GRANDE PRAIRIE REGIONAL COLLEGE

DEPARTMENT OF SCIENCE

TWENTY-SEVENTH SESSION 1992-93

CHEMISTRY 1000: Introductory University Chemistry

PREREQUISITE: Chemistry 30 or equivalent and Mathematics 30 or equivalent

INSTRUCTOR: Dr. John P. Sloan, Office #J207
Telephone # 539-2004 (Office)

LECTURES: MWF, 1:00 - 1:50 in J227

ALBERTA TRANSFER CREDIT:
U of Alberta: Chem 104, 6 credits
U of Calgary: Chem 201 and Chem 203, 6 credits
U of Lethbridge: Chem 1000 and Chem 2000, 6 credits

COURSE OUTLINE:

LECTURE COMPONENT:

A study of general chemistry with emphasis on:

1. gaining an understanding of chemical principles;
2. developing an ability to use the principles in problem solving, and;
3. relating the significance of chemistry to the world around us.

Topics Include: chemical foundations; introduction to atoms, molecules and ions; stoichiometry, chemical calculations and types of reactions; the properties of gases; thermochemistry; atomic structure and periodicity; bonding, ionic, polar and covalent bonds; molecular structure, valence-shell electron pair repulsion theory, and quantum theory; chemical kinetics, rates and mechanisms of chemical reactions; chemical equilibria; acids and bases; solubility and precipitation reactions; thermodynamics, spontaneity, entropy and free energy; electro-chemistry, oxidation-reduction reactions; and nuclear and radiochemistry.

LABORATORY COMPONENT

The laboratory component consists of a series of experiments designed to highlight the practical application of the principles of general chemistry. The experiments are directly related to the topics covered in the course, and details are provided in the laboratory course outline.

TUTORIAL COMPONENT

The tutorial component consists of problem solving and discussion sessions with weekly problem sets, and multiple choice tests. These are marked towards the tutorial grading component.

Notes:

1. Lectures will be on Mondays, Wednesdays and Fridays from 11:00 to 11:50 h in J227.

2. Laboratory Periods: each student will have a 3 hour assigned laboratory period in Lab J116 or Lab J119.

3. Tutorial Period: each student will attend an assigned tutorial period as follows:

   Section AS1: Tuesdays 8:00-9:20 h in J201

   Section AS2: Thursdays 11:00-12:20 h in J201.

TEXT BOOKS AND LABORATORY ITEMS:

The following books are required:

1. Zumdahl, S.S., Chemistry, 2nd Edition, Heath, 1989;

2. Chemistry 1000/1040 Experiments, University of Alberta, 1992-93, and;

3. A hard backed and bound Laboratory Notebook.

The following book is recommended:

1. Zumdahl, S.S., Solutions Guide to Accompany Chemistry, Heath, 1989.

Notes:
1. All books and lab coats are available at the College Bookstore.

2. Safety glasses are provided and are required for the laboratory.

EVALUATION:

The examination schedule and composition of the final grade is:

1.	First semester Midterm Exam: Thursday, October 22.	10%
2.	First semester Final Exam to be scheduled between Dec. 10 and 18.	20%
3.	Second semester Midterm Exam Thursday, February 18.	12.5%
4.	Second semester Final Exam to be scheduled between April 19 and 28.	25%
5.	Laboratory	20%
6.	Tutorial Grading Component	12.5%
		100%

The grades are based on the nine point stanine scale and correlate with the following designations:

Stanine		Designation
9	----------	Outstanding
8	----------	Excellent
7	----------	Very Good
6	----------	Good
5	----------	Fair
4	----------	Pass
3		
2		
1		

Notes:
1. The two mid-term exams will each be of two hours duration, and the final exams

will be of three hours duration;

2. between 5 and 15% of exam content will be taken directly from problem assignments;

3. a pass grade is essential for the laboratory component;

4. the tutorial grade component will consist of weekly problem assignments, and multiple choice quizzes, and will contribute towards 12.5% of the final grade;

5. Weekly problem assignments consist of up to 10 questions each, and are due at the commencement of each seminar;

6. all problem assignments and laboratory reports are required to be written in ink and clearly legible;

7. regular attendance in lecture, laboratory, and tutorial components is a course requirement.

CHEMISTRY 202

READING AND PROBLEM ASSIGNMENTS

All references are to: Zumdahl, S.S., Chemistry, Heath, 1989.

FALL SEMESTER

Week of Sept 1: Chemical Foundations.
Read and Study Chapter 1.

