Prepared by the Department of Natural Sciences & Applied Technology
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1. Course Number: CHM109 / CHM109L
Course Title: Chemistry for the Health Sciences I
Chemistry for the Health Sciences I Laboratory

2. Description: An introductory course for students in various health-related programs. Emphasis is placed on the practical aspects of inorganic chemistry. Some organic chemistry is introduced. (3 class hours / 2 laboratory hours)

3. Student Learning Outcomes (instructional objectives, intellectual skills):
Upon successful completion of this course, students are able to do the following:

- Use the basic vocabulary of matter and energy and distinguish between chemical and physical properties and chemical and physical and physical changes
- Recognize various forms of matter: homogeneous and heterogeneous mixtures, substances, elements and compounds
- Use the unit factor method to carry out conversions among units and apply appropriate units to describe the results of measurements
- Describe density and specific gravity and use the unit factor method to carry out density calculations
- Describe temperature measurements on various common scales and convert between these scales
- Carry out calculations relating energy changes to heat absorbed or liberated and to physical and chemical changes
- Describe the evidence for the existence and properties of electrons, protons, and neutrons and predict the arrangement of the particles in atoms
- Describe isotopes and their composition
- Write Lewis dot representations of atoms and ions and predict whether bonding between specified elements will be primarily ionic, covalent, or polar covalent
- Name and write formulas for common binary and ternary inorganic compounds
- Write Lewis dot formulas for molecules and polyatomic ions
- Recognize and use formula weights and mole relationships and interconvert masses, moles, and formulas
- Describe the Periodic Table
- Write balanced chemical equations to describe chemical reactions
- Use stiochiometric relationships from balanced chemical equations to calculate the moles and/or masses of reactants and products involved in each of the reactions
- Describe the factors that favor the dissolution process and use the terminology of solutions: solvent, solute, concentration
- Express concentrations of solutions in terms of molarity and percents and use solution concentrations in stoichiometric calculations for chemical reactions
- Complete and balance equations for acid-base reactions
- Recognize and classify acids (strong, weak) and bases (strong, weak)
- Describe the kinetic molecular theory of gases, liquids, and solids
- Use Boyle's Law, Charles' Law, Avogadro's Law, and the Combined Gas Law, as appropriate, to calculate changes in pressure, volume, temperature, and amount of gas
- Describe how mixtures of gases behave and predict their properties (Dalton's Law of Partial Pressures)
- Describe the types of nuclear particles and write and balance equations that describe nuclear reactions
- Describe the biological hazards associated with nuclear reactions and the methods used for protection

- Differentiate between nuclear reactions that are induced by bombardment of nuclei, nuclear fission, and nuclear fusion
- Describe saturated hydrocarbons (alkanes and cycloalkanes); their structures and their nomenclature
- Describe unsaturated hydrocarbons (alkenes and alkynes); their structures and their nomenclature
- Distinguish between constitutional isomers, conformers, stereoisomers, geometric isomers
- Describe and name some aromatic hydrocarbons
- Describe some functional groups and be able to recognize examples from the following classes: halides, alcohols and phenols, ethers, amines, aldehydes, ketones, carboxylic acids, esters, amides
- Identify some common polymers and the reactions by which they are formed; identify the monomer from which they are formed
- Describe the structure of carbohydrates, fats, proteins, nucleic acids and their relationship to the basic functional groups
- Compare and contrast nonelectrolytes, strong electrolytes, and weak electrolytes.
- Classify types of chemical reactions: decomposition reactions, displacement reactions, and various types of metathesis reactions.
- Evaluate the factors that affect equilibria and predict the result when stresses are introduced into systems at equilibrium.
- Use appropriate techniques in the laboratory, collect and analyze meaningful data, and present clearly and cogently written laboratory results (utilizing Standard American English).
- Work cooperatively in a small group setting to complete various laboratory exercises, following the written instructions provided.
- Explain some of the ways in which Chemistry can be applied to the problems of society in general.
- Effectively utilize appropriate quantities and units to describe chemical phenomena.
- Use a variety of devices and instruments in taking laboratory measurements.
- Use a scientific calculator as a tool in solving a wide variety of problems.
- Solve problems that involve any of the topics included in the outline for this course.

4. **Credits:** Four credits

5. **Satisfies General Education Requirement:** Natural or Physical Science

6. **Prerequisite:** MAT030 (Elementary Algebra) or MAT035 (Algebra for Non-STEM), ENL108 (Critical Reading & Thinking) or satisfactory basic skills assessment scores

7. **Semesters Offered:** Fall, Spring, and Summer

8. **Suggested General Guidelines for Evaluation:** Course grading procedures and make-up policies are detailed in a student handout. In summary, 75% of the course grade evaluation is based on achievement in the lecture portion of the course, while 25% is based on the laboratory portion of the course.

9. **General Topical Outline:**

1. Units of Measurement
2. Properties of Matter
3. Structure of Matter
4. Chemical Bonding
5. Chemical Equations and Reactions
6. Physical States of Matter
7. Solution Chemistry
8. Reaction Rates and Equilibria
9. Acids and Bases
10. Nuclear Chemistry
11. Introduction to Organic Chemistry
12. Principal Organic Functional Groups

Laboratory Outline

1. Laboratory Safety
2. Measurements
3. Density and Specific Gravity
4. Formula of a Hydrate
5. Heat and Temperature
6. Radiation
7. Charles' Law
8. Properties of Solutions
9. Rates of Reaction
10. Ionization, Acids, Bases and Salts
11. Neutralization - Titration
12. Chemical Equilibrium - Reversible Reactions
13. Organic Models - Exercise
14. Hydrocarbons - Exercise