

SWEETWATER UNION HIGH SCHOOL DISTRICT

DIVISION OF ADULT EDUCATION

High School Subjects

<u>VI</u>	<u>Chemistry 1, 2</u>	<u>9047</u>
Level	2012	<u>9048</u>
		Code

DURATION: Satisfactory completion of all required work and a minimum of 60 hours.

GRADE LEVEL: Adult/9-12

PREREQUISITES: It is recommended students have completed the Algebra requirement or higher. Chemistry 1 and Chemistry 2 are sequential courses. Chemistry 1 must be completed prior to enrolling in Chemistry 2.

CREDIT: One (1) semester credit toward the physical science requirement for each semester towards high school graduation may be earned.

PROGRAM DESCRIPTION:

This two semester course is a rigorous college preparatory science course, which is intended to provide students with problem solving, critical thinking, and deduction skills. This course is taught in a manner where concepts scaffold and build on each other. Information taught early in the course is revisited throughout the course.

GOALS:

Through the principles and practice presented in this course, students will

- 1.0 Ask meaningful questions and conduct careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students will develop their own questions and perform investigations (CS IAE 1.0).
- 2.0 Understand that the periodic table displays the elements in increasing atomic number and understand how periodicity of the physical and chemical properties of the elements relates to atomic structure (CS Chem 1.0).
- 3.0 Comprehend biological, chemical and physical properties of matter result from the ability of atoms to form bonds from electrostatic forces between electrons and protons and between atoms and molecules (CS Chem 2.0).

- 4.0 Explain how the bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes and chemical properties and provide the biochemical basis of life (CS Chem 10.0).
- 5.0 Describe that the conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants (CS Chem 3.0).
- 6.0 Explain that energy is exchanged or transformed in all chemical reactions and physical changes of matter (CS Chem 7.0).
- 7.0 Explain gases and their properties through the Kinetic Molecular theory which describes the motion of atoms and molecules (CS Chem 4.0).
- 8.0 Describe how solutions are homogeneous mixtures of two or more substances (CS Chem 6.0).
- 9.0 Describe how acids, bases and salts are three classes of compounds that form ions in water solutions (CS Chem 5.0).
- 10.0 Explain how chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules (CS Chem 8.0).
- 11.0 Describe how chemical equilibrium is a dynamic process at the molecular level (CS Chem 9.0).
- 12.0 Demonstrate that nuclear processes are those in which an atomic nucleus changes, including radioactive decay of naturally occurring and human-made isotopes, nuclear fission, and nuclear fusion (CS Chem 11.0).

OBJECTIVES:

Students who successfully complete this course will be able to:

1. Ask meaningful questions and conduct careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students will develop their own questions and perform investigations. Students will:
 - 1.1. Identify and communicate sources of unavoidable experimental error and recognize the issues of statistical variability and the need for controlled tests (CS IAE 1b and 1j).
 - 1.2. Formulate explanations by using logic and recognize the cumulative nature of scientific evidence (CS IAE 1d, & 1j).

- 1.3. Distinguish between hypothesis and theory as scientific terms and recognize the usefulness and limitations of models and theories as scientific representations of reality (CS IAE 1f & 1g).
 - 1.4. Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent and can identify reasons for inconsistent results (CS IAE 1n, & 1c).
 - 1.5. Select and use appropriate tools and technology to perform tests, collect data, analyze relationships and display data as necessary in science (CS IAE 1a).
2. Understand that the periodic table displays the elements in increasing atomic number and understand how periodicity of the physical and chemical properties of the elements relates to atomic structure. Students will:
- 2.1. Know the experimental basis for Thomson's discovery of the electron. Rutherford's nuclear atom, Millikan's oil drop experiment, and Einstein's explanation of the photoelectric effect (CS Chem 1h).
 - 2.2. Know the experimental basis for the development of the quantum theory of atomic structure and the historical importance of the Bohr model of the atom (CS Chem 1i).
 - 2.3. Explain that the nucleus of the atom is much smaller than the atom yet contains most of its mass (CS Chem 1e).
 - 2.4. Understand how to relate the position of an element in the periodic table to its atomic number and atomic mass and can identify metals, semimetals, nonmetals, and halogens on the periodic table (CS Chem 1a, & 1b).
 - 2.5. Identify alkali metals, alkaline earth metals and transition metals, trends in ionization energy, electronegativity, and the relative sizes of ions and atoms on the periodic table (CS Chem 1c).
 - 2.6. Relate the position of an element in the periodic table to its quantum electron configuration and to its reactivity with other elements in the table (CS Chem 1g).
 - 2.7. Identify the lanthanide, actinide, and transactinide elements and know that the transuranium elements were synthesized and identified in laboratory experiments through the use of nuclear accelerators and determine the number of electrons available for bonding based on the periodic table (CS Chem 1f, & 1g).

