Course Competency

CHM 1990C Introductory Chemistry with Recitation

Course Description

This course will provide beginning students with certain basic knowledge and skills, which will enable them to be successful in the first semester of General Chemistry I, CHM 1045. The students will learn elementary principles of modern chemistry, including basic measurements, chemical bonding, chemical reactions, stoichiometry, concentration of solutions, and chemical nomenclature. (3 Hr. Lecture, 2 Hr. Lab)

Course Competency	Learning Outcomes
Competency 1:demonstrate knowledge of the basic units, calculations, conversions, and measurements that are at the very foundation of chemistry	1. Critical thinking 2. Numbers / Data
1. Demonstrating how very large or very small numbers are expressed in scientific or exponential notation. 2. Converting ordinary numbers into scientific or exponential notation and vice-versa. 3. Adding, subtracting, multiplying, and dividing numbers in scientific or exponential notation. 4. Applying the concept of significant figures and rounding off. 5. Categorizing units as units of length, mass, volume, or temperature. 6. Applying dimensional analysis to solve unit conversion problems. 7. Showing an ability to use the metric system of measurements by solving metric conversion and English-to-metric conversion problems:7.1 Using conversion factors for simple unit conversions.7.2 Using conversion factors for fractional unit conversions.7.3 Using conversion factors for square and cubic unit conversions.7.4 Using fractional units as conversion factors to convert from one	

type of measurement to another. 8. Converting among the three common temperature scales. 9. Defining density. 10. Calculating density. 11. Calculating the volume of a prism and of a cylinder. 12. Calculating the volume of an object by water displacement. 13. Using density as a conversion factor as the method to convert between mass and volume.	
Competency 2:demonstrate knowledge of matter's classification, properties, andchanges	
1. Classifying matter as either a pure substance or mixture. 2. Classifying pure substances as either elements or compounds. 3. Classifying a mixture as either homogeneous or heterogeneous. 4. Distinguishing between the physical and chemical properties of matter. 5. Distinguishing between the physical and chemical changes that matter undergoes. 6. Characterizing the three common states of matter. 7. Identifying the names used to describe changes in physical states of matter. 8. Identifying the names used to represent the temperatures at which the physical state of matter occur. 9. Applying the Law of Conservation of Matter. 10. Applying the Law of Conservation of Energy.	
Competency 3:demonstrate knowledge of the basic building blocks of matter	
1. Identifying the three major subatomic particles (electrons, protons, and neutrons) of the atom and describing their general arrangement within the atom. 2. Defining isotopes and determining how	

the properties and structure of various isotopes of a single element differ. 3. Relating an element's isotopic abundance and mass to its average atomic mass. 4. Identifying the number of protons, neutrons, electrons, mass number, and atomic number that an atom has given its isotopic symbol. 5. Learning the names and symbols of several common elements. 6. Describing the formation of ions from their parent atoms, and learning their names. 7. Showing how atoms or ions combine to form compounds. 8. Identifying the basic repeating unit of elements (atom, molecule, or formula unit), ions (ion or formula unit), and compounds (molecule or formula unit).	
Competency 4:demonstrate an ability to understand several of the intricacies of the periodic table	
1. Distinguishing between periods and groups on the periodic table. 2. Showing the relationship between position on the periodic table and atomic number. 3. Using the structure of the periodic table to classify elements (e.g., metal, non-metal, metalloid, noble gas, representative element, transition element, inner transition element, lanthanide, rare earth, actinide, alkali metal, alkaline earth metal, and/or halogen). 4. Showing the relationship between elements having similar chemical properties and being in the same group. 5. Giving the reason for elements having similar chemical properties based upon their atomic structures. 6. Using the periodic table to identify common patterns including ionization energy, atomic radii, metallic character, nonmetallic character and electronegativity within periods and	

groups of elements. 7. Describing the relationship that exists between the number of valence electrons an element has and its group number. 8. Describing the relationship between an element's group number and the ion that it commonly forms.	
Competency 5:demonstrate knowledge of electronic structure	
1. Identifying the s, p, d, f blocks in the periodic table. 2. Demonstrating the relationship that exists among wavelength, frequency, and energy of electromagnetic radiation. 3. Giving the maximum number of electrons that can be accommodated in the various energy levels, sublevels, and orbitals. 4. Applying the Aufbau Principle, Pauli's Exclusion Principle and Hund's Rule to construct electron orbital diagrams. 5. Writing electronic configurations for neutral atoms and ions. 6. Giving the number of valence electrons in an atom. 7. Relating electronic configurations to the position of elements in the periodic table.	
Competency 6:demonstrate knowledge of composition stoichiometry	
1. Predicting the type of bond that two atoms will form. 2. Describing how and why ionic and covalent bonds form. 3. Describing the difference between ionic, polar and non-polar covalent bonds. 4. Defining electronegativity. 5. Predicting bond polarity by calculating the electronegativity differences of the elements involved in bonding. 6. Identifying the traits of ionic compounds and covalent compounds. 7. Writing the Lewis electron dot structure of elements, simple ions, ionic compounds,	

polyatomic ions and covalent compounds. 8. Using the Valence Shell Electron-Pair Repulsion Theory to determine molecular geometry and bond angles of chemical species containing up to four pairs of valence electrons.	
Competency 7:demonstrate knowledge of chemical reactions in relation to reaction stoichiometry	
1. Identifying what atoms are present in a compound and in what ratio. 2. Defining a mole. 3. Calculating the molar mass of a substance from the sum of its atomic masses. 4. Converting between mass, moles, and number of atoms or molecules in a sample of a substance. 5. Converting between the mass, moles or number of atoms between a given amount of a compound given its formula and an element present in the formula or among different elements present in the formula. 6. Calculating the mass percent of an element in a given compound. 7. Using the mass percent to find the amount of an element in a given size sample of a compound. 8. Defining empirical formula. 9. Determining the empirical formula of a compound from elemental masses or mass percentages. 10. Determining the molecular formula of a compound given its empirical formula or the information needed to determine it and its molar mass.	
Competency 8:demonstrate knowledge of chemical reactions in relation to reaction stoichiometry	
1. Balancing chemical equations. 2. Identifying out the significance of the coefficients in a balanced chemical equation.	

