NORTHWESTERN CONNECTICUT COMMUNITY COLLEGE

COURSE SYLLABUS

Course Title: Concepts in Chemistry   **Course #:** CHE* 111

Course Description: This course is designed to introduce the student to basic principles inorganic chemistry. Concepts covered include: metric measurement and metric system conversions,   matter classification, states, properties,   and   composition, identification of symbols for most commonly used elements, periodic table of the elements, energy, atomic theory, introduction to quantum theory, nomenclature and classification of inorganic compounds, electron dot diagrams, chemical formulas for compounds, chemical reactions, stoichiometry, limiting reagents, empirical formula calculations, solutions, and gas laws. 3 hours lecture and 2 hours laboratory

Prerequisite: Math 137 or satisfactory score on the math placement test

Goals: To understand and apply the principles of scientific methods.
To develop skills in measurement.
To understand the atomic structure of chemical substances and the changes they undergo
To understand the basic processes involved in chemical reactions
To use chemical equations to solve quantitative problems
To understand units of basic solution concentration
To apply gas laws in solving quantitative problems

Outcomes: At the end of this course students should be able to:
- Identify the steps in the process of scientific method
- Explain uncertainty in instrumental measurement
- Identify the number of significant digits in a measurement
- Round off a value to the allowed number of significant digits
- Use scientific notation
- Use a scientific calculator
- Apply unit analysis method of problem solving
- Use metric units in measurements involving mass, volume and length, problem solving and unit conversions within the metric system and from English to metric units
- Explain the concept of density and specific gravity and perform calculations that relate to density, mass and volume
- Recognize different temperature scales and convert temperature from one temperature scale to another
- Explain the concept of specific heat and perform calculations that relate heat to mass, specific heat and temperature change of a substance
- Describe the three states of matter in terms of motion of particles
- Classify a sample of matter as an element, compound, or mixture
- State the name and symbols of selected elements
- Distinguish between the properties of metals and nonmetals
- Predict whether an element is a metal, nonmetal, or metalloid given its position in the periodic table
- Explain the law of definite composition for a compound
- Explain the law of conservation of matter
- Explain the law of conservation of energy
- Distinguish between potential and kinetic energy
- Discuss the important contributions by those important in the discipline of chemistry

- Describe the Dalton model of the atom
- State the components of the atom and their relative charges and masses
- Write the electron configuration of an atom using *s, p, d, and f,* and quantum numbers
- Explain isotopes and determine the number of protons, electrons and neutrons in given isotopes
- Calculate the atomic mass for an element given the mass and abundance of the naturally occurring isotopes
- Explain periodic arrangement of the elements
- Write the electron configuration of selected elements, ions and compounds
- Recognize and write the structure for selected ions
- Recognize and discuss ionic and covalent bonds
- Write systematic names and formulas for inorganic compounds, ionic and covalent and classical and common names for selected substances
- Write a chemical equation from the description of a chemical reaction
- Identify the seven diatomic elements
- Write balanced chemical equations for combination , decomposition, single replacement, double replacement, neutralization and combustion reactions when given starting reagents
- Convert mass to moles of a solid and a gas and vice versa and to convert mass to number of particles using Avogadro's number
- Calculate percent composition, empirical and molecular formulas when given experimental data or percent composition and molar mass (for molecular formulas)
- Perform stoichiometry calculations
    - Mass – mass
    - Mass – volume
    - Volume – volume
- Identify limiting reagents in a chemical reaction given the mass of two or more reagents
- Calculate percent yield
- Calculate the molarity of a solution of unknown concentration given the mass of the solute and volume of solution
- Calculate pH of a strong acid if given the concentration of Hydrogen ions
- Calculate the molarity of an acid of unknown concentration in a titration reaction
- Calculate pressure, volume or temperature for a gas after a change in conditions using Charles Law, Boyle's Law or the combined gas law
- Use the ideal gas equation to solve for pressure, volume, moles or temperature of a gas
- Explain the relationship between temperature and volume, temperature and pressure and volume and pressure using the gas laws

Competencies:

Scientific Reasoning: Upon the completion of this course, students should be able to:
- Explain the methods of scientific inquiry that lead to the acquisition of knowledge. Such methods include observations, testable hypotheses, logical inferences, experimental design, data acquisition, interpretation, and reproducible outcomes.
- Apply scientific methods to investigate real-world phenomena, and routine and novel problems. This includes data acquisition and evaluation, and prediction.
- Represent scientific data symbolically, graphically, numerically, and verbally.
- Interpret scientific information and draw logical references from representations such as formulas, equations, graphs, tables, and schematics.
- Evaluate the results obtained from scientific methods for accuracy and/or reasonableness

Scientific Knowledge: Upon the completion of this course, students should be able to:
- Communicate using appropriate scientific terminology.

- Use representations and models to communicate scientific knowledge and solve scientific problems.
- Plan and implement data collection strategies appropriate to a particular scientific question.
- Articulate the reasons that scientific explanations and theories are refined or replaced.
- Evaluate the quality of scientific information on the basis of its source and the methods used to generate it.