Camosun College

Department of Chemistry and Geoscience

Chemistry 120 2002/3

Instructor: Graham Shorthill

Office: Fisher 342C

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Office hours: See the posted times on the office door

Texts:

Brown, Lemay and Bursten

Chemistry: The Central Science. Ninth edition

Chemistry 120 laboratory manual

Study guide for the text.

Duotang binder for lab reports

These items are available from the bookstore. Students must have their own set of safety glasses in order to work in the laboratory. People who normally wear glasses do not have to purchase another pair.

Assessment: The final grade in the course will be based on the following components

Quiz 1	Chapters 1-4 & 10	10%
Quiz 2	Chapters 6-9	25%
Comprehensive final		40%
Laboratory		25%

Grades: The following percentages refer to the composite total obtained at the end of the course .

A range	85% to 100%
B range	70% to 84%
C range	60% to 69%
D range	50% to 59%
F range	<50%

Note: This table is given only as a guide and the exact equivalency will be determined by the instructor when all the marks are available. In cases where there is a major difference between the mark on the final examination and the composite total, the instructor reserves the right to adjust the final grade to reflect this difference. The passing grade is C and to pass the course, students must obtain passing grades in both the lecture and laboratory portions of it.

Sequence of Topics

Topics:	Chapters
Review	1,2,3,&4
Gases	10
Atomic structure and the periodic table	6&7
Chemical bonding and molecular geometry	8&9
Intermolecular forces of attraction	11
Solutions	13
Introduction to environmental chemistry	18

Lectures: These will follow the sequence given above. The quizes will be held in the laboratory periods of weeks five and ten.

Out of class work will be assigned each week and the answers to problems will be posted. Before each examination, students will receive a copy of a past examination covering the same topics to help the revision and to guide the classroom review of the material covered. Answers will be given to the numerical parts of the paper but each student is responsible for preparing and checking the descriptive parts of the paper.

Course content

Review: Chapters 1 to 4, the topics below will be covered in class. Students are responsible for the reviewing the remainder of the these chapters which contain material covered in Chemistry 11 and 12 or Camosun's Chem 060 and 080 /110

Chapter 1

1-1 Why do we study chemistry?
1-2 Classification of matter
1-4 Units of measurement

Chapter 2

2-1 The atomic theory of matter
2-2 Atomic structure
2-3 Isotopes, atomic numbers and mass numbers
2-4 The periodic table
2-5 Molecules and molecular compounds
2-6 Ions and ionic compounds

Chapter 3

3-2 Patterns of chemical reactivity
3-4 The mole
3-5 Empirical formulas and combustion analysis
3-7 Limiting reagents

Chapter 4

4-4 Chemical reactions
4-5 Concentrations of solutions
4- 6 Solution stoichiometry

Gases

Chapter 10

10-1 Characteristics of gases
10-2 Pressure
10-3 The gas laws
10-4 The ideal gas equation
10-5 Application of the ideal gas equation
10-6 Gas mixtures and partial pressures
10-7 Kinetic theory of gases
10-8 Effusion and diffusion

Atomic structure:

Chapter 6

6-1 The wave nature of light
6-2 Quantized energy and photons
6-3 Bohr's model of the atom
6-4 The wave behavior of matter
6-5 Quantum mechanics and atomic orbitals
6-6 Orbital shapes
6-7 The many-electron atom
6-8 Electronic configurations
6-9 The periodic table

Periodic properties:

Chapter 7

7-2 Atomic sizes
7-3 Ionization energy
7- 4 Electron affinities
7-5 Metals, non-metals and metalloids
7-6 Group trends for groups 1 and 2
7-7 Group trends for non metal groups

Bonding:

Chapter 8

8-1 Chemical bonds, symbols and the octet rule
8-2 Ionic bonding
8-3 Sizes of the ions
8-4 Covalent bonding
8-5 Bond polarity and electronegativity
8-6 Drawing Lewis structures
8-7 Resonance structures
8-8 Exceptions to the octet rule

Chapter 9

9-1 Molecular shapes
9-2 The V.S.E.P.R. model
9-3 Polarity of polyatomic molecules
9-4 covalent bonding and orbital overlap
9-5 Hybrid orbitals
9-6 Multiple bonds

