Prepared by the State Board of Education Science TEKS Streamlining Committees

First Draft, September 2016

These draft proposed revisions reflect the changes to the science Texas Essential Knowledge and Skills (TEKS) that have been recommended by State Board of Education-appointed TEKS streamlining committees for **High School**. Proposed deletions are shown in red font with strikethroughs (~~deletions~~). ~~Text~~ proposed to be moved from its current student expectation is shown in purple font with strikethrough (moved ~~text~~) ~~and is~~ shown in the proposed new location in purple font with underlines (new text location). Recommendations to clarify language are shown in blue font with underlines (clarifying language).

Comments in the right-hand column provide explanations for the proposed changes. The following notations were used as part of the explanations:

CRS—information added or changed to align with the Texas College and Career Readiness Standards (CCRS)

ER—information added, changed, or deleted based on expert reviewer feedback

MV—multiple viewpoints from within the committee

VA—information added, changed, or deleted to increase vertical alignment

HIGH SCHOOL, SCIENCE DRAFT RECOMMENDATIONS TABLE OF CONTENTS

§112.34. Biology, Beginning with School Year 2010-2011.		
	TEKS with edits	Committee Comments
(a)	**General requirements.** Students shall be awarded one credit for successful completion of this course. Prerequisites: none. This course is recommended for students in Grade 9, 10, or 11.	Note: SEs tied to CCRS were not removed.
(b)	**Introduction.**	
(1)	Biology. In Biology, students conduct laboratory and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students in Biology study a variety of topics that include: structures and functions of cells and viruses; growth and development of organisms; cells, tissues, and organs; nucleic acids and genetics; biological evolution; taxonomy; metabolism and energy transfers in living organisms; living systems; homeostasis; and ecosystems and the environment.	
(2)	Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.	Recommended edit: Current: …that are not scientifically testable. Change to: … that cannot currently be addressed by science. Other committees affected are in agreement with the suggested edit.
(3)	Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.	
(4)	Science and social ethics. Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).	
(5)	Science, systems, and models. A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.	
(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:**	Necessary for environmental concerns and safety.
(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 scientific methods and equipment during laboratory and field investigations. The student is expected to:**	All SEs are essential for the scientific process in general. Supports introduction statements 2 and 3.
(A)	know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;	
(B)	know that 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 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 they 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 descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;	
(F)	collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as ~~calculators, spreadsheet software,~~ data-collecting probes, ~~computers,~~ standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, ~~electronic~~ balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, ~~cameras,~~ Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;	Technical edit- change micropipettors to micropipettes. Items not specific to the course; general classroom materials. Any type of balance can be used.
(G)	analyze, evaluate, make inferences, and predict trends from data; and	
(H)	communicate valid conclusions supported by the data. ~~through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.~~	List not needed. Common classroom practices.
(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:**	All SEs are necessary for the demonstration of mastery of scientific concepts. Supports introduction statement 2, 3 and 4.

(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;~~	SE now begins with a verb. The including statement is deleted to streamline for time; students can't master everything on the including list in an on-level one-year biology course. "All sides of scientific evidence" is grammatically incorrect; evidence does not have sides, only different perspectives on the interpretation of the evidence. MV (2/10): various interpretations of the evidence are important at times. Recommended edit: such as different perspectives of the interpretation of the data. "In all fields or science," is deleted for correct syntax. Other committees affected are in agreement with the suggested edit.
(B)	communicate and apply scientific information extracted from various sources such as current events, ~~news reports,~~ published journal articles, and marketing materials;	Redundant with current events. Other committees affected are in agreement with the suggested edit.
(C)	draw inferences based on data related to promotional materials for products and services;	
(D)	evaluate the impact of scientific research on society and the environment;	
(E)	evaluate models according to their limitations in representing biological objects or events; and	
(F)	research and describe the history of biology and contributions of scientists.	Recommended edit: Change "research" to "investigate." Other committees affected are in agreement with the suggested edit.
(4)	**Science concepts. The student knows that cells are the basic structures of all living things with specialized parts that perform specific functions and that viruses are different from cells. The student is expected to:**	
(A)	compare and contrast prokaryotic and eukaryotic cells;	Essential knowledge for the study of life. Supports introductory statement 1. Supports CCRS.

