteristics of water.
2. Utilize solution terminology, account for and compare the solubilities of ionic and molecular compounds, and describe the impact of temperature and pressure on solubility.
3. Describe the characteristics of solubility equilibria and use mathematical techniques employed in dealing with this phenomenon.
4. Describe and account for the colligative and osmotic properties of aqueous solutions.
5. Account for differences in the rates of chemical reactions, apply Le Chatelier's principle to equilibrium processes, and explain how catalysts influence reaction rates.
6. Apply mathematics and equilibrium constant expressions to descriptions of reversible reactions and chemical equilibria.
7. Identify Arrhenius, Bronsted and Lewis acids and bases, and describe the chemical properties of each type of substance.

8. Describe the ionization of water, the pH scale, weak and strong acids and bases, neutralization and the actions of buffer solutions.
9. Perform mathematical calculations involving pH, hydronium ion concentrations and acid-base titrations.
10. Define oxidation and reduction and assign oxidation numbers to the elements of substances involved in oxidation-reduction reactions. Demonstrate the ability to use oxidation numbers in balancing redox reactions.
11. Demonstrate an understanding of electrochemistry and account for the characteristics and uses of the standard hydrogen electrode, standard reduction potentials, electrolytic and voltaic cells.
12. Describe the characteristics of the major types of organic compounds – alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, ethers, aldehydes and ketones, carboxylic acids and esters, amines and amides.

Detailed Course Outline:

1. Review Material:
Atomic theory and the periodic table (Chapter 4)
-The nuclear atom: electrons, protons and neutrons
-Atomic number, mass number, and isotopes, atomic mass
-The Bohr model of the atom
-Electrons and orbitals, or can electrons spin?
-Electron configuration, the periodic table, families and periods
Chemical bonding (Chapter 8)
-Why bond?
-Electron dot formulas, Lewis dot structures
-Ionic bonds: opposites attract
-Names of simple ionic compounds
-Covalent bonds: a union made by sharing of electrons
-Equal and unequal sharing of electrons, polar covalent bonds
-Octet rule, exceptions to the octet rule
-Names for covalent compounds
-Electronegativity, competition for electrons
-Molecular shapes, important figures
Chemical reactions (Chapters 10, 11)
-Chemical reactions, chemical equations, reactants, products
-Types of chemical reactions,
-Balancing chemical equations-everything has to come from somewhere
-Calculations, chemical arithmetic and the mole, Avogadro's number
-The limiting reactant, reagent in control
-Energy Changes, enthalpy, entropy, endothermic and exothermic processes

2. Gases, liquids, and solids (Chapters 12, 13)
-What is a gas?, definition of gas pressure
-Boyle's law, Charles's law, and the ideal gas law
-Henry's law, heavenly sodas

-Daltons law of partial pressures, each gas counts
-Respiration, by gas diffusion
-Ionic forces (opposites attract), intermolecular forces (dispersion and dipole-dipole)
-Hydrogen bonding, a special type of bond
-Liquids: viscosity and surface tension (how do you think these tall trees grow?)
-Phase changes, liquids to gases; how do they do that?
-Evaporation, vapor pressure, dynamic equilibrium, boiling points
-The solid state: amorphous and crystalline, types of crystalline solids, how about those diamonds?
-Melting of solids, energy wanted
-Water: a most special liquid

3. Solutions (Chapter 14)
-What is a solution?
-Hydrophilic and hydrophilic interactions, local attractions
-Solubility of ionic and covalent compounds, stir that sugar!
-Low solubility salts, a precipitate is born, solubility product constant
-Molarity, percent concentrations, ratio concentrations
-Dynamic equilibrium
-Solubility and temperature
-Colligative properties of solutions, osmosis, dialysis

4. Reaction Rates: (Chapter 15)
-Measuring rates of reactions, determining rate expressions
-Collision theory, how fast can these molecules hit?
-Reaction mechanisms, rate-determining step
-Activation energy, potential energy and ΔH
-Energy diagrams
-Factors affecting rate, effects of temperature, concentration, and catalysts on rates

5. Equilibrium: (Chapter 15)
-Reversibility of reactions
-Dynamic equilibrium, evaporation and condensation
-Factors affecting equilibrium, a balancing act
-Le Chatelier's principle (minimizing the effects)
-Equilibrium constant, K expressions
-Dependence of K on T
-Mathematical applications of K
-Equilibrium applications
-Solubility equilibrium, solubility and precipitation
-Qualitative analysis, K_{sp} expressions and calculations

6. Acids and Bases: (Chapter 16)
-Acid-base definitions, Arrhenius acids and bases, Bronsted acids and bases
-Conjugate acid-base pairs, neutralization reactions
-Strong and weak acids and bases, amphiprotic substances
-Vinegar and baking soda: a fizzy affair