3. Converting between moles and/or masses of reactants and/or products in a balanced equation. 4. Determining which reactant in a chemical reaction is the limiting reagent and which is the excess reagent. 5. Using the limiting reagent concept in calculations. 6. Computing the amount of the excess reagent left over. 7. Comparing the amount of substance actually formed in the reaction (actual yield) with the predicted amount (theoretical yield) to determine the percent yield of a chemical reaction. 8. Calculating the actual yield or theoretical yield given the percent yield and using the formula.	
Competency 9:demonstrate knowledge of the properties of solutions	
1. Distinguishing between a solute and solvent in a solution. 2. Distinguishing between the different types of solutions: saturated, unsaturated, and supersaturated. 3. Defining the concentration of a solution in terms of mass percent and showing how to calculate it. 4. Using mass percent as a conversion factor among grams of solvent, solute and/or solution. 5. Defining the concentration of a solution in terms of molarity and showing how to calculate it. 6. Using molarity as a conversion factor between moles of solute and liters of solution. 7. Calculating the initial or final concentration or volume of a solution made by dilution of a stock solution. 8. Converting between moles and liters of solution using molarity as a conversion factor in a chemical reaction that includes substances in a solution.	

Competency 10: demonstrate knowledge of writing chemical formulas and chemical nomenclature of inorganic compounds	1. Numbers / Data
1. Determining the oxidation number of atoms in a neutral compound. 2. Determining the oxidation number of atoms in a polyatomic ion. 3. Naming common polyatomic ions given their formulas. 4. Writing the formula of common polyatomic ions given their names. 5. Distinguishing between binary compounds and ternary compounds. 6. Using oxidation numbers to write formulas of binary and ternary compounds. 7. Distinguishing between metals with one oxidation number and metals with variable oxidation numbers. 8. Naming a binary ionic or covalent compound given its formula. 9. Writing the formula of a binary ionic or covalent compound given its name. 10. Naming a compound containing a metal or ammonium and a negative polyatomic ion given its formula. 11. Writing the formula of a compound containing a metal or ammonium and a negative polyatomic ion given its name. 12. Writing the formula of a compound containing ammonium and a simple negative ion. 13. Naming a compound given the formula of a compound containing ammonium and a simple negative ion. 14. Recognizing formulas as acids, bases, salts or covalent compounds. 15. Naming a binary acid given its formula. 16. Writing the formula of a binary acid given its name. 17. Naming a ternary acid including oxy-acids given its formula. 18. Writing the formula of a ternary acid including oxy-acids given its name.	
Competency 11: demonstrate knowledge of some of the various aspects of chemical reactions	

1. Describing what an electrolyte is. 2. Demonstrating the behavior of a strong electrolyte, a weak electrolyte and a nonelectrolyte. 3. Predicting if a chemical formula represents a strong electrolyte, weak electrolyte or a nonelectrolyte. 4. Categorizing chemical reactions including ionization, combination, decomposition, single replacement and double replacement. 5. Recognizing if a double replacement reaction can also be classified as a neutralization reaction. 6. Predicting the products of a combination reaction between a fixed charged metal and a nonmetal. 7. Predicting the products of a single replacement reaction and whether the reaction occurs based on the electromotive series of metals. 8. Predicting the products of a double replacement reaction and whether the reaction occurs based on the solubility rules. 9. Expressing double replacement reactions as total ionic and net ionic equations. 10. Describing what a redox reaction is. 11. Identifying reactions that are redox reactions versus nonredox reactions. 12. Recalling which are the strong acids and that all other acids are weak. 13. Recalling which are the strong bases and that all other bases are weak.	
Competency 12: The student will activate, reinforce and apply knowledge of arithmetic and algebra as necessary to master using unit conversions, ratios and formulas for volume, density, molarity, ratios, percent by mass and specific heat capacity	1. Numbers / Data 2. Critical thinking
1. Participating in collaborative learning to analyze data and deconstruct and find meaning to carefully sequenced questions and/or problem situations instead of	

simply getting the answer to a given problem. Participating in Socratic dialog and justifying answers with sound logic. Justifying and defending the groups' current thinking by combining individual arguments to form one cogent statement. Presenting, analyzing and discussing results. Developing numerical, algebraic and graphical models of real-life situations.	
Competency 13: The student will activate, reinforce and apply knowledge of chemical concepts such as stoichiometry, electronic configurations and chemical reactions	1. Critical thinking 2. Information Literacy 3. Numbers / Data 4. Environmental Responsibility
1. Participating in collaborative learning to analyze data and deconstruct and find meaning to carefully sequenced questions and/or problem situations instead of simply getting the answer to a given problem. Engaging in productive discussions and providing logical setups for calculated answers. Summarizing findings and work on assignments that correlate to the student's mastery of the content and providing documentation to support conclusions. Analyzing real-life problem situations and arriving at his or her own conclusions and solutions to context-rich performance tasks while comparing each other's approaches and models. Revising, rewriting and/or writing scripted, conceptual questions about a given problem and/or problem situation Building numerical, algebraic and graphical models of real-life situations	