(B)	investigate and explain cellular processes, including homeostasis, ~~energy conversions,~~ transport of molecules~~, and synthesis of new molecules~~; and	Energy conversions moved to 9(B) for clarification. Synthesis of new molecules deleted to streamline for time, as a response to survey recommendations, and because the concept is inherent to 6C.
(C)	compare the structures of viruses to cells, describe viral reproduction, and describe the role of viruses in causing diseases such as human immunodeficiency virus (HIV) and influenza.	Essential knowledge for the study of life. Supports introductory statement 1. Supports CCRS.
(5)	**Science concepts. The student knows how an organism grows and the importance of cell differentiation. The student is expected to:**	
(A)	describe the stages of the cell cycle, including deoxyribonucleic acid (DNA) replication and mitosis, and the importance of the cell cycle to the growth of organisms;	Essential knowledge for the study of organism development. Supports introductory statement 1. Supports CCRS.
(B)	~~examine specialized cells of plants and animals, including roots, stems, and leaves, of plants; and animal cells such as blood, muscle, and epithelium;~~	Streamlining for specificity and time. Committee and survey both called for simplification; the changes reflect recommendations. MV: (2/10) Recommendation: change “examine” to “compare” for clarity. This SE has been assessed at a higher level than currently stated.
(C)	describe the roles of DNA, ribonucleic acid (RNA), and environmental factors in cell differentiation; and	Essential knowledge for the study of organism development. Supports introductory statement 1. Supports CCRS.
(D)	recognize that disruptions of the cell cycle lead to diseases such as cancer.	Essential for real-world application.
(6)	**Science concepts. The student knows the mechanisms of genetics, including the role of nucleic acids and the principles of Mendelian Genetics. The student is expected to:**	
(A)	identify components of DNA, and describe how information for specifying the traits of an organism is carried in the DNA;	Essential knowledge for the study of growth and development and biological evolution. Supports introductory statement 1. Supports CCRS.

(B)	recognize that components that make up the genetic code are common to all organisms;	Essential knowledge for the study of genetics, biological evolution, and taxonomy. Supports introductory statement 1.
(C)	explain the purpose and process of transcription and translation using models of DNA and RNA;	Essential knowledge for the study of life, growth and development, and genetics. 4B synthesis of new molecules is inherent to 6C. Supports introductory statement 1. Supports CCRS.
(D)	recognize that gene expression is a regulated process;	Essential knowledge for the study of living systems and growth and development. Supports introductory statement 1. Supports CCRS.
(E)	identify and illustrate changes in DNA and evaluate the significance of these changes;	Essential knowledge for the study of nucleic acids and genetics, growth and development, and evolution. Supports introductory statement 1. Supports CCRS.
(F)	predict possible outcomes of various genetic combinations such as monohybrid crosses [and] dihybrid crosses ~~and non-Mendelian inheritance~~; and	Essential for understanding genetic diversity. Non-Mendelian is not aligned to the language in the Knowledge and Skills statement. Survey feedback supports deletion of non-Mendelian inheritance. Streamlining for time.
(G)	recognize the significance of meiosis to sexual reproduction.~~; and~~	Essential for understanding genetic diversity and the continuation of life. Supports introductory statement 1. Supports CCRS.

~~(H)~~	~~describe how techniques such as DNA fingerprinting, genetic modifications, and chromosomal analysis are used to study the genomes of organisms.~~	Streamlining for time. SE not aligned with the Knowledge and Skills statement. Survey feedback highly supports deletion of the SE as non-essential.
(7)	**Science concepts. The student knows evolutionary theory is a scientific explanation for the unity and diversity of life. The student is expected to:**	
(A)	analyze and evaluate how evidence of common ancestry among groups is provided by the fossil record, biogeography, and homologies, including anatomical, molecular, and developmental;	Essential for the study of biological evolution. Supports introductory statement 1. Supports CCRS.
~~(B)~~	~~analyze and evaluate scientific explanations concerning any data of sudden appearance, stasis, and sequential nature of groups in the fossil record;~~	Streamlining for time. Not enough time for students to master concept. Cognitively inappropriate for 9th grade students. MV (2/10) : Survey was split between support to delete and support to keep 7B. Recommendation: analyze ~~and evaluate~~ scientific explanations concerning any data of ~~sudden appearance,~~ stasis~~,~~ and sequential nature of groups in the fossil record;
(C)	analyze and evaluate how natural selection produces change in populations, not individuals;	Essential for the study of biological evolution and ecosystems. Supports introductory statement 1. Supports CCRS.
(D)	analyze and evaluate how the elements of natural selection, including inherited variation, the potential of a population to produce more offspring than can survive, and a finite supply of environmental resources, result in differential reproductive success;	Essential for the study of biological evolution and ecosystems. Supports introductory statement 1. Supports CCRS.
(E)	analyze and evaluate the relationship of natural selection to adaptation and to the development of diversity in and among species; and	Essential for the study of biological evolution and ecosystems. Supports introductory statement 1. Supports CCRS.

