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

COURSE OUTLINE

CHEM 150 - COLLEGE CHEMISTRY I

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SCHOOL OF SCIENCE, HEALTH, AND PROFESSIONAL STUDIES
SCIENCE DEPARTMENT
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CHEM 150 - COLLEGE CHEMISTRY I

A. TITLE: College Chemistry I

B. COURSE NUMBER: CHEM 150

C. **CREDIT HOURS:** 4

D. WRITING INTENSIVE COURSE No

E. COURSE LENGTH: 15 weeks

F. SEMESTER(S) OFFERED: Fall

G. HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:
3 hours lecture, 3 hours laboratory per week

H. CATALOGUE DESCRIPTION:

This is the first semester of a two-semester college level course in chemistry. Topics include atomic structure, the periodic chart, moles, chemical reactions, stoichiometry, aqueous solutions, gas laws, gases in the atmosphere, thermochemistry, and chemical bonding theory.

I. PRE-REQUISITES/CO-COURSES:

Prerequisites: NYS Chemistry Regents Exam of 65 or above OR Introduction to Chemistry (CHEM 101/100) OR Investigative Chemistry (CHEM 107/108) OR General Organic and Biochemistry (CHEM 121), and Intermediate Algebra (MATH 106) or high school equivalent or permission of instructor.

J. GOALS (STUDENT LEARNING OUTCOMES)

By the end of this course, the student will:

Course Objective	*Institutional SLO*
1. Demonstrate the ability to apply mathematics to scientific concepts, such as conversions, density, percent composition, logarithms, half-life of nuclear reactions, and molar calculations (molar mass, molarity, molality, normality, stoichiometry, molar volume with the gas laws, molar heat)	2. Crit. Thinking 3. Prof. Competence
2. Use atomic properties given on the Periodic Table of Elements to identify elements, compounds (ionic, covalent, and acid) and nuclear components (alpha, beta, gamma, positron, proton, neutron) by	2. Crit. Thinking 3. Prof. Competence

writing correct chemical formulas (molecular and empirical) and chemical names (nomenclature).	
3. Write and predict chemical reactions (such as composition, decomposition, single replacement, double replacement, combustion reactions, as well as nuclear reactions) and calculate amounts of reactants and/or products in a chemical reaction by using stoichiometry and the concept of limiting reactant.	2. Crit. Thinking 3. Prof. Competence
4. Apply the kinetic theory of gases to explain the observed properties of gases, utilize the combined gas law and the ideal gas law to calculate the relationship between temperature, pressure, volume, and number of moles of an ideal gas, and apply Dalton's law of partial pressure to calculations involving mixtures of gases	2. Crit. Thinking 3. Prof. Competence
5. Apply the concepts of thermodynamics to calculate colorimetric changes and enthalpy changes in a chemical reaction; interpret enthalpy diagrams and activation energy, distinguish between exothermic and endothermic reactions, and use Hess's Law to calculate the enthalpy change of a reaction from the enthalpies of formation of individual reaction components	2. Crit. Thinking 3. Prof. Competence
6. Apply the scientific method to be able to perform experiments and to use appropriate experimental apparatus effectively, as well as demonstrate the ability to read, collect, organize, compute, evaluate and interpret quantitative and qualitative data and/or information in a laboratory setting, as well as communicate scientific results effectively in writing.	1. Communication 2. Crit. Thinking 3. Prof. Competence

K. TEXTS:

Gilbert, T.R., Kirss, R. V., Foster, N., and Davies, G., *Chemistry, the Science in Context*, Fourth Edition, W.W. Norton and Co. Inc., New York, NY, 2014, with *SmartWork*® Online Homework Access.

Leedom, G., and Heldt, N., *College Chemistry I, Laboratory Manual, Fall 2014,* on-line via ANGEL/Blackboard

L. REFERENCES: Internal references too numerous to cite

M. EQUIPMENT:

Lecture facilities for 60 students, various demonstration-equipment, computers with word processing, spreadsheet and computer graphing capabilities, and laboratory facilities for 18 students per lab.

