

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

Semester: II

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APPROVED: _____
Chairperson Date

WATER RESOURCES AND PULP & PAPER

CHM 218-5

PRINCIPLES OF CHEMISTRY II THEORY

CALENDAR DESCRIPTION

PRINCIPLES OF CHEMISTRY II

CHM 218-5

Course Name

Course Number

PHILOSOPHY/GOALS:

CHM 218-5 is a continuation of CHM 104-4 from semester 1. The major emphasis is on Quantitative Analysis; the student is expected to analyze a variety of samples and arrive at satisfactory results. The theory component of the course deals with the following concepts: solution chemistry, M, N, %, ppm, types, reactions, balancing equations, chemical calculations, K_{sp} , K_{eg} , K_a , K_b , K_w , 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 230-3 (Water Chemistry) and Pulp and Paper - PPE 220-4 (Pulp Testing II).

TEXTBOOK(S):

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

LAB MANUAL:

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

EVALUATION:

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

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

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

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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 K_{sp} .
- 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:
(# equivalent Base = # 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).
- 9) Make use of $M = \frac{\% \text{ Purity} \times \text{S.G.} \times 1000}{\text{GMW}}$ to determine concentration of stock acids and bases.

UNIT II: Samples and Statistical Analyses of Data

Assignment #1
Test #1

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) Determine solubility of compounds using K_{sp} and also calculate K_{sp} for given solubility. Complete work sheets for the above.

Assignment #2
Test #2

UNIT IV: 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.
- 3) Write formula 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.
- 9) Calculate % ionization of a weak acid or base.

Assignment #3

Test #3

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UNIT VI: 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.

Test #4

ATTENDANCE:

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

EXEMPTIONS:

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

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

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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:

Term Test	
Quizzes & Assignments	100 marks
Final Exam	
Lab Work	<u>100 marks</u>
	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.