Course Abstract

If you need accommodations due to a disability, contact Disability Services in Edison Hall Room 100, 732.906.2546.

To foster a productive learning environment, the College requires that all students adhere to the Code of Student Conduct which is published in the college catalog and website.

Course ID and Name: **CHM 117 Chemistry I**

Department: Natural Sciences

Chairperson: Dr. Donna Howell
Office Location: SH 104
E-mail Address: DHowell@middlesexcc.edu
Telephone: 732.906.2592

Prerequisites: Appropriate score on the College's Placement Test or MAT 013 and one year of high school laboratory science or BIO 010 or CHM 010

Course Description

A foundation course involving a study of the metric system, bonding, periodic table, chemical equations, mole-related concepts, stoichiometry and gas law. Laboratory experiences stress proper lab technique, use of equipment, treatment of data and safety.

Learning Outcomes:

Upon successful completion of this course, student will be able to:

1. Use the scientific method of inquiry, through the acquisition of scientific knowledge
2. Understand the basic structure of the atom, determine the electron configuration of atoms and use periodic trends to predict properties of atoms
3. Understand the basic theories of chemical bonding (ionic, polar covalent and non-polar covalent)
4. Determine formulas and names for inorganic compounds
5. To balance chemical equations, identify the different types of chemical reactions (combustion, decomposition, single replacement and double replacement) and predict the products of a reaction
6. Use stoichiometric relations and the mole concept to calculate the amount of product formed in a reaction

General Education Status: Science

Credits: 4 **Lecture Hours:** 4 **Lab Hours:** 3

COURSE REQUIREMENTS

Students must attend every lecture and laboratory session. Lecture performance is evaluated by exams, homework assignments, and quizzes. Laboratory performance is measured by practical examinations, laboratory reports, quizzes and observation of student laboratory technique.

Assessment tool	% of final grade
4 Lecture Exams	40%
Final Lecture Exam	20%
Quizzes	10%
Lab Exams	30%

FINAL EXAM

The final exam will be administered during the special exam days. The hourly exams will contain multiple choice and open-ended questions but the final exam will be multiple choice.

GRADING STANDARD:

Upon completion of the course, grades will be assigned as follows:

A = 90 – 100%
B+ = 86 - 89%
B = 80 - 85%
C+ = 76 - 79%
C = 70 - 75%
D = 60 - 69%
F = <60%

Course Content:

1. Metric system
2. Bonding
3. Periodic Table
4. Chemical equations
5. Mole-related concepts
6. Stoichiometry
7. Gas laws

Textbooks for Course:

Author	Title	Publisher	Copyright
Nivaldo J Tro	Introductory Chemistry, 5th Edition	Person	2015

REQUIRED CALCULATOR

A non-programmable and non-graphical scientific calculator is required for this course. It is advisable to purchase a calculator which includes parenthesis functions, scientific notation capabilities, and logarithmic functions. No programmable / graphical calculators, cell phones, or similar devices are allowed during the quizzes or exams. The TI-83 and TI-84 calculators are examples of calculators that are not acceptable.

LECTURE OUTLINE

1. MEASUREMENT AND PROBLEM SOLVING
   A. Scientific Notation: Writing Large and Small Numbers
   B. Significant Figures: Writing Numbers to Reflect Precision
   C. Significant Figures in Calculations

D The Basic Units of Measurement
E. Problem Solving and Unit Conversion
F. Solving Multistep Conversion Problems.

2. MATTER AND ENERGY
A. Classifying Matter According to Its State: Solid, Liquid, and Gas
B. Classifying Matter According to Its Composition: Elements, Compounds, and Mixtures
C. Differences in Matter: Physical and Chemical Properties
D. Changes in Matter: Physical and Chemical Changes
E. Conservation of Mass: There is No New Matter
F. Energy
H. Energy and Chemical and Physical Change
I. Temperature: Random Motion of Molecules and Atoms
J. Temperature Changes: Heat Capacity
K. Energy and Heat Capacity Calculations

3. ATOMS AND ELEMENTS
A. Indivisible: The Atomic Theory
B. The Nuclear Atom
C. The Properties of Protons, Neutrons, and Electrons
D. Elements: Defined by Their Numbers of Protons
E. Looking for Patterns: The Periodic Law and the Periodic Table
F. Ions: Losing and Gaining Electrons
G. Isotopes: When the Number of Neutrons Varies
H. Atomic Mass: The Average Mass of an Element's Atoms

4. MOLECULES AND COMPOUNDS
A. Defining compounds and Molecules
B. Chemical Formulas: How to Represent Compounds
C. A Molecular View of Elements and Compounds
D. Writing Formulas for Ionic Compounds
E. Nomenclature: Naming Compounds
F. Naming Ionic Compounds
G. Naming Molecular Compounds
H. Naming Acids
I. Nomenclature Summary
J. Formula Mass: The Mass of a Molecule or Formula Unit