(F)	analyze ~~and evaluate the effects of~~ other evolutionary mechanisms, including genetic drift, gene flow, mutation, and recombination.~~; and.~~	Essential for the study of biological evolution and ecosystems. Supports introductory statement 1. Supports CCRS. Streamlining for time. Not enough time for students to master concept. Developmentally inappropriate.
~~(G)~~	~~analyze and evaluate scientific explanations concerning the complexity of the cell.~~	Survey strongly supports the deletion of the entire SE. Redundant; same course. 4(A), 4(B) and 5(A)
(8)	**Science concepts. The student knows that taxonomy is a branching classification based on the shared characteristics of organisms and can change as new discoveries are made. The student is expected to:**	
(A)	define taxonomy and recognize the importance of a standardized taxonomic system to the scientific community;	Essential for the study of taxonomy. Supports introductory statement 1.
(B)	categorize organisms using a hierarchical classification system based on similarities and differences shared among groups; and	Essential for the study of taxonomy. Supports introductory statement 1. Supports CCRS.
(C)	compare characteristics of taxonomic groups, including archaea, bacteria, protists, fungi, plants, and animals.	Essential for the study of taxonomy. Supports introductory statement 1. Supports CCRS.
(9)	**Science concepts. The student knows the significance of various molecules involved in metabolic processes and energy conversions that occur in living organisms. The student is expected to:**	
(A)	compare the ~~structures and~~ functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids;	Survey results support removal of the structures component of the SE. Students have not had sufficient chemistry instruction to master the structures of macromolecules. 7th grade committee recommended the removal of 7.6ABC during streamlining; the removal of that strand supports the removal of the structure component of this SE.

		Function is essential for the study of living systems; metabolism and energy transfer; and nucleic acids and genetics. Supports introductory statement 1. Supports CCRS.
(B)	compare the reactants and products of photosynthesis and cellular respiration in terms of energy, energy conversions, and matter; and	Moved from 4(B); this language is better aligned with this Knowledge and Skills statement. Survey results support the move of energy conversions from 4B to 9B.
(C)	identify and investigate the role of enzymes.~~; and~~	Essential for the study of living systems; and metabolism and energy transfer. Supports introductory statement 1. Supports CCRS.
~~(D)~~	~~analyze and evaluate the evidence regarding formation of simple organic molecules and their organization into long complex molecules having information such as the DNA molecule for self-replicating life.~~	Streamlining for time. Survey results support removal of entire SE. Redundant 5(A), 5(C), 6(A), 6(B), and 9(A)
(10)	**Science concepts. The student knows that biological systems are composed of multiple levels. The student is expected to:**	
(A)	describe the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals;	Essential for the study of living systems; growth and development; metabolism and energy transfer; and homeostasis. Supports introductory statement 1. Supports CCRS.
(B)	describe the interactions that occur among systems that perform the functions of transport, reproduction, and response in plants; and	Essential for the study of living systems; growth and development; metabolism and energy transfer; and homeostasis. Supports introductory statement 1. Supports CCRS.
(C)	analyze the levels of organization in biological systems and relate the levels to each other and to the whole system.	Essential for the study of living systems; ecosystems; and homeostasis. Supports introductory statement 5.

