J. Sargeant Reynolds Community College
Course Content Summary

Course Prefix and Number: CHM 112 Credits: 4

Course Title: General Chemistry II

Course Description:

Explores the fundamental laws, theories, and mathematical concepts of chemistry. Designed primarily for science and engineering majors. Requires a strong background in mathematics. Students must earn a grade of C or higher in the lecture portion of the course to earn an overall grade of C or higher. Part II of II. This is a Passport and UCGS transfer course. Prerequisite: CHM 111 with a grade of C or higher and MTH 161 or higher. Lecture 3 hour. Laboratory 3 hours. Total 6 hours per week. 4 credits

General Course Purpose:

The general purpose of this course is to prepare the student for advanced study in science through development of: skills in problem solving and in critical thinking, an understanding of the methods of scientific inquiry, and an understanding of the general concepts and principles of chemistry.

Course Prerequisites/Co-requisites:

CHM 111 with a grade of C or higher and MTH 161 or higher

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

Liquids and Intermolecular Forces

- Explain and apply the principles of Intermolecular Forces. Describe and predict the properties of liquids. Perform phase change calculations. Draw and interpret phase diagrams and perform vapor pressure calculations. Identify the types of solids.
- Solutions
- Explain and predict the properties of solutions, including: solubility of gases in liquids, solubility of liquids in liquids and solids in liquids. Perform calculations using different units of concentration. Explain colligative properties and apply the equations for colligative properties.

Kinetics

- Apply concepts in Kinetics: explain and do calculations using the rate law, the integrated rate laws and the Arrhenius equation. Understand reaction orders, collision theory, reaction mechanisms and catalysis.

Chemical Equilibrium

- Recognize dynamic Chemical Equilibrium: Apply the law of mass action to homogeneous and heterogeneous equilibria. Perform equilibria calculations. Apply Le Chatelier's Principle.

Acids/bases and solubility

- Recognize and predict properties of aqueous solutions. Write reactions for acid/base hydrolysis reactions. Identify Bronsted and Lewis acids and bases. Identify strong and weak acids, strong and weak bases and salts. Perform calculations (especially pH calculations) for: strong and weak acids, strong and weak bases, salts and buffers.
- Perform titration calculations for the addition of strong acids or bases to both strong and weak acids or bases.
- Perform solubility calculations for slightly soluble ionic compounds and predict precipitation reactions.

Thermodynamics

- Apply the laws of thermodynamics. Explain entropy and spontaneity. Perform entropy calculations. Employ the idea of maximum work and be able to perform Gibbs free energy calculations both at standard state and nonstandard state.

Electrochemistry

- Explain and employ the concepts in Redox and Electrochemistry. Explain and write balanced Redox reactions. Describe and label electrochemical cells. Be able to calculate the EMF for an electrochemical cell both at standard state and nonstandard state. Be able to use standard reduction potentials to predict the spontaneity of reactions. Be able to perform electrolysis calculations. Describe batteries and corrosion.

Laboratory Skills

- Perform a minimum of 8 “wet” supervised hands-on labs per semester.
- Work in the lab safely. Wear Splash resistant goggles, proper clothing and closed toed shoes.
- Properly handle and dispose of chemicals.
- Read and analyze an SDS.
- Properly collect hazardous waste.
- Recognize basic laboratory equipment.
- Make measurements using the correct number of significant figures.
- Utilize notebook skills (especially data acquisition, data handling and data analysis).
- Required student deliverable: Students will perform a minimum of 2 wet labs using a lab notebook. The notebook needs to include an introduction, procedure, data table and conclusion.
- Utilize spreadsheets to graph (plot) and analyze data and do basic error analysis. Required student deliverable: Students will write 1 formal lab report using proper scientific analytical writing. The formal lab report must include good data analysis.
- Use volumetric glassware, including a buret.
- Perform accurate titrations.
- Use basic lab equipment including: balance, hot plate and thermometer.
- Use of spectrometer or colorimeter.
- Connect topics discussed in lecture and lab observations.

Major Topics to be Included:

- Liquids and Intermolecular Forces
- Solutions
- Kinetics
- Chemical Equilibrium
- Acids/bases and solubility
- Thermodynamics

- Electrochemistry
- Laboratory Skills

Effective Date/Updated: January 1, 2022