

**STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK**



COURSE OUTLINE

CHEM 101 - INTRODUCTION TO CHEMISTRY

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**SCHOOL OF SCIENCE, HEALTH, AND CRIMINAL JUSTICE
SCIENCE DEPARTMENT
May 14, 2015**

CHEM 101 - INTRODUCTION TO CHEMISTRY

- A. **TITLE:** Introduction to Chemistry
- B. **COURSE NUMBER:** CHEM 101
- C. **CREDIT HOURS:** 3 credit hours
- D. **WRITING INTENSIVE COURSE:** No
- E. **COURSE LENGTH:** 15 weeks
- F. **SEMESTER(S) OFFERED:** Fall/Spring
- G. **HOURS OF LECTURE:** Three hours of lecture per week.
- H. **CATALOG DESCRIPTION:** This is an overview of chemistry that will include atomic structure, English-metric unit conversions, chemical nomenclature, the mole concept, stoichiometry, chemical reactions, states of matter, thermodynamics, gas laws, modern atomic theory and acid-base theory. It is designed for those students who have had little or no chemistry background. Students must enroll in both CHEM 101 and CHEM 100 simultaneously, unless they have previously passed one of the courses. Students must also pass both CHEM 101 and CHEM 100 to receive Natural Science General Education credit.
- I. **PRE-REQUISITES:** MATH 100 Beginning Algebra
- CO-REQUISITES:** CHEM 100 Introduction to Chemistry Lab.
- J. **GOALS (STUDENT LEARNING OUTCOMES):** By the end of this course, the student will:

<i>Course Objective</i>	<i>Institutional SLO</i>
a. Understand and apply the scientific method; perform mathematical manipulations (<i>e.g.</i> dimensional analysis) with correct use of units and significant figures; define matter and its properties and changes, as well as mixtures and separation of mixtures; comprehend chemical foundations, atomic theory, chemical formulas, ions and isotopes; build, name and classify ionic and molecular compounds.	2. Crit. Thinking 3. Prof. Competence
b. Write and balance chemical equations; identify and predict the outcome of the various chemical reactions including acid-base and precipitation reactions; use concepts such as the mole and molar mass to determine chemical composition; calculate amounts of chemicals involved in reactions based on balanced chemical equations; explain endothermic and exothermic processes, define and understand enthalpy, Hess's law and the laws of thermodynamics.	2. Crit. Thinking 3. Prof. Competence

c. Understand the basics of Modern Atomic Theory and energy emission by atoms; write electron configurations and draw orbital box diagrams of elements; understand and perform calculations based on the relationships between pressure, volume and temperature of gases (Boyle's Law, Charles's Law, Avogadro's Law and the Ideal Gas Law); define and perform calculations related to acid, base and pH.	2. Crit. Thinking 3. Prof. Competence
d. Attain a comprehensive understanding of the foundations of chemistry, synthesizing, recalling and applying principles of chemistry to solve wide-ranging problem types.	2. Crit. Thinking 3. Prof. Competence

K. TEXTS:
Zumdahl, S. & Decoste, D. *Introductory Chemistry*, Eighth Edition, Houghton-Mifflin Publishers, 2015.

L. REFERENCES:

M. EQUIPMENT:

N. GRADING METHOD: A-F

O. MEASUREMENT CRITERIA/METHODS: Exams and Homework

P. DETAILED TOPICAL OUTLINE:

I. Measurements and Calculations

- A. Scientific Notation
- B. Units
- C. Measurements of Length, Volume and Mass
- D. Uncertainty in Measurement
- E. Significant Figures
- F. Temperature Conversions
- G. Mathematical manipulations such as dimensional analysis with proper attention to units and significant figures

II. Matter

- A. Matter and its general properties
- B. Physical and Chemical Properties and Changes
- C. Elements and Compounds
- D. Mixtures and Pure Substances
- E. Separation of Mixtures

III. Chemical Foundations: Elements, Atoms and Ions

- A. Elements and their Symbols
- B. Dalton's Atomic Theory
- C. Formulas of Compounds
- D. The Structure of the Atom
- E. Introduction to the Periodic Table

- F. Isotopes
- G. Ions and Compounds that Contain Ions

IV. Nomenclature

- A. Naming Compounds
- B. Binary Compounds (Type I, II and III)
- C. Compounds that contain Polyatomic Ions
- D. Naming Acids
- E. Writing Formulas from Names

V. Chemical Reactions: An Introduction

- A. Evidence for a Chemical Reaction
- B. Chemical Equations
- C. Balancing Chemical Equations

VI. Reactions in Aqueous Solutions

- A. Predicting Whether a Reaction Will Occur or Not
- B. Reactions that form Solids
- C. Solubility Rules
- D. Reactions That Form Water: Acids and Bases
- E. Reactions of Metals with Non-Metals
- F. Ways to Classify Reactions

VII. Chemical Composition

- A. Atomic Masses: Counting Atoms by Weighing
- B. The Mole
- C. Molar Mass
- D. Percent Composition of Compounds
- E. Empirical and Molecular Formulas

VIII. Chemical Quantities

- A. Information given by Chemical Equations
- B. Mole-Mole Relationships
- C. Mass Calculations

IX. Energy

- A. Nature of Energy
- B. Temperature and Heat
- C. Exo and Endothermic Processes
- D. Thermodynamics
- E. Measuring Energy Changes
- F. Thermochemistry (Enthalpy)
- G. Hess's Law
- H. Energy and Our World

X. Modern Atomic Theory

- A. Rutherford's Atom
- B. Emission of Energy by Atoms
- C. The Energy Levels of Hydrogen
- D. The Bohr Model of The Atom
- E. The Wave Mechanical Model of the Atom
- F. The Hydrogen Orbitals
- G. Electronic Arrangements of the First Eighteen Atoms on The Periodic Table
- H. Atomic Properties and The Periodic Table

XI. Chemical Bonding

- A. Types of Chemical Bonds
- B. Electronegativity
- C. Bond Polarity and Dipole Moments
- D. Stable Electron Configurations and Charges on Ions
- E. Ionic Bonding and Structures of Ionic Compounds

XII. Gases

- A. Pressure
- B. Pressure and Volume: Boyle's Law
- C. Volume and Temperature: Charles's Law
- D. Volume and Moles: Avogadro's Law
- E. The Ideal Gas Law
- F. Dalton's Law of Partial Pressures

XIII. Liquids and Solids

- A. Water and its Phase Changes
- B. Energy Requirements for the Changes of State
- C. Intermolecular Forces
- D. Evaporation and Vapor Pressure
- E. The Solid State: Types of Solids
- F. Bonding in Solids

XIV. Acids and Bases

- A. Lewis Acids and Bases
- B. Arrhenius Acids and Bases
- C. Acid and Base Strength
- D. pH Scale
- E. Calculating the pH of Strong Acids and Bases