South Central College

CHEM 108 Introduction to Chemistry

Common Course Outline

Course Information

Description A one-semester introduction to the field of chemistry, this course is designed to allow the student to understand how chemistry relates to everyday life and to learn some of the language and concepts of chemistry. This course uses a math-based approach . The course is designed to prepare students for Principles of Chemistry I or to be utilized as a general Liberal Arts and Sciences course. Lecture and a 2 hour lab are included. (Prerequisite: MATH 0085 or a score of 75.5 or higher on the Elementary Algebra portion of the Accuplacer test.) (MNTC 3: Natural Sciences)

Total Credits 4

Total Hours 80

Types of Instruction

Instruction Type	Credits/Hours
Classroom Presentation	
On-Campus Lab	

Pre/Corequisites

Prerequisite Math 0085 or a score of 75.5 or higher on the elementary algebra portion of the accuplacer test.

Course Competencies

1. Use scientific methods of measurement.

Learning Objectives

Use the metric system of measurement in a laboratory setting and in problem solving.
Write numbers in scientific notation.
Solve density problems.
Solve metric conversion problems.
Describe the meaning of accuracy and precision in measurement.
Recognize proper use of significant figures in problem solving.
Calculate density in a laboratory setting using appropriate tools and measurement techniques.

2. Relate matter and energy.

Learning Objectives

Identify substances as solids, liquids or gases based on properties such as shape and volume; and by the arrangement, interaction, and movement of particles.
Calculate heat loss or gain in calories using specific heat.
Recognize that heat is a form of energy.

Identify energy as potential or kinetic.

3. Classify matter.

Learning Objectives

Differentiate between elements, compounds, and mixtures.
Classify mixtures as homogeneous or heterogeneous.
Identify properties and changes as physical or chemical.
Describe the properties of metals, nonmetals, and metalloids.
Identify groups and periods on the periodic table.
Locate alkali metals, alkaline earth metals, halogens, noble gases, and transition elements on the periodic table and recognize their properties.
Discuss the functions and dietary sources of six elements found in the human body.
Analyze a mixture in the laboratory using liquid chromatography.
Calculate the percent water in a compound using appropriate laboratory techniques.

4. Demonstrate knowledge of atomic models.

Learning Objectives

Define atomic number and mass number.
Locate protons, neutrons, and electrons in a model of an atom.
Calculate the number of protons, neutrons, and electrons in a neutral atom given the atomic number and mass number.
Define isotope.
Write symbols of isotopes when given name and mass number.
Determine the quantity of an element present in a mixture or compound in the laboratory.

5. Demonstrate the concept of periodicity.

Learning Objectives

Identify elements based on their electron arrangements.
Define valence electrons.
Draw electron dot diagrams of main group elements.
Interpret trend in atomic size and ionization energy as periodic properties.

6. Use the language of chemistry.

Linked External Standards

3c - Communicate their experimental findings, analyses, and interpretations both orally and in writing.

Learning Objectives

Identify compounds as ionic or covalent.
Use the octet rule to describe the formation of ions.
Write names of ionic and binary covalent compounds.
Write formulas for ionic and binary covalent compounds.
Write and balance chemical equations.
Identify types of reactions including combination, decomposition, single replacement, double replacement, and oxidation-reduction.

7. Determine the shape and polarity of molecules.

Learning Objectives

Predict whether compounds are polar or non-polar based on their electrode-negativities.
Predict shapes and polarity of molecules using VSEPR theory.

8. Solve problems involving chemical quantities.

Learning Objectives

Calculate molar mass.
Solve stoichiometry problems.
Solve percent composition problems.
Calculate the percent composition of a substance in the laboratory.
Determine moles of substances involved in a chemical reaction in the laboratory.
Determine Avogadro's number through experimentation in the laboratory.

9. Predict the effects of changes on chemical equilibrium and reaction rates.

Linked External Standards
3a - Demonstrate understanding of scientific theories.

Learning Objectives
Recognize the effect of concentration, heat, surface area, and catalysts on rate of reaction.
Apply LeChatelier's principle to equilibrium reactions.
Apply LeChatelier's principle to biological systems, such as the carbonic acid / bicarbonate buffer system.
Determine factors which affect reaction rates through experimentation in the laboratory.

