Texas Essential Knowledge and Skills (TEKS)

1. **Scientific processes. The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:**
   - A. demonstrate safe practices during laboratory and field investigations, including the appropriate use of safety showers, eyewash fountains, safety goggles or chemical splash goggles, as appropriate, and fire extinguishers;
   - B. know specific hazards of chemical substances such as flammability, corrosiveness, and radioactivity as summarized on the Safety Data Sheets (SDS); and
   - C. demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.
2. **Scientific processes. The student uses scientific practices to solve investigative questions. The student is expected to:**
   - A. know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;
   - B. know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories;
   - C. know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but may be subject to change as new areas of science and new technologies are developed;
   - D. distinguish between scientific hypotheses and scientific theories;
   - E. plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting equipment and technology, including graphing calculators, computers and probes, electronic balances, an adequate supply of consumable chemicals, and sufficient scientific glassware such as beakers, Erlenmeyer flasks, pipettes, graduated cylinders, volumetric flasks, and burettes;
   - F. collect data and make measurements with accuracy and precision;
   - G. express and manipulate chemical quantities using scientific conventions and mathematical procedures, including dimensional analysis, scientific notation, and significant figures;
   - H. organize, analyze, evaluate, make inferences, and predict trends from data; and
   - I. communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphs, journals, summaries, oral reports, and technology-based reports.
3. **Scientific processes. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:**
   - A. analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;
   - B. communicate and apply scientific information extracted from various sources such as current events, published journal articles, and marketing materials;
   - C. draw inferences based on data related to promotional materials for products and services;
   - D. evaluate the impact of research on scientific thought, society, and the environment;
   - E. describe the connection between chemistry and future careers; and
   - F. describe the history of chemistry and contributions of scientists.
4. **Science concepts. The student knows the characteristics of matter and can analyze the relationships between chemical and physical changes and properties. The student is expected to:**
   - A. differentiate between physical and chemical changes and properties;
   - B. identify extensive properties such as mass and volume and intensive properties such as density and melting point;
   - C. compare solids, liquids, and gases in terms of compressibility, structure, shape, and volume; and
   - D. classify matter as pure substances or mixtures through investigation of their properties.
5. **Science concepts. The student understands the historical development of the Periodic Table and can apply its predictive power. The student is expected to:**
   - A. explain the use of chemical and physical properties in the historical development of the Periodic Table;
   - B. identify and explain the properties of chemical families, including alkali metals, alkaline earth metals, halogens, noble gases, and transition metals, using the Periodic Table; and
   - C. interpret periodic trends, including atomic radius, electronegativity, and ionization energy, using the Periodic Table.
6. **Science concepts. The student knows and understands the historical development of atomic theory. The student is expected to:**
   - A. describe the experimental design and conclusions used in the development of modern atomic theory, including Dalton's Postulates, Thomson's discovery of electron properties, Rutherford's nuclear atom, and Bohr's nuclear atom;
   - B. describe the mathematical relationships between energy, frequency, and wavelength of light using the electromagnetic spectrum;
   - C. calculate average atomic mass of an element using isotopic composition; and
   - D. express the arrangement of electrons in atoms of representative elements using electron configurations and Lewis valence electron dot structures.
7. **Science concepts. The student knows how atoms form ionic, covalent, and metallic bonds. The student is expected to:**
   - A. name ionic compounds containing main group or transition metals, covalent compounds, acids, and bases using International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules;
   - B. write the chemical formulas of ionic compounds containing representative elements, transition metals and common polyatomic ions, covalent compounds, and acids and bases;
   - C. construct electron dot formulas to illustrate ionic and covalent bonds;
   - D. describe metallic bonding and explain metallic properties such as thermal and electrical conductivity, malleability, and ductility; and
   - E. classify molecular structure for molecules with linear, trigonal planar, and tetrahedral electron pair geometries as explained by Valence Shell Electron Pair Repulsion (VSEPR) theory.
8. **Science concepts. The student can quantify the changes that occur during chemical reactions. The student is expected to:**
   - A. define and use the concept of a mole;
   - B. calculate the number of atoms or molecules in a sample of material using Avogadro's number;
   - C. calculate percent composition of compounds;
   - D. differentiate between empirical and molecular formulas;
   - E. write and balance chemical equations using the law of conservation of mass;
   - F. differentiate among double replacement reactions, including acid-base reactions and precipitation reactions, and oxidation-reduction reactions such as synthesis, decomposition, single replacement, and combustion reactions;
   - G. perform stoichiometric calculations, including determination of mass and gas volume relationships between reactants and products and percent yield; and
   - H. describe the concept of limiting reactants in a balanced chemical equation.
9. **Science concepts. The student understands the principles of ideal gas behavior, kinetic molecular theory, and the conditions that influence the behavior of gases. The student is expected to:**
   - A. describe and calculate the relations between volume, pressure, number of moles, and temperature for an ideal gas as described by Boyle's law, Charles' law, Avogadro's law, Dalton's law of partial pressure, and the ideal gas law; and
   - B. describe the postulates of kinetic molecular theory.
10. **Science concepts. The student understands and can apply the factors that influence the behavior of solutions. The student is expected to:**
    - A. describe the unique role of water in solutions in terms of polarity;
    - B. apply the general rules regarding solubility through investigations with aqueous solutions;
    - C. calculate the concentration of solutions in units of molarity;
    - D. calculate the dilutions of solutions using molarity;
    - E. distinguish among types of solutions such as electrolytes and nonelectrolytes; unsaturated, saturated, and supersaturated solutions; and strong and weak acids and bases;
    - F. investigate factors that influence solid and gas solubilities and rates of dissolution such as temperature, agitation, and surface area;
    - G. define acids and bases and distinguish between Arrhenius and Bronsted-Lowry definitions and predict products in acid-base reactions that form water; and
    - H. define pH and calculate the pH of a solution using the hydrogen ion concentration.
11. **Science concepts. The student understands the energy changes that occur in chemical reactions. The student is expected to:**
    - A. describe energy and its forms, including kinetic, potential, chemical, and thermal energies;
    - B. describe the law of conservation of energy and the processes of heat transfer in terms of calorimetry;
    - C. classify reactions as exothermic or endothermic and represent energy changes that occur in chemical reactions using thermochemical equations or graphical analysis; and
    - D. perform calculations involving heat, mass, temperature change, and specific heat.
12. **Science concepts. The student understands the basic processes of nuclear chemistry. The student is expected to:**
    - A. describe the characteristics of alpha, beta, and gamma radioactive decay processes in terms of balanced nuclear equations; and
    - B. compare fission and fusion reactions.