(11)	**Science concepts. The student knows that biological systems work to achieve and maintain balance. The student is expected to:**	
(A)	describe the role of internal feedback mechanisms in the maintenance of homeostasis;	MV: 4/9: Keep as written 3/9: Edit 2/9:Delete Survey results: 8 delete; 4 keep Essential for the study of living systems and homeostasis. Supports introductory statement 1. Supports CCRS.
~~(B)~~	~~investigate and analyze how organisms, populations, and communities respond to external factors;~~	Streamlining for time. Duplicate; same course: 11(A), 12(A) and 12(B). Survey supports deletion of entire SE as non-essential or repetitive of middle school SEs.
(C)	summarize the role of microorganisms in both maintaining and disrupting the health of both organisms and ecosystems; and	Essential for the study of living systems; and ecosystems and the environment. Supports introductory statement 1. Supports CCRS.
(D)	describe how events and processes that occur during ecological succession can change populations and species diversity.	Essential for the study of living systems; and ecosystems and the environment. Supports introductory statement 1. Supports CCRS.
(12)	**Science concepts. The student knows that interdependence and interactions occur within an environmental system. The student is expected to:**	
(A)	interpret relationships, including predation, parasitism, commensalism, mutualism, and competition among organisms;	Essential for the study of ecosystems and the environment. Supports introductory statement 1.
(B)	compare variations and adaptations of organisms in different ecosystems;	Essential for the study of ecosystems and the environment; biological evolution; and taxonomy. Supports introductory statement 1.

(C)	analyze the flow of matter and energy through trophic levels using various models, including food chains, food webs, and ecological pyramids;	Essential for the study of ecosystems and the environment; and energy transfer. Supports introductory statement 1 & 5. Supports CCRS.
~~(D)~~	~~recognize that long-term survival of species is dependent on changing resource bases that are limited;~~	Streamlining for time. Duplicate; same course 7(D). Factually incorrect; long term survival is dependent on non-changing factors. Survey results support deletion of SE.
(E)	describe the flow of matter through the carbon and nitrogen cycles and explain the consequences of disrupting these cycles; and	Essential for the study of ecosystems and the environment; cycles; and energy transfer. Supports introductory statement 1 & 5. Supports CCRS.
(F)	describe how environmental change can impact ecosystem stability.	Essential for the study of ecosystems and the environment; [ecological] homeostasis; and change and consistency. Supports introductory statement 1 & 5.

§112.38. Integrated Physics and Chemistry, Beginning with School Year 2010-2011 (One Credit).		
	TEKS with edits	Committee Comments
(a)	**General requirements.** Students shall be awarded one credit for successful completion of this course. Prerequisites: none. This course is recommended for students in Grade 9 or 10.	
(b)	**Introduction.**	
(1)	Integrated Physics and Chemistry. In Integrated Physics and Chemistry, students conduct laboratory and field investigations, use scientific methods during investigation, and make informed decisions using critical thinking and scientific problem solving. This course integrates the disciplines of physics and chemistry in the following topics: force, motion, energy, and matter.	
(2)	Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that cannot be addressed by science ~~are not scientifically testable~~.	Clarification= VA with other science high school courses
(3)	Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.	
(4)	Science and social ethics. Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).	
(5)	Science, systems, and models. A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.	
(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; 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 scientific methods during laboratory and field investigations. 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)	plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting equipment and technology;	Survey-delete “selecting equipment and technology” Committee disregards this survey suggestion to encourage inquiry methods
(C)	collect data and make measurements with precision;	
(D)	organize, analyze, evaluate, make inferences, and predict trends from data; and	
(E)	communicate valid conclusions.	
(3)	**Scientific processes. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions. 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~~;	Not necessary= one course being address on scope VA= SE adjusted on Biology and Physics TEKS Scientific evidence has multiple interpretations not sides
(B)	communicate and apply scientific information extracted from various sources such as current events, ~~news reports,~~ published journal articles, and marketing materials;	Clarification = duplications with current events Survey – delete SE Committee disregards this survey suggestion; it is an essential skill
(C)	draw inferences based on data related to promotional materials for products and services;	Survey – delete SE Committee disregards this survey suggestion; it is an essential skill
(D)	evaluate the impact of research on scientific thought, society, and the environment;	Survey – delete SE Committee disregards this survey suggestion; it is an essential skill

