SAULT COLLEGE
of Applied Arts and Technology
Sault Ste. Marie

COURSE OUTLINE

CHM 125-4

GENERAL CHEMISTRY THEORY

revised May, 1980

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GENERAL CHEMISTRY THEORY

General Chemistry Theory for Chemical Engineering and Medical Laboratory students consists of three hours per week devoted to basic chemical concepts and one hour spent on solving related problems.

PREREQUISITE:

Since this course is a continuation of CHM 115-4, students entering this program must have successfully completed CHM 115 taught in semester one, or have approval of the instructor.

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UNIT ONE - Chemical Equilibrium in Gaseous Systems.

In this introductory unit on chemical equilibrium, the approach is to study the conditions that apply to a system in chemical equilibrium and to develop principles to predict both direction and extent to which a reaction will proceed under a given set of conditions.

TOPICS DISCUSSED:

- Gaseous Equilibrium Systems; Concept of K_c
- General Form and Properties of K_c
- Applications of K_c
- Effect of Changes in Conditions upon the Position of an Equilibrium
- Related problems

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UNIT TWO - Precipitation Reactions.

Most reactions considered until now have been ones that primarily take place in the gas phase or solids to gases. Although they are important, many reactions taking place in aqueous solution are of even greater significance. In this unit, a variety of reactions in water solution will be studied with emphasis being placed on precipitation reactions. Principles will be developed to enable us to predict under what conditions reactions will occur, what products are formed, and how to represent them by a chemical equation.

TOPICS DISCUSSED ARE:

- Net Ionic Equations.
- Solubilities of Ionic Compounds
- Solubility Equilibria
    * common ion effect
    * diverse ion effect
    * solubility product constant
- Precipitation reactions in analytical chemistry (Qualitative Analysis)
- Precipitation reactions in inorganic preparations
- Related problems

UNIT THREE - Acids - Bases

The last unit dealt with reactions taking place in aqueous solutions, i.e. precipitation reactions, and last semester we studied the properties and use of water as a solvent. Water also plays a significant role in reactions involving acids and bases. In this unit we shall take a further look at water and it's effect on acid and base solutions. Principles will be studied to enable us to predict when a solution will be acidic or basic, the properties of an acid-base mixture, and be able to write a net ionic equation, determine the equilibrium constant and apply the principles of equilibrium.

TOPICS DISCUSSED ARE:

PART A - Acids - Bases:

- The Dissociation of Water; Nature of Acids and Bases.
- The concept of pH.
- Strong acids and bases.
- Weak acids.
- Weak bases.
- Acid-Base properties of salt solutions.
- General Theories of Acids and Bases:
    * Arrhenius
    * Bronsted - Lowry
    * Lewis

PART B - Acid Base Reactions:

- Types of Acid Base Reactions
    *Reactions of strong acids and bases
    *Reactions of weak acids and strong bases
    *Reactions of strong acids and weak bases
    *Reactions of strong acids with solids
- Acid - Base Titrations
    *Normality and gram equivalent mass
    *Acid-base indicators
    *Shape of titration curves
- Buffers

UNIT THREE - Continued.....

- Application of Acid-Base Reactions in Inorganic Synthesis
- Applications in Qualitative Analysis
- Related Problems

UNIT FOUR - OXIDATION - REDUCTION
PART A - Electrochemical Cells
PART B - Reactions - Spontaneity and Extent

Many reactions dealt with so far have been between atoms, molecules or ions with little, if any, concern of what happens to the particles of the atom - the electrons. Reactions involving electron transfer or oxidation - reduction will be dealt with here.

In Part A of this unit the principles of oxidation - reduction, writing and balancing equations and application of principles to electrolytic and galvanic processes will be discussed.

Part B deals with redox reactions and the ~~priciples~~ principles that enable us to decide whether a given redox reaction will occur and the extent to which reaction will occur.

TOPICS DISCUSSED ARE:

Part A:

- Oxidation Numbers

- Balancing Oxidation - Reduction Equations

    * Oxidation number method
    * Half equation method

- Electrolytic Cells

    * Commercial cells
    * Electroplating
    * Quantitative aspects of electrolysis

- Voltaic Cells

    * Simple voltaic cells: The Zn-Cu^{2t} Cell
    * Dry cell
    * Lead storage battery
    * Fuel cells

Part B:

- Standard Voltages

- Ease of Reduction and Oxidation

- Effect of Concentration on Voltage

- Strong Oxidizing Agents

UNIT FOUR Continued.....

- Corrosion of Iron
    * Corrosion protection by coatings
    * Cathodic protection
- Redox Reactions in Analytical Chemistry
    * Qualitative Analysis
    * Quantitative Analysis
- Related Problems

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UNIT FIVE - RATES OF REACTION

In our study of reactions we have seen that some reactions occur rapidly while others are relatively slow. In this unit the principles of "Chemical Kinetics" will be developed to enable us to predict how rapidly a reaction will occur.

TOPICS DISCUSSED ARE:

- Meaning of Reaction Rate
- Dependence of Reaction Rate upon Concentration
- Order of a Reaction
- Dependence of Reaction Rate upon Temperature
    * Activation energy
- Catalysis
- Collision Theory
- Reaction Mechanisms
- Related Problems