Course Objectives/Course Outline

Spokane Community College

Course Title: **Chemical Concepts with Lab**

Prefix and Course Number: **CHEM& 110**

Course Learning Outcomes:

By the end of this course, a student should be able to:

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Course Outline:

I. Identify some of the main contributors to the science of chemistry.
   a. Contributions of Rutherford, Dalton, Avogadro, Einstein and other scientists to our present knowledge of chemistry.

II. Outline the key elements of the scientific method and describe some of the experiments that led to the discovery of the structure of atoms.
   a. Observation, experimentation and data analysis.
   b. Theory, models and scientific laws.
   c. Experiments such Thompson's cathode ray, gold foil, Millikan's oil drop or the photoelectric effect.

III. Carry out simple unit conversions.
   a. English, metric, and SI systems.
   b. Dimensional analysis.
   c. Scientific notation.
   d. Significant figures.

IV. Describe the structure of atoms, molecules and ionic compounds, give examples of each and name them.
   a. Matter.
   b. Element symbols and compound formulas.
   c. Periodic table and atomic and molecular masses.
   d. Atomic structure including the concepts of nuclear structure, isotopes, energy levels and electronic structure.
   e. Naming molecular and ionic binary compounds and common acids.

V. Compare and contrast physical and chemical properties and physical and chemical changes. Predict the solubility of substances using the 'like dissolves like' rule.
   a. Physical vs. chemical properties.
   b. Physical vs. chemical changes.
   c. Polarity and intermolecular forces.
   d. Solubility and the solution process.
   e. Introduction to concentration and the mole.
   f. The 'like dissolves like' rule.

VI. Recognize acids and bases. Predict the products of common acid-base neutralization reactions and write balanced chemical equations. Understand the concept of pH.

a. Arrhenius theory.
b. Acid dissociation in water and acid strength.
c. Concept of pH.

VII. Recognize when an oxidation-reduction has occurred and predict the products of simple redox reactions using an activity series. Write balanced chemical equations for the reaction.
a. Oxidation and reduction.
b. Activity series.

VIII. Recognize the different types of chemical reactions .
a. Balancing chemical equations.
b. Precipitation reactions.
c. Redox reactions.
d. Acid-base neutralization reactions.
e. Predict the products of the above reactions and write balanced chemical equations for each.

IX. State the thermodynamic laws and define the terms endothermic and exothermic.
a. Thermodynamic laws.
b. Energy changes in chemical reactions or physical changes.
c. Endothermic and exothermic processes.

X. Understand gas laws conceptually and use them to predict the behavior of gases.
a. Boyle's Law.
b. Charles' Law.
c. Avogadro's Law.
d. Ideal gas law and its uses.

XI. Distinguish between organic and inorganic compounds and draw Lewis Dot structures for both types of compounds.
a. Organic and inorganic compounds. Biochemical molecules.
b. VSEPR theory and Lewis dot structures.

XII. Explain how a nuclear reaction occurs and write balanced nuclear equations.
a. Nuclear vs. chemical changes.
b. Nuclear equations.
c. Sources of radiation.
d. Radiation damage.
e. Concept of half life and carbon dating.
f. Fission, fusion and nuclear energy.

XIII. Apply/relate the above concepts to issues such as:
a. The Ozone Layer – Structure of ozone vs. diatomic oxygen, reactions that lead to formation and destruction of ozone.
b. Acid Rain – Industrial processes that lead to acid rain, effects of acid rain on materials and living organisms.
c. Water Pollution – Recognizing common pollutants, allowable concentrations. Water purification.
d. Energy and Fuels – Renewable vs. nonrenewable fuels. Pros and cons of different fuels, energy conservation.
e. Nuclear Power – Using nuclear energy to produce electricity, nuclear

waste disposal.

f. Batteries – Common batteries and fuel cells.
g. Plastics and Polymers – Addition and condensation polymers, plastic recycling.
h. Nutrition and Drugs – Drug design and how drugs work. Carbohydrates, proteins and fats.
i. Genetic Engineering – DNA and heredity.

XIV. Optional topics: Stoichiometry, including solution stoichiometry and chemical kinetics.

XV. Perform laboratory experiments related to the above course learning objectives, record observations, gather and analyze data, and present the results in written form.