SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: PRINCIPLES OF CHEMISTRY II THEORY

Code No.:   CHM 218-4 5

Program: WATER RESOURCES II & PULP & PAPER II

Semester: II

Date: JUNE, 1983

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New: _____   Revision: x

APPROVED:

_____   _____
Chairperson   Date

WATER RESOURCES AND PULP & PAPER
CHM 218-4
PRINCIPLES OF CHEMISTRY II THEORY

CALENDAR DESCRIPTION

PRINCIPLES OF CHEMISTRY II   CHM 218-4
Course Name   Course Number

PHILOSOPHY/GOALS:

CHM 218-4 is a continuation of CHM 104-4 from semester 1. The major
emphasis is on Quantitative Analysis and so the student is expected to
analyze a variety of samples and arrive at satisfactory results. The theory
is a review of atomic structure and bonding with a continuation of solution
chemistry and problem solving from semester 1. Organic Chemistry is
introduced for the first time.

CHM 218 serves as a prerequisite for CHM 230-3 (Water Chemistry) and Pulp
and Paper - PPE 120-4 (Pulp Testing I).

TEXTBOOK(S):

Malone, L. J. , Basic Concepts of Chemistry, Wiley (1981).

LAB MANUAL:

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

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UNIT I: Solution Chemistry

The student should be able to:

(1) Understand why water is a universal solvent.

(2) Write the solubility rules and understand the relationship between
     solubility and Ksp.

(3) Calculate the mass of solute required to prepare Molar or Normal
     solutions.

(4) Calculate the amount of solution required to prepare a more dilute
     solution $(C_1V_1 = C_2V_2)$.

(5) Write and balance equations involved in precipitation reactions and
     make calculations based on these equations as to unknown
     concentration.

(6) Do calculations involved in acid/base titrations and standardization of
     unknown solutions:

$$\text{(\# equivalent Base} = \text{\# equivalent Acid)}$$

(7) Express solution concentrations in other units and be able to convert
     from one to another. For example, % by weight, % volume, p.p.t.,
     p.p.m., p.p.b., mg/L, etc.

(8) Express concentration of solutions in ppm (mg/l)

$$M = \frac{\text{\% Purity x S.G. x 1000}}{\text{GMW}}$$

UNIT II: Samples and Statistical Analyses of Data

The Student will be able to:

(1) Use the correct significant figures and answer questions according to
     given data.

(2) Use the correct statistics in analyzing laboratory data.

(3) Eliminate a result based on statistics - rejection of a measured value.

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UNIT III: Reaction Chemistry

The student should be able to:

(1) Determine the products and balance the five types of chemical reactions.

   - Direct combination reactions
   - Decomposition reactions
   - Single displacement reactions
   - Double displacement reactions including neutralization
   - Redox reactions

(2) Make stoichiometric calculations of the above.

(3) Complete work sheets for the above.

UNIT IV: Organic Chemistry

The student should be able to:

(1) Apply the Theory of Hybridization of carbon and relate this to the classes of organic compounds.

(2) List the classes of organic compounds and give the functional group of each class.

(3) Explain the type of bonds in the hydrocarbon families in terms of hybridization,   ,   , single, double, triple, bond angle.

(4) Identify and give examples of terms commonly used in organic chemistry, such as isomer, acids, bases, etc.

(5) Explain why there are millions of organic compounds and what threat they pose to the environment.

UNIT V: Acid-Base Theory

The student should be able to:

(1) Define and give examples of an acid, a base, a strong/weak acid, a strong/weak base.

(2) Be able to apply the concept of ionization to determine strong/weak acid.

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UNIT VI: Acid-Base Theory - (Continued)

(3) Write formulas and name the strong acids, strong bases, weak acids, weak bases.

(4) Write the dissociation equation for acids and bases in water.

(5) Understand the concept of pH and apply it to problem solving in order to calculate pH, $[H^+]$, pOH, $[OH^-]$.

(6) Use K equilibria K_w, K_a, K_b, and solve related problems.

(7) List the ways in which pH of a solution can be determined.

(8) Describe how to calibrate and use a pH meter.

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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 & Bases - standardization of NaOH, and determination of unknown KHP

(2) Gravimetric Cl^- - Cl^- in a known (NH_4Cl) 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 unknown 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

EVALUATION:

Mid-Term Test	35 marks
Quizzes & Assignments	
Final Exam	65 marks
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 of the lab. Late labs are reduced 10% per week.