Chapter 112. Texas Essential Knowledge and Skills for Science

§112.45. Chemistry.

(a) General requirements. Students shall be awarded one credit for successful completion of this course. Suggested prerequisites: one unit of high school science, Algebra I, and completion of or concurrent enrollment in a second year of math. This course is recommended for students in Grades 10, 11, or 12.

(b) Introduction.

(1) In Chemistry, students conduct field and laboratory investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students study a variety of topics that include: characteristics of matter; energy transformations during physical and chemical changes; atomic structure; periodic table of elements; behavior of gases; bonding; nuclear fusion and nuclear fission; oxidation-reduction reactions; chemical equations; solutes; properties of solutions; acids and bases; and chemical reactions. Students will investigate how chemistry is an integral part of our daily lives.

(2) Science is a way of learning about the natural world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models, and also should know that science may not answer all questions.

(3) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.

(4) Investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the natural world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the natural world.

Underlined student expectations are identified as part of the Texas Assessment of Knowledge and Skills (TAKS)

(c) Knowledge and skills.

(1) **Scientific processes.** The student, for at least 40% of instructional time, conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during field and laboratory investigations; and

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(2) **Scientific processes.** The student uses scientific methods during field and laboratory investigations. The student is expected to:

(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(B) collect data and make measurements with precision;

(C) express and manipulate chemical quantities using scientific conventions and mathematical procedures such as dimensional analysis, scientific notation, and significant figures;

(D) organize, analyze, evaluate, make inferences, and predict trends from data; and

(E) communicate valid conclusions.

(3) **Scientific processes.** The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(B) make responsible choices in selecting everyday products and services using scientific information;

(C) evaluate the impact of research on scientific thought, society, and the environment;

(D) describe the connection between chemistry and future careers; and

(E) research and describe the history of chemistry and contributions of scientists.

(4) **Science concepts.** The student knows the characteristics of matter. The student is expected to:

(A) differentiate between physical and chemical properties of matter;

(B) analyze examples of solids, liquids, and gases to determine their compressibility, structure, motion of particles, shape, and volume;

(C) investigate and identify properties of mixtures and pure substances; and

(D) describe the physical and chemical characteristics of an element using the periodic table and make inferences about its chemical behavior.

(5) **Science concepts.** The student knows that energy transformations occur during physical or chemical changes in matter. The student is expected to:

(A) identify changes in matter, determine the nature of the change, and examine the forms of energy involved;

(B) identify and measure energy transformations and exchanges involved in chemical reactions; and

(C) measure the effects of the gain or loss of heat energy on the properties of solids, liquids, and gases.

(6) **Science concepts.** The student knows that atomic structure is determined by nuclear composition, allowable electron cloud, and subatomic particles. The student is expected to:

(A) describe the existence and properties of subatomic particles;

(B) analyze stable and unstable isotopes of an element to determine the relationship between the isotope's stability and its application; and

(C) summarize the historical development of the periodic table to understand the concept of periodicity.

(7) **Science concepts.** The student knows the variables that influence the behavior of gases. The student is expected to:

(A) describe interrelationships among temperature, particle number, pressure, and volume of gases contained within a closed system; and

(B) illustrate the data obtained from investigations with gases in a closed system and determine if the data are consistent with the Universal Gas Law.

(8) **Science concepts.** The student knows how atoms form bonds to acquire a stable arrangement of electrons. The student is expected to:

(A) identify characteristics of atoms involved in chemical bonding;

(B) investigate and compare the physical and chemical properties of ionic and covalent compounds;

(C) compare the arrangement of atoms in molecules, ionic crystals, polymers, and metallic substances; and

(D) describe the influence of intermolecular forces on the physical and chemical properties of covalent compounds.

(9) **Science concepts.** The student knows the processes, effects, and significance of nuclear fission and nuclear fusion. The student is expected to:

(A) compare fission and fusion reactions in terms of the masses of the reactants and products and the amount of energy released in the nuclear reactions;

(B) investigate radioactive elements to determine half-life;

(C) evaluate the commercial use of nuclear energy and medical uses of radioisotopes; and

(D) evaluate environmental issues associated with the storage, containment, and disposal of nuclear wastes.

(10) **Science concepts.** The student knows common oxidation-reduction reactions. The student is expected to:

(A) identify oxidation-reduction processes; and

(B) demonstrate and document the effects of a corrosion process and evaluate the importance of electroplating metals.

(11) **Science concepts.** The student knows that balanced chemical equations are used to interpret and describe the interactions of matter. The student is expected to:

(A) identify common elements and compounds using scientific nomenclature;

(B) demonstrate the use of symbols, formulas, and equations in describing interactions of matter such as chemical and nuclear reactions; and

(C) explain and balance chemical and nuclear equations using number of atoms, masses, and charge.

(12) **Science concepts.** The student knows the factors that influence the solubility of solutes in a solvent. The student is expected to:

(A) demonstrate and explain effects of temperature and the nature of solid solutes on the solubility of solids;

(B) develop general rules for solubility through investigations with aqueous solutions; and

(C) evaluate the significance of water as a solvent in living organisms and in the environment.

(13) **Science concepts.** The student knows relationships among the concentration, electrical conductivity, and colligative properties of a solution. The student is expected to:

(A) compare unsaturated, saturated, and supersaturated solutions;

(B) interpret relationships among ionic and covalent compounds, electrical conductivity, and colligative properties of water; and

(C) measure and compare the rates of reaction of a solid reactant in solutions of varying concentration.

(14) **Science concepts.** The student knows the properties and behavior of acids and bases. The student is expected to:

(A) analyze and measure common household products using a variety of indicators to classify the products as acids or bases;

(B) demonstrate the electrical conductivity of acids and bases;

(C) identify the characteristics of a neutralization reaction; and

(D) describe effects of acids and bases on an ecological system.

(15) **Science concepts.** The student knows factors involved in chemical reactions. The student is expected to:

(A) verify the law of conservation of energy by evaluating the energy exchange that occurs as a consequence of a chemical reaction; and

(B) relate the rate of a chemical reaction to temperature, concentration, surface area, and presence of a catalyst.

Source: The provisions of this §112.45 adopted to be effective September 1, 1998, 22 TexReg 7647.