N. GRADING METHOD: A-F

O. MEASUREMENT CRITERIA/METHODS:

1. Class Grade (quizzes, exams, online graded homework) 60%
2. Laboratory Assignments 25%
3. Comprehensive Final Exam 15%

P. DETAILED COURSE OUTLINE:

1. Unit Conversions, Density, Percent
    a. Method of problem solving using unit conversion method
    b. Metric - Metric unit conversions
    c. Density measurements and using density as a conversion factor
2. Percent and percent composition
3. Significant figures
4. Atomic Theory, Electron Configuration
    a. Development of the atomic theory
    b. Number of protons, neutrons, and electrons in different isotopes and different ions
    c. Atomic mass
    d. Bohr model of the atom
    e. Electron configuration and order of filling energy sublevels with electrons
    f. Orbital diagrams and determining the number of unpaired electrons in an atom
    g. Quantum numbers
5. Periodic Chart
    a. Classification of the elements: Periodic law and the Periodic Table
    b. Determining the charge on an atom from the Periodic Table
    c. Trends on the Periodic Table: atomic radius, ionic radius, electronegativity, reactivity, and ionization energy
    d. Determination of the electron configuration from the periodic chart
6. Chemical Compounds, Moles
    a. Concept of the mole to count atoms: Avogadro's Number
    b. Naming chemical compounds
    c. Writing formulas of chemical compounds
    d. Determination of oxidation states
    e. Molecular mass
7. Chemical Reactions
    a. Writing chemical equations
    b. Balancing chemical equations
    c. Prediction of products in a chemical reaction
8. Stoichiometry

a. Unit conversion method to solve stoichiometry problems
b. Determination of limiting reactant
c. Determination of percent yield

9. Aqueous Solutions
   a. Concentrations: molarity, percent by mass, parts per million
   b. Stoichiometry of reactions in solutions
   c. Acid-base reactions: titration
   d. Oxidation reduction reactions
   e. Balancing oxidation reduction reactions in solution
10. Gas Laws
   a. Kinetic molecular theory and gas pressure
   b. Combined gas law
   c. Standard temperature and pressure: a mole of any gas
   d. Ideal gas law
   e. Gases in chemical reactions
   f. Mixtures of gases: Dalton's law of partial pressure
11. Atmospheric Gases
   a. Composition and structure of the atmosphere
   b. Nitrogen and its compounds: smog
   c. Oxygen and its compounds: the ozone layer
   d. Fossil fuel burning: the Greenhouse effect and acid rain
12. Thermochemistry
   a. Heat, heat capacity and specific heat
   b. Heat of reaction: the calorimeter
   c. Enthalpy of reaction and enthalpy diagrams
   d. Hess's Law
   e. Standard enthalpies of formation
13. Nuclear Chemistry
   a. Types of nuclear processes
   b. Nuclear equations
   c. Radioactive decay and half-life
   d. Nuclear fission and nuclear fusion
   e. Nuclear power plant
   f. Uses of radioisotopes

Q. <u>LABORATORY OUTLINE</u>:

1. Check-in, safety, and programming the Excel Spreadsheet
2. Density: Determination of the density of a solid and of a liquid and determination of the specific gravity of a solid
3. Separation of a Mixture by Physical and Chemical Means
4. Determination of the Formula of a Hydrate
5. Aspirin Synthesis
6. Analysis of Aspirin by Spectroscopy

7. Titration
8. Types of Chemical Reactions: Observation of chemical reactions and writing the chemical equation representing those reactions
9. Determination of Calcium Carbonate in Eggshell
10. Identification of a Metal Carbonate or Metal Hydrocarbonate
11. Determining the Heat Capacity of a Metal
12. Thermochemistry and Hess' Law
13. Determining the Moles of a Gas from the Ideal Gas Law Equation
14. Lab Practical