3. Comprehend biological, chemical and physical properties of matter result from the ability of atoms to form bonds from electrostatic forces between electrons and protons and between atoms and molecules. Students will:
 - 3.1. Understand atoms combine to form molecules by sharing electrons to form covalent or metallic bonds, or by exchanging electrons to form ionic bonds and how electronegativity and ionization energy relate to bond formation (CS Chem 2a & 2g).
 - 3.2. Analyze chemical bonds between atoms in molecules such as H₂, CH₄, NH₃, H₂CCH₂, N₂, Cl₂, and many large biological molecules are covalent and that salt crystals such as NaCl are repeating patterns of positive and negative ions held together by electrostatic attraction (CS Chem 2b, & 2c).
 - 3.3. Demonstrate how to draw Lewis dot structures (CS Chem 2e).
4. Explain how the bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes and chemical properties and provide the biochemical basis of life. Students will:
 - 4.1 Understand that large molecules (polymers), such as proteins, nucleic acids, and starch, are formed by repetitive combinations of simple subunits (CS Chem 10a).
 - 4.2 Explain the bonding characteristics of carbon that result in the formation of a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules and that amino acids are the building blocks of proteins (CS Chem 10b & 10c).
5. Describe that the conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants. Students will:
 - 5.1. Describe chemical reactions by writing balanced equations and know the quantity of one mole is set by defining one mole of carbon-12 atoms to have a mass of exactly 12 grams (CS Chem 3a, & 3b).
 - 5.2. Explain one mole equals 6.023×10^{23} particles (atoms or molecules) (CS Chem 3c).
 - 5.3. Determine the molar mass of a molecule from its chemical formula and a table of atomic masses, and calculate its percentage composition and how to convert the mass of a molecular substance to moles, number of particles or volume of gas at standard temperature and pressure (CS Chem 3d).
 - 5.4. Calculate the masses of reactant and products in a chemical reaction from the

mass of one of the reactants or products, and the relevant atomic masses (CS Chem 3e).

- 5.5. Calculate the percentage yield in a chemical reaction (CS Chem 3f).
6. Explain that energy is exchanged or transformed in all chemical reactions and physical changes of matter. Students will:
 - 6.1 Describe temperature and heat flow in terms of the motion of molecules (or atoms) and understand chemical processes can either release (exothermic) or absorb (endothermic) thermal energy (CS Chem 7a, &7b)
 - 6.2 Understand energy is released when a material condenses or freezes and absorbed when a material evaporates or melts (CS Chem 7c).
 - 6.3 Solve problems involving heat flow and temperature changes, using known values of specific heat and latent heat of phase change (CS Chem 7d).
7. Explain gases and their properties through the Kinetic Molecular theory which describes the motion of atoms and molecules. Students will:
 - 7.1 Understand the random motion of molecules and their collisions with a surface create the observable pressure on that surface and that the random motion of molecules is the reason for the diffusion of gases (CS Chem 4a & 4b).
 - 7.2 Understand the values and meanings of standard temperature and pressure (STP) (CS Chem 4d).
 - 7.3 Convert between Celsius and Kelvin temperature scales and know there is no temperature lower than 0 Kelvin (CS Chem 4e, & 4f).
 - 7.4 Understand the kinetic theory of gases relates the absolute temperature of gas to the average kinetic energy of its molecules or atoms (CS Chem 4g).
 - 7.5 Demonstrate how to apply the gas laws to relations between the pressure, temperature, and volume of any amount of an ideal gas or any mixture of ideal gases and can solve problems by using the ideal gas law in the form $PV = nRT$ (CS Chem 4c, & 4h).
8. Describe how solutions are homogeneous mixtures of two or more substances. Students will:
 - 8.1 Understand that atoms and molecules in liquids move in a random pattern relative to one another because the intermolecular forces are too weak to hold the atoms or molecules in a solid form (CS Chem 2d).