- 1.1 The Scientific Method;
- 1.2 Units of Measurement;
- 1.3 Uncertainty in Measurement;
- 1.4 Significant Figures and Calculations;
- 1.5 Dimensional Analysis;
- 1.6 Temperature;
- 1.7 Density;
- 1.8 Classification of Matter, and;
- 1.9 Separation of Mixtures.

Weeks of Sept 7 & 14: Atoms, Molecules, and Ions.
Read and Study Chapter 2.

- 2.1 The early history of chemistry;
- 2.2 Fundamental Chemical Laws;
- 2.3 Dalton's Atomic Theory;
- 2.4 Characterization of the Atom, the Electron, Radioactivity, and the Nuclear Atom, and;
- 2.5 The Modern View of Atomic Structure, an introduction;
- 2.6 Molecules and Ions;
- 2.7 The Periodic Table, an introduction;
- 2.8 Naming Compounds and Drawing Formulas from Names.

Week of Sept 21: Stoichiometry.
Read and Study Chapter 3.

- 3.1 Atomic Masses;
- 3.2 The Mole;
- 3.3 Molecular Weight/Molar Mass;
- 3.4 Percentage Composition of Compounds;
- 3.5 Determining the Formula of a Compound;
- 3.6 Chemical Equations;
- 3.7 Balancing Chemical Equations;
- 3.8 Stoichiometric Calculations on Reactants and Products, and;
- 3.9 Limiting Reagent Calculations.

Weeks of Sept 28 & Oct 5 Chemical Reaction Classification and Solution Stoichiometry.
Read and Study Chapter 4.

- 4.1 Water, the Common Solvent;
- 4.2 Aqueous Solutions, Strong and Weak Electrolytes;
- 4.3 The Composition of Solutions;
- 4.4 Classification of Chemical Reactions;
- 4.5 Precipitation Reactions;
- 4.6 Reactions in Solution;
- 4.7 Selective Precipitation;
- 4.8 Stoichiometry of Precipitation Reactions;
- 4.9 Acid-Base Reactions;
- 4.10 Oxidation-Reduction Reactions;
- 4.11 Balancing Oxidation-Reduction Reactions, and;
- 4.12 Oxidation-Reduction Titrations.

Weeks of Oct 12 & 19 Gases.
Read and Study Chapter 5.

- 5.1 Early Experiments;
- 5.2 The Gas Laws of Boyle, Charles and Avogadro;
- 5.3 The Ideal Gas Law;
- 5.4 Gas Stoichiometry;
- 5.5 Dalton's Law of Partial Pressures;
- 5.6 The Kinetic Molecular Theory of Gases;
- 5.7 Effusion and Diffusion, and;
- 5.8 Chemistry in the Atmosphere.

Week of Oct 26 Thermochemistry.
Read and Study Chapter 6.

- 6.1 The Nature of Energy;
- 6.2 Enthalpy and Calorimetry;
- 6.3 Hess's Law;
- 6.4 Standard Enthalpies of Formation;
- 6.5 Present Sources of Energy, and;
- 6.6 New Sources of Energy.

Weeks of Nov 2 and 9 Atomic Structure and Periodicity.
Read and Study Chapter 7.

- 7.1 Electromagnetic Radiation;
- 7.2 The Nature of Matter;
- 7.3 The Atomic Spectrum of Hydrogen;
- 7.4 The Bohr Model;
- 7.5 The Wave Mechanical Model of the Atom;
- 7.6 Quantum Numbers;
- 7.7 Orbital Shapes and Energies;

	7.8	Electron Spin and the Pauli Principle;
	7.9	Polyelectronic Atoms;
	7.10	The History of the Periodic Table;
	7.11	The Aufbau Principle and the Periodic Table;
	7.12	The Polyelectronic Model, Further Developments;
	7.13	Periodic Trends in Atomic Properties, and;
	7.14	The Properties of the Alkali Metals.
Weeks of Nov 16 and 23		Bonding, General Concepts and VSEPR Model. Read and Study Chapter 8.
	8.1	Types of Chemical Bonds;
	8.2	Electronegativity;
	8.3	Bond Polarity and Dipole Moments;
	8.4	Ions, Electron Configuration and Sizes;
	8.5	Formation of Binary Ionic Compounds;
	8.6	Partial Ionic Character of Covalent Bonds;
	8.7	The Covalent Chemical Bond, a Model;
	8.8	Covalent Bond Energies and Chemical Reactions;
	8.9	The Localized Electron Bonding Model;
	8.10	Lewis Structures;
	8.11	The Octet Rule, Exceptions;
	8.12	Resonance, and;
	8.13	Molecular Structure, the VSEPR Model.
Week of Nov 30		Covalent Bonding, the Molecular Orbital Theory. Read and Study Chapter 9.
	9.1	Hybridization and the Localized Electron Model;
	9.2	The Molecular Orbital Model;
	9.3	Bonding in Homonuclear Diatomic Molecules;
	9.4	Bonding in Heteronuclear Diatomic Molecules, and;
	9.5	Combining the Localized Electron and Molecular Orbital Models.

