Revised Fall 2016

**MOHAWK VALLEY COMMUNITY COLLEGE**

**UTICA, NEW YORK**

### COURSE OUTLINE

**I. Catalog Description**

CH142--General Chemistry 2 **C-3, P-3, Cr-4.0**

Prerequisite: CH141--General Chemistry 1, and MA 122, 125 or 139, or an appropriate math placement test result.

This course is a continuation of CH141 General Chemistry 1. Topics include chemical thermodynamics, electrochemistry, chemical kinetics, properties of solutions, and chemical and solution equilibrium. In addition to 4 laboratory experiments requiring formal reports, laboratory work is focused on a self-paced semi micro qualitative analysis scheme in which students are required to correctly identify unknowns.

**II. Student Learning Objectives**

In addition to the outcomes stated in General Chemistry 1 Students should be able to:

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* 1. Describe how the change in internal energy of a system is related to the exchange of heat and work with its surroundings and represent it with an energy diagram.
  2. Use the terms spontaneity, entropy, randomness, free energy and temperature.
  3. Express the concentration of solutions in different units including molarity, molality, % mass, ppm and ppb.
  4. Quantify the effect of solute concentration in terms of colligative properties.
  5. Express and determine rates of chemical reactions and factors affecting the rate.
  6. Calculate the rate of a reaction using the method of initial rates and the integrated rate laws.
  7. Identify chemical equilibrium as being a dynamic condition and calculation of Kc, Kp, ionization of water, Kw, Ka, Kb, and Ksp.
  8. Identify acids and bases based on the Arrhenius, Bronsted-Lowry, and Lewis theories.
  9. Calculate the pH at any point during an acid-base titration.
  10. Understand the properties of buffers qualitatively and quantitatively.
  11. Assign oxidation numbers to elements or ions in a chemical equation. Balance a redox equation by the method of half-reactions.
  12. Draw diagrams of simple voltaic and electrolytic cells labeling the anode, cathode and directions of ion and electron movement and the signs of the electrodes.
  13. Calculate the cell EMF.
  14. Perform a collaborative group laboratory study of chemical kinetics, and evaluation and presentation of results via a group report.

**III. General Topical Outline**

1. Properties of Solutions
   1. Ways of expressing concentration of a solution
   2. Interconversion of concentration units
   3. Colligative properties, applications
2. Chemical Kinetics
   * 1. Rate of a chemical reaction, rate constant, rate law
     2. Order of a reaction
     3. Factors affecting the rate
     4. Catalysis, applications
3. Chemical Equilibrium
4. The significance of the term Dynamic Equilibrium
5. The law of mass action
6. The equilibrium constant, K, in terms of concentration, (Kc) and pressure (Kp), and interconversion of Kc and Kp
7. Applications of equilibrium constants, predicting the direction in which a reaction mixture moves to achieve equilibrium, calculation of equilibrium constants once equilibrium is established
8. Factors affecting equilibrium--LeChatelier's Principle
9. Acid Base Equilibria
10. Autoionization of water, ion-product constant
11. Arrhenius Theory of acids and bases
12. Bronsted-Lowry acids and bases
13. Identification of strong, acids/bases and calculation of their pH using the Equilibrium constant.
14. Calculation of percent ionization of a weak acid/base
15. Relation between Ka and Kb
16. Lewis acids and bases
17. Aqueous Equilibria
18. The common ion effect
19. Buffers
20. Titration curves
21. Solubility Equilibria, solubility and pH, selective precipitation of ions
22. Chemical Thermodynamics
    1. Spontaneous processes
    2. Enthalpy and Entropy
    3. Gibb's Free
    4. Energy Free energy and K
23. Electro Chemistry
24. Oxidation--Reduction reactions
25. Balancing Oxidation--Reduction equations
26. Method of half-reactions
27. Voltaic cells, cell EMF
28. EMF and free-energy change
29. The Nernst Equation
30. Commercial voltaic cells
31. Electrolysis
32. Corrosion

### LABORATORY SCHEDULE

Chemistry 142 - Recommended Lab Schedule

Week Experiment

1-2 The majority of the lab is devoted to a semi-Independent guided study. The student will be assigned unknowns and asked to determine the ions present in the sample.

3 Kinetics

4- 7 Continuation of Qualitative Analysis

8 Equilibrium - Freeman Separates 1041

9-10 Continuation of Qualitative Analysis

11 Titration of an unknown acid to determine Ka

12-15 Continuation of Qualitative Analysis.

13 or 14 Electrochemistry

15 Check Out

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