Revised 2016

**MOHAWK VALLEY COMMUNITY COLLEGE**

**UTICA, NEW YORK**

### COURSE OUTLINE

**I. Catalog Description**

CH141--General Chemistry 1 **C-3, P-3, Cr-4.0**

Prerequisites: MA 121, 139, or appropriate math placement test result, and High School Chemistry, or permission of Dean. MA 125 may be taken as a co-requisite.

This course introduces the field of chemistry to science and engineering students. Topics include dimensional analysis, stoichiometry, introduction to thermodynamics, periodicity, atomic structure and bonding, introduction to nuclear reactions, intermolecular forces and states of matter, solutions, and acid/base concepts. The laboratory exercises exemplify chemical principles and develop individual problem-solving abilities with emphasis on modern computerized instrumentation. The laboratory experience includes preparation of the laboratory report and notebook.

**II. Student Learning Objectives**

Upon the completion of General Chemistry 1 the students will be able to:

1. Relate the importance of safety in the lab, including the safe handling and disposal of chemicals not only in the lab, but also in the home.
2. Define and use a vocabulary of chemical terms.
3. Apply a scientific approach to a problem and critically evaluate data collected.
4. Determine IUPAC nomenclature of inorganic compounds.
5. Apply the skill of writing chemical equations and an ability to interpret them both qualitatively and quantitatively.
6. Understand introductory nuclear chemistry and be able to write a balanced chemical decay producing alpha, beta, and/or gamma radiation.
7. Be able to utilize Excel or any similar program to organize and analyze data. Emphasis is placed on graphing and spreadsheet calculations.
8. Use the periodic table to predict whether an element is a metal or non-metal, and its properties.
9. Identify a substance as an acid, base, or salt and predict if it is an electrolyte or not from its formula.
10. Apply thermodynamic concepts to determine the heat of a reaction using calorimetry, bond enthalpies, and Hess’s Law.
11. Demonstrate an understanding of the importance of chemistry in environmental study and the world generally.
12. Demonstrate a unified approach to problem solving, applying mathematical skills to theoretical concepts in chemistry.
13. Use communication skills effectively through written exams and lab reports.
14. Write the electronic configuration for any element in the periodic table.
15. Use the relationship between electronic structure, chemical bonding, and properties of substances to classify chemical forces into ionic, covalent, and metallic bonds.
16. Study and apply bonding theories including VSEPR, hybridization and molecular orbital theory in order to determine molecular properties.
17. Describe how gases respond to changes in pressure, volume, temperature, and quantity, and derive the ideal-gas equation. Understand Kinetic Molecular Theory and how gases deviate from ideal.
18. Identify the types of intermolecular attractive forces in liquids.

**III. General Topical Outline**

1. Introduction - Some Basic Concepts
   1. Chemical symbols
   2. Differentiate between physical and chemical changes
   3. Interconversion of Metric and English systems using dimensional analysis.
2. Atomic Structure
   1. Historical development
   2. The modern view of atomic structure
   3. The periodic table
3. Stoichiometry
   1. Calculations with chemical formulas and equations. Interconversion of moles, mass in grams and number of atoms, ions or molecules using dimensional analysis.
4. Aqueous Reactions: Solution Stoichiometry
   1. Calculation of molarity
   2. Dilution calculations
   3. Stoichiometric relationships for solutions

5. Thermochemistry

a. The first law of thermodynamics

b. Enthalpy change

c. Standard state

6. Electronic Structure of Atoms

a. Wave properties and speed of propagation of radiant energy

b. Planck's Quantum Theory, Bohr's Model of the Atom

c. The uncertainty principle

d. Quantum theory, atomic orbitals

e. Electron configuration, periodic table

7. Periodic Properties of Elements

a. Valence orbitals, atomic radius, ionization energy, electron affinity

b. Metals, non metals, metalloids

c. Group trends

8. Basic Concepts of Chemical Bonding

a. Valence electrons

b. Lewis symbols

c. Ionic bond

d. Ion size

e. Covalent bond

f. Electronegativity

g. Lewis dot structures

9. Molecular Geometry

a. Valence shell electron--pair repulsion model

b. Prediction of geometry of a molecule/ion from the Lewis structure

c. Dipole moment, polarity

d. Valence bond theory

e. Hybridization, multiple bonds

f. Molecular orbital theory

10. Gases

a. The dependence of the gaseous state on temperature, pressure, volume, and amount of material

b. The difference between gases and the other states of matter

c. The kinetic theory of gases

d. Deviations of real gases from ideal behavior/Van der Waals equation

11. Intermolecular Forces: Liquids/Solids

a. The kinetic-molecular model to explain the difference in motion of particles in gases, liquids and solids and how they relate to their states

b. The types of inter-molecular forces

c. Phase diagrams

d. Crystal structure

e. Bonding in solids

12. Modern Materials: Applications and development of several kinds of materials

a. Liquid crystals

b. Polymers

c. Ceramics

d. Thin films

### LABORATORY SCHEDULE

Chemistry 141 - Recommended Lab Schedule

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| --- | --- |
| Week # | Experiment |
| 1 | Check In - Safety procedures, handling data |
| 2 | Trace Contamination/ Measurement and significant figures |
| 3 | Thermometer Calibration and density of salt solutions |
| 4 | Using Excel |
| 5 | Chemical Reactions ( part 1) |
| 6 | Chemical Reactions ( part 2) |
| 7 | The determination of percentage acid in an unknown |
| 8 | Thermochemistry--The Heat of Reaction |
| 9 | Spectrophotometer |
| 10 | The Determination of Silver in an Alloy - Gravimetric – Part (I) |
| 11 | The Determination of Silver in an Alloy – AA – Part (II) |
| 12 | Molecular Modeling and VSEPR |
| 13 | Molecular Weight by the Method of Dumas |
| 14 | Crystal Structure |
| 15 | Make Up and Check Out |

**ANY CHANGES IN THE LABORATORY SCHEDULE MUST GO THROUGH THE FULL TIME CHEMSITRY FACULTY.**