WINTER SEMESTER

Weeks of Jan 5 and 11: Chemical Kinetics.
Read and Study Chapter 12.

- 12.1 Reaction Rates;
- 12.2 Rate Laws, an Introduction;
- 12.3 Determining the Form of the Rate Law;
- 12.4 The Integrated Rate Law;
- 12.5 Rate Laws, a Summary;
- 12.6 Reaction Mechanisms;
- 12.7 Chemical Kinetics, a Model, and;
- 12.8 Catalysis, Heterogeneous and Homogeneous.

Weeks of Jan 18 and 25: Chemical Equilibrium.
Read and Study Chapter 13.

- 13.1 The Equilibrium Condition;
- 13.2 The Equilibrium Constant;
- 13.3 Equilibrium Expressions involving Pressures;
- 13.4 Heterogeneous Equilibria;
- 13.5 Equilibrium Constant, Applications;
- 13.6 Solving Equilibrium Problems, and;
- 13.7 Le Châtelier's Principle.

Weeks of Feb 1 and 8: Acids and Bases I.
Read and Study Chapter 14.

- 14.1 The Nature of Acids and Bases;
- 14.2 Acid Strength, Water as an Acid and a Base;
- 14.3 The pH Scale;
- 14.4 pH calculations of Strong Acid Solutions;
- 14.5 pH Calculations of Weak Acid Solutions;
- 14.6 Bases;
- 14.7 Polyprotic Acids;
- 14.8 Acid-Base Properties of Salts;
- 14.9 Acid-Base Properties, the Effect of Structure;
- 14.10 Acid-Base Properties of Oxides;
- 14.11 The Lewis Acid-Base Model, and;
- 14.12 Solving Acid-Base Problems, a Strategy.

Weeks of Feb 15 & Mar 1: Acids and Bases II,
Applications of Aqueous Equilibria.
Read and Study Chapter 15.

- 15.1 Acids and Bases, The Common Ion Effect;
- 15.2 Buffered Solutions;
- 15.3 Buffer Capacity;
- 15.4 Titrations and pH Curves;

	15.5	Acid-Base Indicators;
	15.6	Solubility Equilibria and Solubility Products;
	15.7	Precipitation and Qualitative Analysis, and;
	15.8	Complex Ion Equilibria.

Week of Feb 15: Winter Break.
No Classes, Labs, and Reading and Study Assignments. Enjoy a Week of Relaxation.

Weeks of Mar 8 and 15: Thermodynamics, Spontaneity, Entropy and Free Energy.
Read and Study Chapter 16.

	16.1	Spontaneous Processes and Entropy;
	16.2	Entropy and the Second Law of Thermodynamics;
	16.3	Spontaneity, the Effect of Temperature;
	16.4	Free Energy;
	16.5	Entropy Changes in Chemical reactions;
	16.6	Free Energy and Chemical Reactions;
	16.7	Free Energy, the Dependence on Pressure;
	16.8	Free Energy and Equilibrium, and;
	16.9	Free Energy and Work.

Weeks of Mar 22 and 29: Electrochemistry.
Read and Study Chapter 17.

	17.1	Galvanic Cells and Cell Potential;
	17.2	Standard Reduction Potentials:
	17.3	Cell Potential, Electrical Work, and Free Energy;
	17.4	Cell Potential, the Dependence on Concentration;
	17.5	Batteries;
	17.6	Corrosion;
	17.7	Electrolysis, and;
	17.8	Commercial Electrolytic Processes.

Week of April 5: Transition Metals and Coordination Chemistry.
Read and Study Chapter 20.

	20.1	The Transition Metals, a Survey.
	20.2	Transition Metals, the First Row;
	20.3	Coordination Compounds;
	20.4	Isomerism;
	20.5	Bonding in Complex Ions;
	20.6	The Crystal Field Model;
	20.7	The Molecular Orbital Model, and;
	20.8	Coordination Complexes, Biological

Importance.

Week of April 12

Nuclear and Radio Chemistry.
Read and study Chapter 21.

21.1 Nuclear Stability and Radioactive Decay;
21.2 The Kinetics of Radioactive Decay;
21.3 Nuclear Transformations;
21.4 Radioactivity, Detection and Uses of;
21.5 Thermodynamics, the Stability of the Nucleus;
21.6 Nuclear Fission and Nuclear Fusion, and;
21.7 The Effects of Radiation.