(E)	describe connections between physics and chemistry and future careers; and	
(F)	~~research~~ investigate and describe the history of physics and chemistry and contributions of scientists.	VA= used same vocabulary as Chemistry Reduces the time for mastery
(4)	**Science concepts. The student knows concepts of force and motion evident in everyday life. The student is expected to:**	
(A)	describe and calculate an object's motion in terms of position, displacement, speed, and acceleration;	
(B)	measure and graph distance and speed as a function of time~~ using moving toys~~;	Not needed = unnecessary example
(C)	investigate how an object's motion changes only when a net force is applied, including activities and equipment such as toy cars, vehicle restraints, sports activities, and classroom objects;	
(D)	~~assess~~ calculate the relationship between force, mass, and acceleration~~, noting the relationship is independent of the nature of the force,~~ using equipment such as dynamic carts, moving toys, vehicles, and falling objects;	Clarification = clarifies that math skills are required for mastery
(E)	~~apply~~ explain the concept of conservation of momentum using action and reaction forces~~ such as students on skateboards~~; ~~and~~	Rigor on CRS is at the Understanding Level of Bloom's Taxonomy recommendation is to change verb level to scaffold SE and to allow mastery time for SE VA= alignment with Physics SE 6D Student on skateboards - Not needed = unnecessary example
(F)	describe the gravitational attraction between objects of different masses at different distances~~, including satellites~~; and	Not needed = unnecessary example/beyond scope Survey – suggestion the SE is not essential/duplicated in multiple grades Committee disregards survey suggestion; SE scaffolds to VA with Phys 5B

(G)	examine electrical force as a universal force between any two charged objects and compare the relative strength of the electrical force and gravitational force.	Survey – suggestion the SE is not essential; duplicated in multiple grades Committee disregards survey suggestion; SE scaffolds to VA with Phys 5C
(5)	**Science concepts. The student recognizes multiple forms of energy and knows the impact of energy transfer and energy conservation in everyday life. The student is expected to:**	
(A)	recognize and demonstrate that objects and substances in motion have kinetic energy such as vibration of atoms, water flowing down a stream moving pebbles, and bowling balls knocking down pins;	
(B)	demonstrate common forms of potential energy, including gravitational, elastic, and chemical, such as a ball on an inclined plane, springs, and batteries;	
(C)	demonstrate that moving electric charges produce magnetic forces and moving magnets produce electric forces;	
(D)	investigate the law of conservation of energy;	
(E)	investigate and demonstrate the movement of thermal energy through solids, liquids, and gases by convection, conduction, and radiation such as in weather, living, and mechanical systems;	
(F)	evaluate the transfer of electrical energy in series and parallel circuits and conductive materials;	
(G)	explore the characteristics and behaviors of energy transferred by waves, including acoustic, seismic, light, and waves on water as they reflect, refract, diffract, interfere with ~~superpose on~~ one another~~, bend around corners, reflect off surfaces,~~ and are absorbed by materials~~, and change direction when entering new materials~~;	VA= alignment with Physics SE 7D
(H)	analyze energy transformations ~~conversions~~ such as those from radiant, nuclear, and geothermal sources; fossil fuels such as coal, gas, oil; and the movement of water or wind; and	VA = energy transformation is the language use for energy conversion on MS TEKS 6.9C and HS Physics 6B Term included on all adopted instructional materials
(I)	critique the advantages and disadvantages of various energy sources and their impact on society and the environment.	Survey – suggests SE not essential Committee disregards survey suggestion; SE VA and scaffolds between 6.7A and Environmental Systems 6.B
(6)	**Science concepts. The student knows that relationships exist between the structure and properties of matter. The student is expected to:**	

(A)	examine differences in physical properties of solids, liquids, and gases as explained by the arrangement and motion of atoms~~, ions,~~ or molecules~~ of the substances and the strength of the forces of attraction between those particles~~;	CRS Rigor on CRS is at the Understanding Level of Bloom's Taxonomy recommendation is to delete examples on SE to allow mastery time for SE VA= aligned with Chemistry SE 4C Not needed = unnecessary example
(B)	~~relate chemical properties of substances to the arrangement of their atoms or molecules;~~	Content not included on CRS recommendation is to delete SE Not needed = Beyond scope
(C)	analyze physical and chemical properties of elements and compounds such as color, density, viscosity, buoyancy, boiling point, freezing point, conductivity, and reactivity;	
(D)	relate the placement of an element on the Periodic Table to its physical and chemical behavior, including bonding and classification; and	Clarification = reordering SE clauses to make language more clear Survey – suggested that SE not essential Committee disregards survey suggestion; skill is essential
(E)	relate the structure of water to its function as a solvent and investigate the properties of solutions and factors affecting ~~gas and~~ solid solubility, including nature of solute, temperature, ~~pressure, pH,~~ and concentration.	CRS = information aligns to CCRS requirements VA= aligned with Chemistry SE 10F which does not includes gas solubility, pressure, nor pH Not needed = reduced scope
(7)	**Science concepts. The student knows that changes in matter affect everyday life. The student is expected to:**	
(A)	investigate changes of state as it relates to the arrangement of particles of matter and energy transfer;	
(B)	recognize that chemical changes can occur when substances react to form different substances and that these interactions are largely determined by the valence electrons;	
(C)	demonstrate that mass is conserved when substances undergo chemical change and that the number and kind of atoms are the same in the reactants and products;	

