CHEM 112 – GENERAL CHEMISTRY II | 4 CREDITS (3+3P)

SYLLABUS

CATALOG DESCRIPTION

Part II of the general study of atomic systems including: kinetics, catalysis, acid-base systems, thermodynamics, electrochemistry, nuclear chemistry, reaction optimization, industrial processes, and coordination chemistry. For engineering and pre-professional majors.

Prerequisites: MATH 170 or equivalent, CHEM 111 or equivalent

Semester Offered: Fall and Spring

Common Student Learning Outcomes

Upon successful completion of San Juan College programs and degrees, the student will demonstrate competency in…

BROAD AND SPECIALIZED LEARNING

Students will actively and independently acquire, apply, and adapt skills and knowledge with an awareness of global contexts.

CRITICAL THINKING

Students will think analytically and creatively to explore ideas, make connections, draw conclusions and solve problems.

CULTURAL AND CIVIC ENGAGEMENT

Students will act purposefully, reflectively, and ethically in diverse and complex environments.

EFFECTIVE COMMUNICATION

Students will exchange ideas and information with clarity in multiple contexts.

INFORMATION LITERACY

Students will be able to recognize when information is needed and have the ability to locate, evaluate, and use it effectively.

INTEGRATING TECHNOLOGIES

Students will demonstrate fluency in the application and use of technologies in multiple contexts.

Student work from this class may be randomly selected and used anonymously for assessment of course, program, and/or institutional learning outcomes. For more information, please refer to the Dean of the appropriate School.

Course Learning Outcomes

Upon successful completion of the course, the student will be able to…

1.1 Identify important factors in the solution process.
1.2 Express concentrations in mass percent, parts per million, mole fraction, molarity, and molality.
1.3 Predict the effect of pressure and temperature on solubility.
1.4 Use Rault's law in vapor pressure lowering and distillation problems.
1.5 Use boiling point elevation and freezing point depression to determine molar mass.
1.6 Calculate osmotic pressure and use osmotic pressure to determine molarity.

2.1 Determine rate laws using the method of initial rates.
2.2 Determine first order rate laws from data.
2.3 Relate rate laws to reaction mechanisms.

2.4 Draw reaction pathway diagrams illustrating catalysis pathways and activation energy.
2.5 Use the Arrhenius equation to calculate rate constants at different temperatures.

3.1 Calculate equilibrium constants and equilibrium concentrations.
3.2 Predict effects on equilibrium using LeChatelier's Principle.
3.3 Use LeChatelier's Principle with thermodynamic and kinetic considerations to optimize typical chemical production.

4.1 Calculate the pH, pOH, [H+], [OH-], and dissociation constants for acid-base, salt, and buffer solutions.
4.2 Calculate concentrations, solubilities, and solubility product constants for slightly soluble compounds.

5.1 Relate the first, second, and third laws of thermodynamics to spontaneous processes.
5.2 Calculate and interpret enthalpy, entropy, and free energy changes for chemical systems.
5.3 Calculate equilibrium constants from thermodynamic data.

6.1 Balance oxidation-reduction reactions.
6.2 Draw and explain processes in galvanic, voltaic, and electrolytic cells.
6.3 Calculate cell emf, concentrations, equilibrium constants, enthalpy, and entropy using electrochemical methods.
6.4 Calculate stoichiometric quantities in electrolytic processes.

7.1 Describe and predict radioactive processes using nuclear equations.
7.2 Use first order kinetics in radiocarbon dating and other decay processes.
7.3 Calculate the mass defect, and binding energy, of nuclei.
7.4 Describe nuclear fission and fusion processes and calculate the associated energy changes.

9.1 Identify the components and structure of complexes.
9.2 Draw and label an octahedral crystal field energy diagram.
9.3 Identify high and low spin complexes
9.4 Use crystal field theory to determine electronic, optical, and magnetic properties of octahedral complexes.

10.1 Safely and effectively manipulate solid, liquid, and gaseous chemical samples in the laboratory.
10.2 Obtain valid data from analog and digital instrumentation in the laboratory.
10.3 Describe the components and purpose of a uv-vis spectrophotometer.
10.4 Perform quantitative analysis using colorimetry and Beer's law in the laboratory.
10.5 Develop and use a qualitative analysis scheme to separate and Identify a mixture of cations and anions in the laboratory.
10.6 Express experimental data in valid precision using the correct number of significant digits in scientific and engineering notations with appropriate units.
10.7 Calculate average, and standard deviation from experimental data and use to express precision of experimentally determined numbers in the laboratory.
10.8 Use spreadsheets to plot data and determine curve fitting parameters.
10.9 Present experimental data, mathematical manipulations, and final conclusions in laboratory reports