**READY, AIM, FIRE! TEKS Grades 11-12**

**§112.35. Chemistry, Beginning with School Year 2010-2011 (One Credit).**

(c)  Knowledge and skills.

(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, and fire extinguishers;

(B)  know specific hazards of chemical substances such as flammability, corrosiveness, and radioactivity as summarized on the Material Safety Data Sheets (MSDS); 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 methods 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 which 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, sufficient scientific glassware such as beakers, Erlenmeyer flasks, pipettes, graduated cylinders, volumetric flasks, safety goggles, and burettes, electronic balances, and an adequate supply of consumable chemicals;

(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)  in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(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:

(F)  research and 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 and intensive properties;

(C)  compare solids, liquids, and gases in terms of compressibility, structure, shape, and volume; and

(7)  Science concepts. The student knows how atoms form ionic, metallic, and covalent bonds. The student is expected to:

(B)  write the chemical formulas of common polyatomic ions, ionic compounds containing main group or transition metals, covalent compounds, acids, and bases;

(C)  construct electron dot formulas to illustrate ionic and covalent bonds;

(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)  use the mole concept to calculate the number of atoms, ions, or molecules in a sample of material;

(C)  calculate percent composition and empirical and molecular formulas;

(D)  use the law of conservation of mass to write and balance chemical equations; and

(E)  perform stoichiometric calculations, including determination of mass relationships between reactants and products, calculation of limiting reagents, and percent yield.

(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;

(B)  perform stoichiometric calculations, including determination of mass and volume relationships between reactants and products for reactions involving gases; and

(C)  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:

(G)  define acids and bases and distinguish between Arrhenius and Bronsted-Lowry definitions and predict products in acid base reactions that form water;

(H)  understand and differentiate among acid-base reactions, precipitation reactions, and oxidation-reduction reactions;

(I)  define pH and use the hydrogen or hydroxide ion concentrations to calculate the pH of a solution; and

(J)  distinguish between degrees of dissociation for strong and weak acids and bases.

(11)  Science concepts. The student understands the energy changes that occur in chemical reactions. The student is expected to:

(A)  understand energy and its forms, including kinetic, potential, chemical, and thermal energies;

(B)  understand the law of conservation of energy and the processes of heat transfer;

(C)  use thermochemical equations to calculate energy changes that occur in chemical reactions and classify reactions as exothermic or endothermic;

(D)  perform calculations involving heat, mass, temperature change, and specific heat; and

(E)  use calorimetry to calculate the heat of a chemical process.

Source: The provisions of this §112.35 adopted to be effective August 4, 2009, 34 TexReg 5063.

**§112.39. Physics, Beginning with School Year 2010-2011 (One Credit).**

(b)  Introduction.

(1)  Physics. In Physics, students conduct laboratory and field 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: laws of motion; changes within physical systems and conservation of energy and momentum; forces; thermodynamics; characteristics and behavior of waves; and atomic, nuclear, and quantum physics. Students who successfully complete Physics will acquire factual knowledge within a conceptual framework, practice experimental design and interpretation, work collaboratively with colleagues, and develop critical thinking skills.

(3)  Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation can be experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.

(c)  Knowledge and skills.

(1)  Scientific processes. The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:

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

(B)  demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

(2)  Scientific processes. The student uses a systematic approach to answer scientific laboratory and field 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 which 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)  design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness;

(F)  demonstrate the use of course apparatus, equipment, techniques, and procedures, including multimeters (current, voltage, resistance), triple beam balances, batteries, clamps, dynamics demonstration equipment, collision apparatus, data acquisition probes, discharge tubes with power supply (H, He, Ne, Ar), hand-held visual spectroscopes, hot plates, slotted and hooked lab masses, bar magnets, horseshoe magnets, plane mirrors, convex lenses, pendulum support, power supply, ring clamps, ring stands, stopwatches, trajectory apparatus, tuning forks, carbon paper, graph paper, magnetic compasses, polarized film, prisms, protractors, resistors, friction blocks, mini lamps (bulbs) and sockets, electrostatics kits, 90-degree rod clamps, metric rulers, spring scales, knife blade switches, Celsius thermometers, meter sticks, scientific calculators, graphing technology, computers, cathode ray tubes with horseshoe magnets, ballistic carts or equivalent, resonance tubes, spools of nylon thread or string, containers of iron filings, rolls of white craft paper, copper wire, Periodic Table, electromagnetic spectrum charts, slinky springs, wave motion ropes, and laser pointers;

(G)  use a wide variety of additional course apparatus, equipment, techniques, materials, and procedures as appropriate such as ripple tank with wave generator, wave motion rope, micrometer, caliper, radiation monitor, computer, ballistic pendulum, electroscope, inclined plane, optics bench, optics kit, pulley with table clamp, resonance tube, ring stand screen, four inch ring, stroboscope, graduated cylinders, and ticker timer;

(H)  make measurements with accuracy and precision and record data using scientific notation and International System (SI) units;

(I)  identify and quantify causes and effects of uncertainties in measured data;

(J)  organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs;

(K)  communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports; and

(L)  express and manipulate relationships among physical variables quantitatively, including the use of graphs, charts, and equations.

(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)  in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(B)  communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;

(C)  draw inferences based on data related to promotional materials for products and services;

(D)  explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society;

(E)  research and describe the connections between physics and future careers; and

(F)  express and interpret relationships symbolically in accordance with accepted theories to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition.

(4)  Science concepts. The student knows and applies the laws governing motion in a variety of situations. The student is expected to:

(A)  generate and interpret graphs and charts describing different types of motion, including the use of real-time technology such as motion detectors or photogates;

(B)  describe and analyze motion in one dimension using equations with the concepts of distance, displacement, speed, average velocity, instantaneous velocity, and acceleration;

(C)  analyze and describe accelerated motion in two dimensions using equations, including projectile and circular examples;

(D)  calculate the effect of forces on objects, including the law of inertia, the relationship between force and acceleration, and the nature of force pairs between objects;

(E)  develop and interpret free-body force diagrams; and

(F)  identify and describe motion relative to different frames of reference.

(5)  Science concepts. The student knows the nature of forces in the physical world. The student is expected to:

(A)  research and describe the historical development of the concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces;

(B)  describe and calculate how the magnitude of the gravitational force between two objects depends on their masses and the distance between their centers;

(6)  Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum. The student is expected to:

(A)  investigate and calculate quantities using the work-energy theorem in various situations;

(B)  investigate examples of kinetic and potential energy and their transformations;

(C)  calculate the mechanical energy of, power generated within, impulse applied to, and momentum of a physical system;

(D)  demonstrate and apply the laws of conservation of energy and conservation of momentum in one dimension;

(E)  describe how the macroscopic properties of a thermodynamic system such as temperature, specific heat, and pressure are related to the molecular level of matter, including kinetic or potential energy of atoms;

(F)  contrast and give examples of different processes of thermal energy transfer, including conduction, convection, and radiation; and

(G)  analyze and explain everyday examples that illustrate the laws of thermodynamics, including the law of conservation of energy and the law of entropy.

Source: The provisions of this §112.39 adopted to be effective August 4, 2009, 34 TexReg 5063.