(D)	~~analyze~~ classify energy changes that accompany chemical reactions such as those occurring in heat packs, cold packs, and glow sticks ~~and classify them~~ as exothermic or endothermic reactions;	Clarification= Rigor on CRS is at the Understanding Level of Bloom's Taxonomy recommendation is to change verb level to scaffold Chemistry SE 11C and to allow enough mastery time for SE Survey – suggested that SE not essential Committee disregards survey suggestion; skill is essential Survey – suggestion the SE is not essential; duplicated in multiple grades Committee disregards survey
(E)	describe types of nuclear reactions such as fission and fusion and their roles in applications such as medicine and energy production; and	Survey – suggested that SE not essential Committee disregards survey suggestion; skill is essential for scaffold SE Chemistry 12C
(F)	research and describe the environmental and economic impact of the end-products of chemical reactions such as those that may result in acid rain, degradation of water and air quality, and ozone depletion.	Survey – suggested that SE not essential Committee disregards survey suggestion; skill is essential for scaffold SE Chemistry 12A

§112.35. Chemistry, Beginning with School Year 2010-2011 (One Credit).		
	TEKS with edits	Committee Comments
(a)	**General requirements.** Students shall be awarded one credit for successful completion of this course. Required prerequisites: one unit of high school science and Algebra I. Suggested prerequisite: completion of or concurrent enrollment in a second year of math. This course is recommended for students in Grade 10, 11, or 12.	
(b)	**Introduction.**	
(1)	Chemistry. In Chemistry, 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 characteristics of matter, use of the Periodic Table, development of atomic theory and chemical bonding, chemical stoichiometry, gas laws, solution chemistry, thermochemistry, and nuclear chemistry. Students will investigate how chemistry is an integral part of our daily lives.	
(2)	Nature of Science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that cannot be addressed by science ~~are not scientifically testable~~.	Introduction subcommittee met and of the four options presented, the chemistry committee preferred this option.
(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.	
(4)	Science and social ethics. Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods and ethical and social decisions that involve the application of scientific information.	
(5)	Scientific systems. A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.	
(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 (~~M~~SDS); and	Change in terminology by OSHA/GHS
(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;	Include scientific law in next revision
(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;	Some equipment not available in all school districts but if changed districts might not buy when it is needed. Duplicate – in 1A and it's not glassware.
(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~~;	The first deletion was to maintain continuity with all statements starting with a verb. The second deletion was already addressed by the KS. These changes were supported by the vertical alignment committee.
(B)	communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;	Some committees removed news reports but our committee felt that the KS implies that students will look at the information and decide if it is factual. News reports are supported by introduction statement 4 (b4).
(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)	~~research~~ investigate and describe the history of chemistry and contributions of scientists.	Deleted to limit the scope but investigate still promotes critical thinking, scientific reasoning, and problem solving.
(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;	Survey data indicates ambiguity regarding extensive and intensive properties. Clarification was added to help differentiate between the physical properties referenced in 4A.
(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)	use the Periodic Table to identify and explain the properties of chemical families, including alkali metals, alkaline earth metals, halogens, noble gases, and transition metals; and	
(C)	use the Periodic Table to identify and explain periodic trends, including atomic ~~and ionic~~ radii, electronegativity, and ionization energy.	Not in CCRS and beyond the scope of academic chemistry and more time can be spent for mastery of other trends.
(6)	**Science concepts. The student knows and understands the historical development of atomic theory. The student is expected to:**	
(A)	describe ~~understand~~ 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;	Clarify: Understand isn't assessable verb
(B)	~~understand~~ describe ~~the electromagnetic spectrum~~ ~~and~~ the mathematical relationships between energy, frequency, and wavelength of light using the electromagnetic spectrum;	Clarification: rephrasing emphasizes the relationships within the EM spectrum involved in atomic theory. Survey data indicated a desire for deletion of this SE as it was originally written.
(C)	~~calculate the wavelength, frequency, and energy of light using Planck's constant and the speed of light;~~	Deletion: limits the scope; the calculations are not necessary to understand the relationships. Survey supports deletion of this SE
(D)	use isotopic composition to calculate average atomic mass of an element; and	
(E)	express the arrangement of electrons in atoms through electron configurations and Lewis valence electron dot structures.	Survey data was mixed. Some indicated a desire for partial deletion of electron configuration, deletion of the entire SE, or keep as is. This stayed as it is fundamental for valence electrons and the properties of elements and how they bond.

