SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: PRINCIPLES OF CHEMISTRY II THEORY & LAB

Code No.: CHM 218-5

Program: WATER RESOURCES II & PULP & PAPER II

Semester: II

Date: JUNE 1984, FOR USE IN JANUARY 1985

Author: J. KORREY/D. HEGGART

New: _____ Revision: _____

APPROVED: _____ _____

Chairperson Date

CALENDAR DESCRIPTION

PRINCIPLES OF CHEMISTRY II	CHM 218-5
Course Name	Course Number

PHILISOPHY/GOALS:

CHM 218-5 is a continuation of CHM 104-4 from semester 1. The major emphasi is on Quantitative Analysis; the student is expected to analyze a variety of samples and arrive at satisfactory results. The theory component of the cou deals with the following concepts: chemical calculations, K_s, K_{eq}, K_a, K_b, acid-base chemistry, pH, H^+, pOH, OH^-, % ionization of weak acids and bases. Introduction to organic chemistry completes the course.

CHM 218 serves as a prerequisite for CHM 230-33 (Water Chemistry) and Pulp a Paper - PPE 220-4 (Pulp Testing II).

TEXTBOOK(S):

Ebbing, Darrell D., General Chemistry, Houghton Mifflin Co., 1984.

LAB MANUAL:

Lab Experiments for CHM 218 - Sault College, Heggart & Korrey.

EVALUATION:

The final grade is arrived at by totalling the theory marks (50%) and the la marks (50%).

The lab mark is the sum of all marks awarded for the analysis plus the writt report for each of the five experiments.

The theory mark is the sum of all tests, assignments, mid-term and final examinations.

EVALUATION - Continued

Term Test Quizzes and Assignments	100 marks
Final Exam Lab Work	100 marks
	200 marks

Assignments are due on the date specified. Late assignments will not be accepted so it is critical that you submit as much of the assignment as possible on the due date. Lab reports are due one week from completion lab. Late labs are reduced 10% per week.

ATTENDANCE:

Your grade will be greatly affected by attendance at scheduled classes a labs. 85% is required at all theory classes while 100% is needed for al Serious illness (doctor's care) is the only valid excuse.

EXEMPTION:

The theory grade is the sum of all test and assignments. Tests will inc all work up to the time of each test. All students having 70% or more c work are exempt from the final exam which will cover the whole course ar counts 20% of the theory grade.

Minimum achievement in lab is	70%
Minimum achievement in theory is	40%
Minimum achievement overall is	55%

UNIT I: SOLUTIONS

1 Types of Solutions
Gaseous Solutions
Liquid Solutions
Solid Solutions

2 Ways of Expressing Concentration
Mass
Percentage of Solute
Conversion of Concentration Units

3 Equivalents and Normality

IONS IN SOLUTION; IONIC EQUATIONS

4-1 Electrolytes
A note about the Hydrogen Ion
Introduction to Chemical Equilibrium
Strong and Weak Electrolytes

4-2 Ionic Equations

4-3 Types of Reactions

METATHESIS REACTIONS

4-4 Solubility and Precipitation
Solubility Rules
Precipitation Reactions

5 Reactions of Acids, Bases and Salts
Neutralization
Reactions of Salts
Formation of a Gas

6 Introduction to Oxidation-Reduction Reactions
Terminology
Understanding oxidation-Reduction Equations

7-1 Properties of Water
Hydrogen Bonding and the Physical Properties of Water
Chemical Properties of Water

THE FOLLOWING TOPICS ARE OPTIONAL FOR WATER RESOURCES ONLY

7-2 Water Pollutants
Thermal Pollution
Biological Oxygen Demand
Inorganic Ions
other Pollutants

UNIT I - Continued

7-3 Water Treatment and Purification

7-4 Removing Ions from Water; Desalination

UNIT II: CHEMICAL EQUILIBRIUM

DESCRIBING CHEMICAL EQUILIBRIUM

1 Chemical Equilibrium - A Dynamic Equilibrium

2 The Equilibrium Constant
Definition of the Equilibrium Constant K_c
Obtaining Equilibrium Constants for Reactions
The Equilibrium Constant K_p

3 Heterogeneous Equilibria

USING AN EQUILIBRIUM CONSTANT

4 Qualitatively Interpreting an Equilibrium Constant

5 Predicting the Direction of Reaction

6 Calculating Equilibrium Concentrations

CHANGING THE REACTION CONDITIONS AND THE APPLICATION OF LeCHATELIER'S PRINCIPLE

7 Adding a Catalyst

8 Removing or Adding Reactants or Products

9 Changing the Pressure and Temperature
Effect of Pressure Change
Effect of Temperature Change
Choosing the Optimum Conditions for Reaction

UNIT III: ACID-BASE CONCEPTS

1 Arrhenius Concept of Acids and Bases

2 Self-Ionization of Water

3 The pH of a Solution

UNIT III - Continued

4 Bronsted-Lowry Concept of Acids and Bases

5 Relative Strengths of Acids and Bases

6 Molecular Structure and Acid Strength

7 Acid-Base Properties of Salt Solutions

8 Lewis Concept of Acids and Bases

UNIT IV: ACID-BASE EQUILIBRIA

SOLUTIONS OF A WEAK ACID OR BASE OR SALT

1 Acid Ionization Equilibria
Experimental Determination of K_a
Calculations from K_a

2 Polyprotic Acids

3 Base Ionization Equilibriak

4 Hydrolysis

SOLUTIONS OF A WEAK ACID OR BASE WITH ANOTHER SOLUTE

5 Common-Ion Effect

6 Buffers 611

7 Acid-Base Titration Curves
Titration of a Strong Acid by a Strong Base
Titration of a Weak Acid by a Strong Base
Titration of a Weak Base by a Strong Acid

UNIT V: SOLUBILITY AND COMPLEX-ION EQUILIBRIA

SOLUBILITY EQUILIBRIA

1 The Solubility Product Constant

2 Solubility and the Common-Ion Effect

3 Precipitation Calculations
Criterion for Precipitation
Completeness of Precipitation
Fractional Precipitation

UNIT V: ORGANIC CHEMISTRY

HYDROCARBONS

1 Alkanes and Cycloalkanes
Methane, the Simplest Alkane
The Alkane Series
Nomenclature of Alkanes
Cycloalkanes
Sources of Alkanes and Cycloakanes

2 Alkenes and Alkynes

3 Aromatic Hydrocarbons
Derivatives of Benzene
Sources and Uses of Aromatic Hydrocarbons

DERIVATIVES OF HYDROCARBONS

4 Organic Compounds Containing Oxygen
Alcohols and Ethers
Aldehydes and Ketones
Carboxylic Acids

5 Organic Compounds Containing Nitrogen and Sulphur
Amines and Amides
Thiols and Sidulfides

LABORATORY WORK

The student will complete the experiments designated for this course in the allotted time. The following experiments are required:

1. Titration of Acids and Bases - standardization of NaOH, and determination of unknown KHP
2. Gravimetric Cl^- - Cl^- in a known (NH_4 Cl) plus Cl^- in an unknown
3. Determination of Water Hardness Ca^{2+} in H_2O (by EDTA titration)
4. Volumetric Cl^- - Cl^- in a known (NaCl) and in unknown (use same unknow as Exp. #2)
5. Gravimetric Ni - use organic precipitant DMG

In addition to the above the student will be able to subject his results to statistical analysis and determine:

1. Precision
2. Relative error
3. Average deviation
4. Standard deviation
5. Whether a result should be excluded by the 2.5d rule, 4.0d rule and by the Q test