-Antacids: from chalk to tums (or how do they spell relief?)
-K_w , autoprotolysis of water
-pH and pOH scales
-Acid dissociation (ionization) constant, K_a , and base dissociation constant, K_b
-Salt hydrolysis, acids or bases? the pH of a salt solution
-Indicators, acid-base titrations, end point (it comes in color)
-Buffers, regulate that pH, blood buffers
-Lewis acids and bases (yes it is the same Lewis)

7. Oxidation and Reduction: (Chapter 17)
-Definition of oxidation and reduction, ole!!
-Assigning oxidation numbers, balancing redox equations
-Half-reactions, couples, balancing with half-reactions
-Redox titrations
-Electrochemical cells, E^o values
-Standard reduction potentials
-Electrolytic cells, electrolysis
-Fuel cells

8. Hydrocarbons (Chapter 19)
-Why carbon?
-Alkanes, straight and branched
-Isomers, same formula but different build
-Cycloalkanes, join the ends, the story of a chair and a boat
-Unsaturated hydrocarbons, look for multiple bonds
-Geometric isomers, either on the same side or on opposite sides
-Aromatic compounds, pleasant? may be!!
-What do you use them for anyway?

LEARNING SUPPORT AND SERVICES FOR STUDENTS

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

ACADEMIC CONDUCT POLICY

There is an Academic Conduct Policy. 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

Chem. 110 Lab Schedule (Fall 2004)
(subject to change)

September 6:	**Labor Day. College closed**
September 13:	Introduction, Safety Video
September 20:	Experiment #1, Energy changes
September 27:	No lab. **Test #1**
October 4:	Experiment #2, Reaction rates
October 11:	**Thanksgiving Day. College closed**
October 18:	Experiment #3, Shifting equilibria
October 25:	No lab. **Test #2**
November 1:	Experiment #4, Precipitation reactions
November 8:	Experiment #5, Qualitative analysis
November 11	**Remembrance Day. College closed**
November 15:	Experiment #6, Acid-base titrations
November 22:	No lab. **Test #3**
November 29:	Experiment #7, Vitamin C; Aspirin; Magnesia
December 6:	No lab. Lecture/Review

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 = < 50

Lab experiments	**25%**
Test 1 Monday, September 27 (2.5 hrs)	**10%**
Test 2 Monday, October 25 (2.5 hrs)	**10%**
Test 3 Monday, November 22 (2.5 hrs)	**10%**
Final Examination (Dec., 3 hrs)	**45%**

	100%

*Final exam at the end of the course will cover **all** course material
*At least a passing grade on lab marks must be achieved in order to write the final exam.
*You must pass both the lecture portion and the lab portion in order to pass the course.
*You must provide your own **safety glasses**. Prescription glasses are OK, but sunglasses are NOT. You must wear these safety glasses at all times while you are in the lab. You will not be allowed to carry out any experiments without safety glasses.
*Office hours are posted on the door. You can, however, drop by the office any time. You will not be wasting my time if you come for help. I'm here to help you learn.

Organization Of The Lab Report

Title of the experiment: State the title of the experiment you have just carried out.

Date: Write the date on which you did the experiment.

Name: Your name and lab partner's name (if applicable)

Objective: State what you want to achieve by doing the experiment in one or two sentences. Be very brief and to the point.

Procedures: You can write the following: Please refer to Chem. 110 lab manual, 2004 Edition pp. xx-xx. Record any changes to the given procedures.

Data: Organize any data, whether numerical or descriptive, in a **neat table** (or tables if applicable). Report such things as **unknown numbers**, **concentrations** of solutions, **masses** of reactants and products. Any relevant data recorded on a rough data sheet should be copied here. Do not forget to write **chemical equations** here.

Discussion and Calculations: In this part of the report, you will make sense out of the data you have obtained. If you obtain a product, calculate the **percentage yield**. Provide a physical description of your product. Show **all** the calculations you do, but there is no need to be repetitive. For example, if you perform 3 or 4 titrations using the same two solutions, then you only need to show the calculation for one trial. In cases where you have not obtained the results you were hoping for, provide a very 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 during or at end of experimental procedures, provide the answers here.

* Lab reports should be written in **ink, including all calculations**. The report does not have to be typed. If you are not using a computer to graph data, use graph paper. If your report does not follow the format given above, it may be deemed unacceptable and you may have to resubmit it. The new report will be considered late if it is not submitted on the same due date (see below).
* Lab reports are normally due one week after the assigned date for the experiment. You will be informed in advance if there are any changes to the due date.
* The report is marked out of 10. For every day the report is late, you lose 1 (one) mark.
* Make sure to **staple** the pages of your report together, including any **rough data sheets**. You lose 1 (one) mark if the pages of your report are not stapled together.