Intermolecular forces

Chapter 11

11-2 Intermolecular forces of attraction
11-1 A molecular comparison between liquids and solids
10-9 Real gases and deviations from ideal behavior
11-3 Properties of liquids
11-4 Phase changes
11-5 Vapour pressure
11-6 Phase diagrams
11-8 Bonding in solids

Solutions:

Chapter 13

13-1 The solution process
13-2 Solubility
13-3 Changes in solubility
13-4 Different ways of expressing concentration
13-5 Colligative properties

The Environment:

Chapter 18

18-1 The earth's atmosphere
18-2 Sunlight and photochemistry
18-3 The ozone layer
18-4 Chemistry of the troposphere
18-5 The oceans
18-6 Fresh water

Camosun College

Department of Chemistry and Geoscience

Chemistry 221

Winter 2003

Instructor	Graham Shorthill
Office	Fisher 342C
Phone No.	370-3441
E-mail	Shorthill@camosun.bc.ca
Office hours	See the posted times on the office door

Texts

The recommended text for the course is " The Elements of Physical Chemistry " by P.W. Atkins. There is also a laboratory manual and study guide which all students must have; both items can be obtained from the bookstore. In addition, there are approximately ten texts held on reserve in the library for students to loan for 72 hours. You can sign them out at the front desk.

It is a departmental requirement that all students working in a laboratory must wear safety glasses. Students, who normally do **not** wear spectacles, must obtain a pair for themselves before they begin the laboratory experiments.

Topics	**Lectures**
Reaction kinetics	15
Thermodynamics	9
Electrochemistry	6
Solutions and colligative properties	3
Phase equilibria	6

Grades: The final grade in the course will be assigned on the basis of the following components:

a/	Quiz 1	15%
b/	Quiz 2	20%
c/	Comprehensive final	40%
d/	Laboratory	25%

The following percentages refer to the composite total obtained at the end of the course:

A range	**85%**	**to**	**100%**	
B range		70%	to	85%
C range		60%	to	70%
D range		50%	to	60%
F		<50%		

N.B. This table is given only as a guideline and the exact equivalency will be determined by the instructor when all the marks are available. In particular, the instructor reserves the right to adjust the final grade, up or down, if a student's preformance on the final examination differs significantly from their overall performance. The passing grade is C and students must obtain passing grades in both the lecture and laboratory portions of the course.

Course Outline

Reaction kinetics

The topics will include:

Factors affecting rates of reaction
Order of reaction
Energy of activation
Consecutive reactions
Reaction mechanisms.
Gas phase kinetics
Solution kinetics
Enzyme kinetics
Catalysis and explosions
Methods of following fast reactions

Thermodynamics

The topics will include:

The first law
Heat and work
Enthalpy
Work done by expansion of a gas
State and non-state functions
Reversible and irreversible changes.
Thermodynamic cycles and thermochemistry

The second law
Entropy and free energy
Free energy changes with pressure and temperature
Clausius - Clapeyron equation
Carnot cycles and energy conversion

The thermodynamics of mixtures
Partial molar volumes
Chemical potential
Gibbs Duhem equation

Electrochemistry

The topics will include:

The Arrhenius theory of dissociation
Ionic conductivity and Kohlrausch's law
The Debye-Huckel theory (ionic strength and activity)

The Nernst equation, cell potentials and cell reactions
Thermodynamics of cells
Fuel cells and energy conversion

Phase equilibria

The topics will include:

Raoult's and Henry's laws
Phase diagrams for one and two component systems
The lever rule

Azeotropes
Eutectic mixtures

Chemical potential and the drive to equilibrium
The phase rule

Colligative proporties

The topics will include:

The elevation of the boiling point
The depression of the freezing point
Osmotic pressure and reverse osmosis

Summary of learning outcomes for Chemistry 221

At the end of this course a student will possess an enhanced ability to:

Kinetics

- Determine the quantitative and qualitative changes in the rate of a chemical reaction produced by changes in concentration, temperature and ionic strength.
- Describe, explain and apply the energy of activation concept to the problems of catalysis.
- Derive reaction mechanisms from experimental data.
- Describe the major methods for following fast reactions and determining the presence of reaction intermediates.
- Use the steady state approximation to explain the mechanisms for reactions in the gas phase and in solutions; apply the same procedures to competitive enzyme kinetics.
- Distinguish between chain reaction explosions and thermal explosions.

