Revised 08/2022

NOVA COLLEGE-WIDE COURSE CONTENT SUMMARY
CHM 101 – INTRODUCTORY CHEMISTRY (4 CR.)

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 per week. Laboratory 3 hours per week. 4 credits.

General Course Purpose

Introductory chemistry is a course for students whose college and career paths require knowledge of the fundamentals of chemistry as applied to health, the environment and general knowledge of how chemistry affects our lives.

Course Prerequisites/Corequisites

Competency in MTE 1-5 as demonstrated through placement or unit completion.

Course Objectives

Upon completing the course, the student will be able to:

Scientific Literacy
- Apply the scientific method of inquiry to analyze data and draw conclusions supported by the data
- Propose one or more solutions that indicate comprehension of a problem

Quantitative Literacy
- Apply mathematical reasoning and techniques in discipline specific ways *(including, but not limited to, quantitative analysis of data)*

Matter and States of matter
- Classify matter as an element, compound, heterogeneous mixture or homogeneous mixture.
- Distinguish between physical and chemical properties/ changes.
- Apply kinetic molecular theory (conceptual) to explain/predict the characteristics and behavior of gases, solids and liquids.
- Calculate the pressure, volume or temperature of a gas after a change in conditions.
- Calculate the pressure, volume, temperature or moles of gas from the ideal gas equation.
- Identify and predict how intermolecular forces affect the physical properties of a specific substance.
- Describe the energy changes that accompany changes of state.

Measurement and Laboratory techniques
- 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, $[H_3O^+]$ ($[H^+]$) and $[OH^-]$.
- Identify conjugate acid/base pairs
- Understand how a buffer works to resist pH changes

<u>Major Topics to be Included</u>

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