**MOHAWK VALLEY COMMUNITY COLLEGE**

**UTICA AND ROME, NEW YORK**

### COURSE OUTLINE

**CH131--College Chemistry** **C-3, P-3, R-1, Cr-4**

**Catalog Description**

Corequisite: MA110 Elementary Statistics or higher

This is a one-semester introductory chemistry course for students in allied health fields. The course examines the history of chemistry, its impact on society and its connection to other disciplines. Topics include scientific method, atomic theory, bonding and reactions, introduction to oxidation-reduction, acid-base concepts, pH, equilibrium, properties of solutions, and introduction of organic chemistry and its biochemical applications. The laboratory sequence supports the above topics and emphasizes careful observation and analysis of data to develop both qualitative and quantitative reasoning ability. This course does not meet graduation requirements for Chemistry, Biology, or Engineering majors.

**Student Learning Objectives**

Upon the completion of College Chemistry, the students will be able to:

1. Demonstrate an understanding of basic chemical concepts including macroscopic level — the properties and transformations of matter, and microscopic level — behavior and properties of individual atoms.

2. Describe how and why chemical reactions happen. Be able to balance chemical reactions and describe the simple mass relationships (mass-to-moles and mole-to-mole conversions) among substances involved in chemical reactions.

3. Describe some of the ways that matter and energy interact in chemical and physical change. Also, describe chemical and physical properties of matter.

4. Identify polar/non-polar molecules based on structure, and connect those properties to physical properties such as boiling point, melting point, and miscibility.

5. Apply the methodology of science to solve problems. For example, making scientific graphs, interpreting data, using dimensional analysis for conversions. Emphasis on understanding the difference between accuracy and precision in measurements.

6. Identify organic functional groups, their properties, and biochemical functions.

7. Do simple data manipulations/calculations and report them correctly.

8. Demonstrate quantitative reasoning.

9. Differentiate between what professional laboratory personnel can and cannot do with data or samples presented to them.

10. Demonstrate critical thinking about scientific content and science processes in response to the wider concerns of a highly technological society and a complex scientific landscape.

11. Demonstrate an understanding of the importance of safety in the laboratory, the safe handling and disposal of chemicals in the laboratory, the home, and in the environment.

**Major Topics**

Topics will be chosen from but not limited to the following areas:

1. Matter — properties; three states of matter; distinguish between mixtures and pure substances; and between elements and compounds; distinguish between chemical and physical properties; names and symbols of the elements.

2. Measurement in Chemistry — name and use the metric and SI units of measure for mass, length, volume and temperature; correct significant figures especially in regard to laboratory measurements; dimensional analysis to convert quantities from one unit to another; definitions of energy; density.

3. Atomic Structure and the Periodic Table — major assumptions of atomic theory; composition of atoms; isotopes and atomic weight; identification of valence electrons in atoms.

4. Chemical Bonding — definitions of ions, ionic bonds and covalent bonds; properties of ionic compounds and covalent compounds; Octet rules and its usage to predict formation of ions or covalent bonds; chemical formulas of ionic compounds; molecular formulas and Lewis structures of covalent compounds; electronegativity and bond/molecular polarity; nomenclature with reference material provided; major differences between ionic and covalent compounds.

5. Chemical Calculations — mole concept; relationship between molar quantities and mass quantities; write and balance chemical equations; simple calculations involving chemical equations (mole-to-mole and mass-to-mole, mole-to-mass calculations)

6. Gases, Liquids and Solids — Kinetic-molecular theory of gases; major intermolecular forces; simple gas laws calculations.

7. Solutions — characteristics of solutions; influences on solubility (solvent structure, solute structure, temperature, concentration, and pressure); simple calculations of solution concentration (especially focused on molarity, osmolarity, ppm/ppb, percent by mass/volume); dilution concepts and calculations; colligative properties of solutions; osmosis.

8. Chemical Reactions — chemical reaction types; oxidation numbers given reference material; collision theory in chemical reactions; energy change during reactions; activation energy and factors that determine reaction rate; introduction to chemical equilibrium and Le Châtelier's principle.

9. Acids, Bases, and Salts — Acid-base theories; strengths of acids and bases; pH concept; the formation of salts and effect of salts on pH; definition of buffer; strong and weak electrolytes and non-electrolytes.

10. Nuclear Chemistry — basic concepts about radioactivity; three common kinds of radiation—alpha, beta, and gamma— balancing of nuclear reactions; the danger and benefit of radiation; calculation of material remaining based on the “half-life bucket method”

11. Organic Chemistry — classify organic molecules into families by functional group; structural formulas and condensed or line structures; recognize and draw isomers; categories of organic reactions; structures and nomenclatures of major organic families; general properties and chemical reactions of major organic families;

12. Biochemistry — Identify nucleic acid, lipid, carbohydrate or protein based on structure; classification of carbohydrates as monosaccharides, disaccharides, and polysaccharides; chirality of biological molecules; basic identification and function of lipids, nucleic acids, and proteins; introduction to the role of biologically relevant small organic molecules, such as vitamins, hormones, and medicines such as aspirin.

### COLLEGE CHEMISTRY LABORATORY SCHEDULE

| WEEK | TITLE |
| --- | --- |
| 1 | Check in  Safety in the Laboratory  Video: 28 Grams of Prevention  Introduction to Laboratory Techniques |
| 2 | Measurement |
| 3 | Extraction of Food Dyes with Paper Chromatography |
| 4 | Properties of Oxygen |
| 5 | Nomenclature and Periodicity |
| 6 | Type of Reactions and Mole Relationships in a Chemical Reaction |
| 7 | Synthesis and Purification of Aspirin |
| 8 | Properties of Gases |
| 9 | Water and Solutions |
| 10 | Chemical Reactions and Equilibrium |
| 11 | Acids and Bases |
| 12 | Hydrocarbons |
| 13 | Alcohols, Esters, Aldehydes and Ketones |
| 14 | Check out/ Review/ make-up lab (at instructor discretion) |
|  |  |

The laboratory exercises will be performed utilizing the laboratory manuals designed and written by the chemistry faculty. The laboratory exercises are designed to augment the theory which are previously developed in the classroom. The data and calculations will be recorded in the laboratory report sheets. These pages are turned in at the end of each lab period as part of the final lab grade. Students must complete at least 60% of the laboratory work successfully to pass the course, regardless of performance in the lecture.

Updated 4/11/2018

Updated 5/14/2018

Updated 4/4/2019

Updated 5/26/2019