South Central College

CHEM 120 Principles of Chemistry I

Course Outcome Summary

Course Information

Description	This course introduces the student to the basic principles of chemistry including atomic and molecular structure, bonding, chemical reactions, solution chemistry, stoichiometry, thermochemistry, periodicity, and states of matter. Laboratory reinforces lecture concepts.
Total Credits	5
Total Hours	96

Types of Instruction

Instruction Type	Credits/Hours
Classroom Presentation	
On-campus Laboratory	

Pre/Corequisites

Math 120 or a score of 103 on the college level math portion of the accuplacer or a minimum ACT math score of 22 and Chem 108 or a grade of "C" or better in high school chemistry within the past 3 years.

Institutional Core Competencies

Critical and Creative Thinking - Students will be able to demonstrate purposeful thinking with the goal of using a creative process for developing and building upon ideas and/or the goal of using a critical process for the analyzing and evaluating of ideas.

Course Competencies

1. Acquire a knowledge of matter and its measurement.

Learning Objectives

Determine physical and chemical properties of matter.
Use the scientific method to solve problems.
Use significant figures in problem solving.
Solve problems involving equations.
Use conversion factors in problem solving.

2. Use modern atomic theory to explore the make-up of matter.

Learning Objectives
Recognize the organization of the periodic table as it relates to atomic structure.
Use the atomic theory to describe ionic and covalent bonding.

3. Understand and use the language of chemistry.

Learning Objectives
Write names and formulas of inorganic and simple organic compounds.
Read and write chemical equations.
Use chemical equations to solve problems.
Solve stoichiometry problems.

4. Exhibit an understanding of aqueous reactions and solutions.

Learning Objectives
Examine the nature of substances dissolved in water.
Identify types of reactions.
Solve problems involving solution stoichiometry and chemical analysis.

5. Solve problems involving thermochemistry.

Learning Objectives
Apply the first law of thermodynamics.
Solve enthalpy problems.
Solve calorimetry problems.
Apply Hess's law in problem solving.
Examine foods and fuels as sources of energy and discuss societal implications.

6. Demonstrate knowledge of the electronic structure of atoms.

Learning Objectives
Demonstrate knowledge of atomic models, including the Bohr model and the wave model.
Draw representations of electron orbitals.
Correlate the electron configuration of an atom with its position on the periodic table.

7. Describe the periodic properties of the elements and use them to make predictions.

Learning Objectives
Exhibit an understanding of ionization energy, effective nuclear charge, electron affinity, and size of atom related to its position on the periodic table.
Recognize that the physical and chemical properties of metals and nonmetals can be understood from the fundamental characteristics of atoms as listed in part 7a.
Examine periodic trends in the chemistry of the group A elements.

8. Demonstrate understanding of the basic concepts of chemical bonding and use these concepts in problem solving.

Learning Objectives
Characterize bonds as ionic, covalent, or metallic.
Arrange compounds in order of increasing lattice energy based on the charges and sizes of the ions involved.
Draw Lewis structures and use them to predict covalent bonding patterns within molecules.
Use average bond enthalpy values to estimate enthalpies of reactions.

9. Use molecular geometry and bonding theories to describe molecules.

Learning Objectives
Use the VSEPR model to describe three-dimensional shapes of molecules.
Determine polarity of a molecule based on its geometry and the individual bond dipole moments.
Identify the hybridization state of atoms in molecules.
Sketch how orbitals overlap to form sigma and pi bonds.
Use molecular orbital theory to describe bonding in molecules.

10. Exhibit an understanding of the characteristics of gases.

Learning Objectives
Apply the gas laws in calculations.

Solve problems using the ideal gas equation.
Describe the kinetic molecular theory and how it explains the pressure and temperature of a gas, the gas laws, and the rates of effusion and diffusion.
Explain why intermolecular attractions and molecular volumes cause real gases to deviate from ideal behavior at high pressure or low temperature.

11. Demonstrate understanding of the properties of liquids and solids.

Learning Objectives

Describe the intermolecular attractive interactions that exist between molecules or ions, and be able to compare the relative strengths of intermolecular attractions in substances based on their molecular structure, or physical properties.
Interpret heating curves and be able to calculate quantities related to temperature and enthalpies of phase changes.
Interpret and sketch phase diagrams; know how water's phase diagram differs from most other substances, and why.
Classify solids based on their bonding/intermolecular forces and understand how difference in bonding relates to physical properties.

12. Investigate the chemistry of modern materials.

Learning Objectives

Research the chemistry of a modern material, such as semiconductors, ceramics, superconductors, polymers, biomaterials, liquid crystals, or nanomaterials.
Examine the effect of the modern material on society.
Prepare a presentation on the material that will be given to the class.

13. Examine the properties of solutions.

Learning Objectives

Calculate the concentration of a solution in terms of molarity, molality, mole fraction, percent composition, and parts per million.
Exhibit understanding of how entropy and enthalpy changes affect solution formation.
Describe the effect of temperature and pressure on solubility of gases and liquids.
Perform solution calculations such as freezing point depression, boiling point elevation, osmotic pressure, and vapor pressure.

14. Perform chemical experiments in a laboratory setting using proper laboratory techniques and procedures.

Learning Objectives

Use equipment appropriately.
Form a hypothesis.
Develop a procedure.
Collect data in a laboratory notebook and analyze the data.
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