10. Solve problems using the gas laws.

Linked External Standards
3a - Demonstrate understanding of scientific theories.

Learning Objectives
Calculate the change in volume of gas in a closed system using Boyle's, Charles, Guy- Lussac's, Avogadro's, and the combined gas law.
Calculate the partial pressure of gases in a system using Dalton's law.
Describe the effect of gas laws on biological systems, for example, gases in the lungs or blood gases.
Observe the effects of changes in temperature, volume, and pressure of a gas through laboratory experimentation.
Draw conclusions on the effects of changes in temperature, volume, and pressure of a gas based on laboratory observations.

11. Demonstrate understanding of solutions.

Linked External Standards
3a - Demonstrate understanding of scientific theories.

Learning Objectives
Identify the solute and solvent in a solution.
Classify solutions as saturated, unsaturated or supersaturated.
Differentiate between electrolytes and nonelectrolytes.
Explain the meaning of "like dissolves like".
Explain the effect of temperature and pressure on solubility.
Calculate the percent concentration of a solute in a solution.
Describe osmosis and dialysis.
Calculate molarity.
Calculate the concentration of a solution that has been diluted.
Determine the molecular weight of an unidentified compound in the laboratory using freezing point depression.

12. Demonstrate understanding of acids, bases, and buffers.

Linked External Standards
3a - Demonstrate understanding of scientific theories.

Learning Objectives
Write names and formulas for inorganic acids and bases.
Define acids and bases using the Arrhenius and Bronsted- Lowry definitions.
Calculate the pH of strong acids and strong bases.
Write balanced equations for reactions of acids and bases.
Perform an acid-base titration in the laboratory.
Determine the effect of adding acid and base to a buffer system through experimentation in the laboratory.

13. Demonstrate basic knowledge of radioactivity.

Learning Objectives
Describe alpha, beta, and gamma radiation.
Describe the measurement of radiation.
Discuss the biological effects of radiation.

Define half-life
Describe the use of radioisotopes in medicine.
Explore the effect of different shielding materials and distance from source in the laboratory.

14. Develop an understanding of basic organic chemistry.

Learning Objectives

Identify properties characteristic of organic or inorganic compounds.
Write names and structural formulas for alkanes, alkenes, alkynes, and cycloalkanes.
Recognize basic functional groups such as carboxylic acid, alcohol, amine, and ester.
Identify cis and trans isomers.

15. Develop laboratory skills.

Linked External Standards

3b - Formulate and test hypotheses by performing laboratory, simulation, or field experiments in at least two of the natural science disciplines. One of these experimental components should develop, in greater depth, students' laboratory experience in the collection of data, its statistical and graphical analysis, and an appreciation of its sources of error and uncertainty.

Learning Objectives

Perform laboratory procedures in a safe and efficient manner.
Use laboratory equipment and materials in a safe and efficient manner.
Know and use laboratory safety rules.
Use Green Chemistry practices in the laboratory.

16. Formulate and test hypotheses in the laboratory.

Linked External Standards

3b - Formulate and test hypotheses by performing laboratory, simulation, or field experiments in at least two of the natural science disciplines. One of these experimental components should develop, in greater depth, students' laboratory experience in the collection of data, its statistical and graphical analysis, and an appreciation of its sources of error and uncertainty.
3c - Communicate their experimental findings, analyses, and interpretations both orally and in writing.

Learning Objectives

Use observations and prior knowledge to create valid hypotheses.
Recognize variables that need to be controlled.
Design an experiment using given parameters.
Use equipment appropriately.
Discuss experimental procedures with a lab partner.

17. Draw conclusions based on laboratory data and analysis of that data.

Linked External Standards

3b - Formulate and test hypotheses by performing laboratory, simulation, or field experiments in at least two of the natural science disciplines. One of these experimental components should develop, in greater depth, students' laboratory experience in the collection of data, its statistical and graphical analysis, and an appreciation of its sources of error and uncertainty.
3c - Communicate their experimental findings, analyses, and interpretations both orally and in writing.

Learning Objectives

Analyze data using graphs and equations.
Analyze sources of error and uncertainty.
Write lab reports to communicate experimental findings, analyses, interpretations and conclusions.
Discuss findings with a lab partner or in a group setting.