Virginia Western Community College
CHM 101
Introductory Chemistry I

Prerequisites

MTE 1, MTE 2, MTE 3 or MDE 10, and a placement recommendation for EDE 11/ENG 111, or successful completion of all developmental English requirements.

Course Description

Explores the experimental and theoretical concepts of general chemistry while emphasizing scientific reasoning, critical and analytical thinking. Designed for the non-science major. This is a Passport and UCGS transfer course. Lecture 3 hours, Laboratory 3 hours. Total 6 hours per week.

Semester Credits: 4 **Lecture Hours: 3** **Laboratory Hours: 3**

Required Materials

Textbook: Timberlake, General, Organic, and Biological Chemistry, Structures of Life, 6th edition, Pearson Publishing. ISBN: 9780134730684

Lab: In-home kit purchased from eScience Labs (can be purchased through bookstore; sent to student in mail). Goggles included with kit, other supplies either in kit or purchased in store.

Course Objectives

- Scientific Literacy
  - o Apply the scientific method of inquiry to analyze data and draw conclusions supported by the data.
  - o Propose one or more solutions that indicate comprehension of a problem.
- Quantitative Literacy
  - o Apply mathematical reasoning and techniques in discipline-specific ways (including, but not limited to, quantitative analysis of data).
- Matter and States of matter
  - o Classify matter as an element, compound, heterogeneous mixture or homogeneous mixture.
  - o Distinguish between physical and chemical properties/ changes.
  - o Apply kinetic molecular theory (conceptual) to explain/predict the characteristics and behavior of gases, solids and liquids.
  - o Calculate the pressure, volume or temperature of a gas after a change in conditions.
  - o Calculate the pressure, volume, temperature or moles of gas from the ideal gas equation.
  - o Identify and predict how intermolecular forces affect the physical properties of a specific substance.
  - o Describe the energy changes that accompany changes of state.
- Measurement and Laboratory techniques
  - o Identify basic units of measurement in the American and metric systems of measurement

- Convert measurements between American and/or metric units using dimensional analysis.
- Express any number in scientific notation.
- Identify the number of significant digits in a given measurement.
- Apply understanding of the inherent precision of laboratory glassware and equipment.
- Perform arithmetic operations, rounding to the correct number of significant digits.
- Calculate the density of a substance and use density to convert between mass and volume of a substance.
- Demonstrate basic laboratory techniques.
- Demonstrate best practices of laboratory safety.

- Atomic Structure and the Periodic Table
  - Identify the regions of the Periodic Table related to metal, nonmetals and metalloids.
  - Identify groups and periods of elements on the Periodic Table.
  - State the charge, location and relative masses of an electron, proton and neutron.
  - Write the electron configuration for selected elements.
  - Count the valence electrons and draw the electron dot symbols for selected elements.
- Nuclear Chemistry
  - Describe the characteristics of alpha, beta and gamma radiation.
  - Write and balance nuclear equations.
  - Relate the amount of radioactive sample to a given half-life.
  - Identify safety issues and health effects associated with radiation exposure.
- Bonding and Nomenclature
  - Using the periodic chart, predict the charge on an ion formed by a main group element.
  - Draw the Lewis structure for a molecule or polyatomic ion and determine the shape by applying Valence Shell Electron Pair Repulsion (VSEPR) theory.
  - Identify bonds and molecules as polar or nonpolar.
  - Write names and formulas for ionic and covalent compounds.
- Chemical Reactions including Redox Reactions and Equilibrium
  - Write and balance chemical equations.
  - Calculate the molar mass of a substance, given its chemical formula.
  - Convert between units of moles, mass and particles.
  - Perform stoichiometry calculations including limiting reactant and theoretical yield calculations.
  - Define oxidation and reduction and recognize the components of a redox reaction.
  - Describe energy changes in a reaction and classify reactions as endothermic or exothermic.
  - Predict the effect of changes in concentration, temperature and catalyst on reaction rates.
  - Use Le Chatelier's principle (conceptual) to predict what happens when equilibrium is disturbed.
  - Use the value of the equilibrium constant to qualitatively describe a reaction system.
- Solutions
  - Predict how specific changes will affect the solubility of a solute.
  - Determine whether a species is soluble or insoluble in a given solvent using solubility rules.
  - State whether a solution is saturated, unsaturated, or supersaturated, given its concentration, temperature, and solubility.
  - Determine whether solute would be an electrolyte and distinguish between a strong vs weak electrolyte in aqueous solution.

  - Perform calculations involving percent concentration and molarity of a solution and dilution of a solution.
  - Qualitatively explain colligative properties, osmosis, boiling and melting point of a solution.
- Acid-Bases
  - List/identify general properties of acids and bases.
  - Classify a solution of given pH as strongly acidic, weakly acidic, neutral, weakly basic, or strongly basic.
  - Identify the Brønsted-Lowry acid and base in a given reaction.
  - Convert between pH, [H3O+] ([H+]) and [OH-].
  - Identify conjugate acid/base pairs.
- Understand how a buffer works to resist pH changes.

Major Topics to be Included

- Matter and States of matter
- Measurement and Laboratory techniques
- Atomic Structure and the Periodic Table
- Nuclear Chemistry
- Bonding and Nomenclature
- Chemical Reactions including Redox Reactions and Equilibrium
- Solutions
- Acid-Bases

Notes to Instructors

1. Participation for laboratory experiments is mandatory. Approved safety glasses must be worn during the performance of laboratory experiments ***over the eyes*** as required.
2. Laboratory reports are due when requested. The report consists of the data and analysis as requested by the instructor. To aid not only the instructor but also especially the students, reports will not be accepted two weeks after the lab due date (or per instructor's syllabus). Completion of the lab experiment followed by submission of the data and calculations on the due date with appropriate write-up contributes toward a good grade. Grading scales for laboratory reports are at the professor's discretion, but will count towards the overall grade for the course.

ADA Statement (PDF)
Title IX Statement (PDF)