5. CHEMICAL COMPOSITION
A. The Mole
B Conversion between moles and atoms of an element
C. Conversion between moles and atoms of a compound
D. Conversion between moles and number of atoms amd molecules
E. Chemical Formulas as Conversion Factors
F. Mass Percent Composition of Compounds
G. Mass Percent Composition from a Chemical Formula
H. Calculating Empirical Formulas for Compounds
I. Calculating Molecular Formulas for Compounds

6. CHEMICAL REACTIONS
   - A. The Chemical Equation
   - B. How to Write Balanced Chemical Equations
   - C. Aqueous Solutions and Solubility: Compounds Dissolved in Water
   - D. Precipitation Reactions: Reactions in Aqueous Solution That Form a Solid
   - E. Writing Chemical Equations for Reactions in Solution: Molecular, Complete Ionic, and Net Ionic Equations
   - F. Acid–Base and Gas Evolution Reactions
   - G. Oxidation–Reduction Reactions
   - H. Classifying Chemical Reactions

7. QUANTITIES IN CHEMICAL REACTIONS
   - A. Making Molecules: Mole-to-Mole Conversions
   - B. Making Molecules: Mass-to-Mass Conversions
   - C. More Pancakes: Limiting Reactant, Theoretical Yield, and Percent Yield
   - D. Limiting Reactant, Theoretical Yield, and Percent Yield from
   - E. Initial Masses of Reactants
   - F. Enthalpy: A Measure of the Heat Evolved or Absorbed in a Reaction

8. ELECTRONS IN ATOMS AND THE PERIODIC TABLE
   - A Light: Electromagnetic Radiation
   - B. The Electromagnetic Spectrum
   - C. The Bohr Model: Atoms with Orbits
   - D. The Quantum-Mechanical Model: Atoms with Orbitals
   - E. Quantum-Mechanical Orbitals and Electron Configurations
   - F. Electron Configurations and the Periodic Table
   - G. The Explanatory Power of the Quantum-Mechanical Model
   - H. Periodic Trends: Atomic Size, Ionization Energy, and Metallic Character

9. CHEMICAL BONDING
   - A. Representing Valence Electrons with Dots
   - B. Lewis Structures of Ionic Compounds: Electrons Transferred
   - C. Covalent Lewis Structures: Electrons Shared
   - D. Writing Lewis Structures for Covalent Compounds
   - E. Resonance: Equivalent Lewis Structures for the Same Molecule
   - F. Predicting the Shapes of Molecules
   - G. Electronegativity and Polarity

10. GASES
   - A. Kinetic Molecular Theory: A Model for Gases
   - B. Pressure: The Result of Constant Molecular Collisions
   - C. Boyle's Law: Pressure and Volume
   - D. Charles's Law: Volume and Temperature
   - E. The Combined Gas Law: Pressure, Volume, and Temperature
   - F. Avogadro's Law: Volume and Moles
   - G. The Ideal Gas Law: Pressure, Volume, Temperature, and Moles
   - H. Mixtures of Gases: 11.10 Gases in Chemical Reactions

LAB OUTLINE

LAB NO.	LABORATORY EXERCISE
1	**Laboratory Policy and Safety Regulations** Laboratory Safe Practices, Mass, Volume, Length Measurements, Significant Figures
2	**Physical Separation of Mixtures** Separation of a three component mixture utilizing physical methodologies, data analysis, conclusions
3	**Density and Specific Gravity** Density determinations for solids and liquids
4	**Specific Heat of Metals** Determination the Specific Heat of different Metals using Calorimeter, data collections and calculations
5	**Solubility of Salts** Separation of a mixture of unknown slats using solubility criteria by gravity and suction filtration
6	**Determining the % water in a Hydrate** Determination of the waters of hydration for known and unknown hydrates, data analysis, conclusions
7	**Lab Exam #1**
8	**Law of Definite Composition** Experiment demonstrating the of Law of Definite Composition, conclusions
9	**Determination of Empirical Formula** Determination of empirical and molecular formula of an unknown compound from experimental data, conclusions
10	**Types of Chemical Reactions** Identification of different types of chemical reactions, balancing chemical equations
11	**Stoichiometry** Chemical equations representing chemical reaction, limiting reactants, calculations, conclusions
12	**Molar Volume of a Gas** Combined Gas Law relationships, Pressure vs. Volumes and Pressure vs. Temperature, data collection, graphical analysis, conclusions
13	**Lab Exam #2 (Final exam)**

Lab Expectations

1. A laboratory report is expected for each experiment and should include:
    a. A statement of purpose
    b. A table of important chemicals used in the experiment including key physical properties
    c. Balanced equations of important reactions
    d. The experimental procedure along with all observations
    e. Measured data
    f. Yield calculations (when applied)
    g. Conclusions
2. Learning outcomes include:

Chemical and Physical Methodologies

i. Separation techniques
ii. Calorimetry

iii. Combustion Analysis
iv. Graphing and data analysis