- 8.2 Define solute and solvent and know how to describe the dissolving process at the molecular level by using the concept of random molecular motion (CS Chem 6a, & 6b).
 - 8.3 Understand temperature, pressure, and surface area affect the dissolving process and can calculate the concentration of a solute in terms of grams per liter, molarity, parts per million, and percent composition (CS Chem 6c, & 6d).
 - 8.4 Understand the relationship between the molality of solute in a solution, and the solutions depressed freezing point or elevated boiling point (CS Chem 6e).
9. Describe how acids, bases and salts are three classes of compounds that form ions in water solutions. Students will:
- 9.1 Explain the observable properties of acids, bases and salt solutions and describe how acids are hydrogen-ion-donating and bases are hydrogen-ion-accepting substances (CS Chem 5a, & 5b).
 - 9.2 Analyze the Arrhenius and Bronsted-Lowry acid base definitions (CS Chem 5e).
 - 9.3 Understand strong acids and bases fully dissociate and weak acids and bases partially dissociate and how to use the pH scale to characterize acid and base solutions (CS Chem 5c, & 5d).
 - 9.4 Calculate pH from the hydrogen ion concentration (CS Chem 5f).
10. Explain how chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules. Students will:
- 10.1 Understand the rate of reaction is the decrease in concentration of reactants or the increase in concentration of products with time and that reaction rates depend on factors as concentration, temperature, and pressure (CS Chem 8a, & 8b).
 - 10.2 Analyze the role a catalyst plays in increasing the reaction rate and Model the definition and role of activation energy in a chemical reaction (CS Chem 8c, & 8d).
11. Describe how chemical equilibrium is a dynamic process at the molecular level (CS Chem. Students will:
- 11.1 Demonstrate how to use Le Chatelier's Principle to predict the effect of changes in concentration, temperature and pressure (CS Chem 9a).
 - 11.2 Analyze how equilibrium is s=established when forward and reverse reaction

rates are equal (CS Chem 9b).

12. Demonstrate that nuclear processes are those in which an atomic nucleus changes, including radioactive decay of naturally occurring and human-made isotopes, nuclear fission, and nuclear fusion. Students will:
 - 12.1 Understand protons and neutrons in the nucleus are held together by nuclear forces that overcome the electromagnetic repulsion between the protons (CS Chem 11a).
 - 12.2 Explain the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions. The change in mass (calculated by $E=mc^2$) is small but significant in nuclear reactions (CS Chem 11b).
 - 12.3 Understand that some naturally occurring isotopes of elements are radioactive, as are isotopes formed in nuclear reactions and know the three most common forms of radioactive decay (alpha, beta, and gamma) and how the nucleus changes in each type of decay (CS Chem 11c, &11d).
 - 12.4 Describe how alpha, beta, and gamma radiation produce different amounts and kinds of damage in matter and have different penetrations (CS Chem 11e).

INSTRUCTIONAL STRATEGIES AND TIMES:

Individual work on assignments	50%
Teacher/student evaluation of student practice	15%
Computer assisted learning	15%
Assessment	20%

EVALUATION:

1. Satisfactory completion of research, Internet, lab and written assignments as evaluated by the instructor.
2. Satisfactory completion of teacher-made and/or standardized test as evaluated by the instructor.
3. Satisfactory progress and participation in classroom activities as evaluated by the instructor.

CONDITIONS FOR REPETITION:

Students who have failed to meet the objectives because of insufficient attendance or inability to master content may repeat the course.

Approved:
BOARD OF TRUSTEES
April 16, 2012