Wayne County Community College District

COURSE SYLLABUS

CHM 105 Introduction to Chemistry

CREDIT HOURS: 4.00 **CONTACT HOURS:** 60.00 HL / 30 HLB

COURSE DESCRIPTION:
An introductory lecture and laboratory course in chemistry for persons without any previous high school chemistry or for those with an inadequate background for CHM 136. Topics include properties of matter, atomic theory and structure, chemical bonds, nomenclature, composition of compounds, chemical equations and calculations from chemical equations and stoichiometry (meets six hours per week; four hours lecture and two hours laboratory).

PREREQUISITES: None

EXPECTED COMPETENCIES: *Upon successful completion of this course, the student will:*

1. Apply strategies of scientific inquiry.
    a. Record observations
    b. Identify hypotheses
    c. Perform experiments
    d. Analyze data
    e. Interpret results
    f. Communicate findings

2. Describe samples of matter in terms of properties and composition.
    a. Define “chemistry”.
    b. Define “matter”.
    c. Classify a fact regarding a sample of matter as either a chemical property, physical property, chemical change or physical change.
    d. Identify the states of matter (solid, liquid, or gas) present in a sample of matter.
    e. Classify samples of matter as one or more of the following: compound. Element, heterogeneous mixture, homogeneous mixture, pure substance.
    f. Use filtration and evaporation to separate samples of matter into components.
    g. Write the symbols (or names) of common elements when given the names (or symbols).
    h. Define “atom”.
    i. Classify a formula or structure as representing one or more of the following: atom, molecule, element, compound, diatomic, triatomic, heteroatomic, homoatomic.
    j. Determine how many atoms of each type are represented in a given formula.

3. Use simple algebraic equations to solve numerical problems involving basic physical quantities.
    a. Count the number of significant figures in a number.
    b. Report measured quantities with the proper number of significant figures.
    c. Apply the rules for retaining significant figures when performing calculations.
    d. Apply the rules for rounding when retaining significant figures.
    e. Convert between standard notation and scientific notation.
    f. List various units used for mass (or weight), volume, distance, temperature, and energy.
    g. Label each quantity in a problem with an appropriate symbol.
    h. Use conversion factors or equations to change units when necessary.
    i. Solve problems involving density, mass, and volume.
    j. Solve problems involving heat, specific heat capacity, mass and temperature.

4. Describe how the periodic table is used to summarize information about the structure and properties of atoms.
    a. Compare and contrast the three major subatomic particles in terms of size, change, and location.
    b. Write an isotope symbol for an atom, given information about it subatomic particles.
    c. Determine the number of each type of subatomic particle present in an atom, given its isotope symbol.
    d. Calculate the atomic mass of an element given the masses and abundances of its isotopes.
    e. State the periodic law.
    f. Explain the difference between a period and a group.
    g. Classify a given element, based on its location in the periodic table, as one or more of the following: alkali metal, alkaline earth metal, transition metal, inner transition metal, representative element, nonmetal, halogen, noble gas.
    h. Classify an unidentified element as either a metal or a nonmetal based on its properties.
    i. Describe the relationship between the shell number, the number of subshells in a shell, the number of orbitals in a subshell and the number of electrons in an orbital.
    j. Write the electron configuration of a given element, using only the periodic table for assistance.
    k. Draw the orbital diagram of a given element, using only the periodic table for assistant.

5. Describe chemical bonding.
    a. Write the name (or formula) of a binary compound givens its formula (or name).
    b. Write the name (or formula) of a compound containing a polyatomic ion given its formula (or name).
    c. Draw Lewis structure for atoms, molecules, or ions.
    d. Describe the molecular geometries of molecules or polyatomic ions that contain central atoms with up to four groups of electrons.
    e. Describe the polarities of bonds.
    f. Describe the polarities of molecules.

6. Solve mathematical problems related to the amounts of reactants and products in a chemical equation. (Stoichiometry)
    a. Define “mole”.
    b. Determine the molar mass of a substance, given either its formula or name.
    c. Write a balanced equation, given the formulas or names of the reactants and products.
    d. Use molar masses and mole ratios to relate the masses of reactants used and products formed in reaction.

7. Describe how the kinetic molecular theory of matter is used to explain the properties of solids, liquids, and gasses.
    a. List the five statements of the kinetic molecular theory of matter.
    b. Compare and contract the states of matter (solid, liquid, and gas) in terms of the following physical properties, volume, shape, density, compressibility, thermal expansion.
    c. Describe how the kinetic theory of matter is used to explain the differing properties if the states of matter (solid, liquid, and gas).

8. Solve numerical problems involving the amount, pressure, volume and temperature of gases.
    a. Identify the four variables used in gas laws.
    b. Define pressure.
    c. Convert between common units used for pressure (atm, mm, Hg, torr, psi), volume (L, mL), temperature (K, C, F) and amount (mol, g, kg, lb).
    d. Calculate the effect on any one of pressure, volume, or temperature when one or both of the others are changed for a given amount of gas.
    e. Calculate any one gas law variable (pressure, volume, amount or temperature) for a sample of gas given the other three.
    f. Calculate the partial pressure of one component of a mixture of gasses, given the total pressure and the partial pressures of the other components.

9. Describe how intermolecular forces relate to changes of state.
    a. Summarize the six state changes, including the name of the change, the initial state, the final state, and whether the change is endothermic or exothermic.
    b. Describe the relationship that exists between the vapor pressure, the temperature, and the rate of evaporation of a liquid.
    c. Describe the relationship that exists between the external pressure, the vapor pressure and the boiling point of a liquid.
    d. Compare and contrast the three types of intermolecular forces.
    e. List the intermolecular forces present in a substance, given its formula or name.
    f. Arrange a set of substances in increasing (or decreasing) order according to various properties (boiling point, vapor pressure,) that depend on intermolecular forces.

10. Describe properties of solutions.
    a. Define the terms “solution”, “solvent”, and “solute”.
    b. Identify quantities in a problem as referring to “solution”, “solvent”, or “solute”.
    c. Describe how temperature and pressure affect solubility.
    d. Identify solutions as either “saturated”, “unsaturated” or “supersaturated”, given sufficient data.
    e. List factors that affect the rate of dissolution of a solute.
    f. Predict the solubility of various substances in water.
    g. Explain the difference between a solution and a colloidal dispersion.
    h. List four colligative properties of solutions.
    i. Predict how a given colligative property will change as the concentration of a solution is increased.
    j. Define the terms osmosis, semi permeable membrane, osmotic pressure, isotonic, hypotonic, hypertonic, and dialysis.
    k. Describe what happens to normal blood cells in isotonic, hypotonic, and hypertonic solutions.
    l. Describe the similarities and differences between osmosis and dialysis.

11. Solve numerical problems involving concentrations of solutions.
12. Describe the changes that occur during chemical reactions.
13. Explain how changing various factors rates and equilibrium positions.
14. Describe acid-base reactions in terms of both Arrhenius theory and Bonsted-Lowry theory.
15. Solve numerical problems involving acids, bases and pH.

16. Describe the changes that occur during nuclear reactions.

ASSESSMENT METHODS:
Student performance may be assessed by examination, quizzes, case studies, oral conversation, group discussion, oral presentations. The instructor reserves the option to employ one or more of these assessment methods during the course.

GRADING SCALE:
90%-100% = A
80%-89.9%= B
70%-79.9%= C
60%-69.9%= D
<60% = E