Thermodynamics

- Distinguish between the following: heat and work, reversible and irreversible changes, state and non state functions, adiabatic and isothermal changes.
- Define and apply the enthalpy concept to the net energy change in a chemical reaction
- Calculate the work done by a gas when it expands: use the Carnot cycle.
- Use the principles of energy conservation and thermodynamic cycles, to calculate changes in any state function.
- Use the definition of entropy to determine the free energy available from a reaction and to predict the conditions under which the reaction would be spontaneous.
- Derive the Clausius - Clapeyron equation and apply it to the problems of volatile organic liquids.
- Describe, explain and apply the concept of partial molar volumes to the problem of dissolving one liquid in another.
- Define and use chemical potentials to explain the drive to equilibrium in both the quantitative and qualitative terms.

Electrochemistry

- Describe, explain and apply the theory of ionic dissociation to measurements of ionic conductivity.
- Describe the concepts of an ionic atmosphere, the ionic strength of a solution and the activity of an ion: use them to explain the properties of solutions at high solute concentrations.
- Derive and use the Nernst equation for the four major types of electrode.
- Calculate thermodynamic data from voltage measurements at different concentrations and temperatures.
- Describe and explain the processes of energy conversion with reference to the operation of a fuel cell and the role of hydrogen as a fuel.

Phase equilibria

- Describe, explain and apply the laws of Raoult and Henry to liquid-vapour equilibria.
- Differentiate between ideal and non-ideal solutions and predict their behaviour when they are distilled.
- Construct phase diagrams and apply the lever rule at particular points to determine the proportion of a component in each phase.
- Describe and explain the unique properties of azeotropes and eutectic mixtures.

Colligative properties

- Describe and explain the drive to equilibrium by the evaporation and condensation of volatile solvents.
- Predict the change in vapour pressure of a volatile solvent with the addition of non-volatile solutes: use the relationship to explain the elevation of the boiling point and the depression of the freezing point of the solvent.
- Differentiate between the behaviour of ionic and molecular solutes in a solution.
- Describe and explain the production of osmotic pressure across a membrane and the role of reverse osmosis in desalination.

Camosun College

Department of Chemistry and Geoscience

Chemistry 110

Instructor: Graham Shorthill **Office hours:** As posted on F342

Telephone: 370-3441 **e-mail:** Shorthill@camosun.bc.ca

Texts: There is a required text book and laboratory manual for this course and they are available in the bookstore.

Fundamentals of Chemistry by R. A. Burns 4th edition
Laboratory Manual for Chemistry 110

In addition, the library has many introductory text books that students can borrow and use to gain a different view or approach to the material covered in this course.

Required: A laminated periodic table, a duotang binder for laboratory reports and safety glasses.

Review From Chem 11 or Chem 060

Chapters 2, 3, 4, 5, 8(8-1 to 8-4), 9 (9-1 to 9-6), 11

Assessment: The final grade in the course will be assigned on the basis of the following components:

a	Quiz 1 (chapters 12, 13, 14)	15%
b	Quiz 2 (chapters 15, 16)	15%
c	Quiz 3 (Chapters 17, 18,)	15%
d	Comprehensive final	35%
e	Laboratory	20%

The percentages in the outline refer to the composite total obtained at the end of the course. This table is given only as a guide line and the exact equivalency will be determined by the instructor when all the marks are available. In particular, the instructor reserves the right to adjust the final grade, up or down, if the student's performance on the final examination differs significantly from their overall performance. The passing grade is C and students must obtain passing grades in both the lecture and the laboratory portions of the course.

A range	85%	to	100%
B range	70%	to	85%
C range	60%	to	70%
D range	50%	to	60%
F	<50%		

Attachment:

Course Outline

Chem 110

Foundations of General chemistry

Developed by Education Approvals Task Force

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