(7)	**Science concepts. The student knows how atoms form ionic, covalent, and metallic~~, and covalent~~ bonds. The student is expected to:**	Changed order to make it consistent with order of SE's.
(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 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;	
(D)	describe ~~the nature of~~ metallic bonding and ~~apply the theory to~~ explain metallic properties such as thermal and electrical conductivity, malleability, and ductility; and	Limits the scope with more direct language.
(E)	~~predict~~ classify molecular structure for molecules with linear, trigonal planar, or tetrahedral electron pair geometries using Valence Shell Electron Pair Repulsion (VSEPR) theory.	MV: some think this SE should remain as it was The committee felt that the SE was important to have students understand that compounds are 3D in structure not 2D. Survey results indicated that this SE was beyond the scope of academic chemistry. Predict was modified as a time issue.
(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;	MV: some think the entire SE should be cut Beyond the Scope: calculating ions is beyond the scope of academic chemistry.
(C)	calculate percent composition and relate it to empirical and molecular formulas;	Limits the scope and calculating empirical and molecular formulas are beyond the scope the academic chemistry. Survey data supported removal of empirical and molecular calculations.
(D)	use the law of conservation of mass to write and balance chemical equations; ~~and~~	
(E)	perform stoichiometric calculations, including determination of mass and gas volume relationships between reactants and products, ~~calculation of limiting reagents~~, and percent yield~~.~~; and	Merged 9B Beyond the Scope: calculation of limiting reagent is beyond the scope of academic chemistry.

(F)	describe the concept of limiting reagents in a balanced chemical equation.	Changing the verb from 8E to limit the scope and streamline timing while retaining the concept of limiting reagent. Technical edit: to be consistent change reagent to reactant
(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)	~~perform stoichiometric calculations, including determination of mass and volume relationships between reactants and products for reactions involving gases~~;	Merged with 8E
(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:**	
(A)	describe the unique role of water in ~~chemical and biological systems~~ solutions;	The SE is broader in scope than the KS
(B)	~~develop and use~~ Apply the general rules regarding solubility through investigations with aqueous solutions;	MV – some think it the SE should be cut completely in academic chemistry. The clarification limits the scope of the SE from synthesis to application.
(C)	calculate the concentration of solutions in units of molarity;	
(D)	use molarity to calculate the dilutions of solutions;	
(E)	distinguish ~~between~~ among types of solutions such as electrolytes and nonelectrolytes, ~~and~~ unsaturated, saturated, and supersaturated solutions, and strong and weak acids and bases;	Technical edit Merged from 10J
(F)	investigate factors that influence 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;	Technical edit for consistency with 10H
(H)	~~understand and~~ 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; and	Understand is too broad in scope. Oxidation-reduction reactions is too broad a term. Providing illustrative examples narrows the scope of the SE.

		Acid-base and precipitation reactions are examples of double replacement reactions. Survey data indicated that modifications were needed.
(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~~.	Merged strong and weak acids and bases into 10E –to limit the scope the committee found the SE to be nonessential and merged into the compatible SE 10E. Survey data supported the deletion of this TEK.
(11)	**Science concepts. The student understands the energy changes that occur in chemical reactions. The student is expected to:**	Not overlapped in physics.
(A)	describe ~~understand~~ energy and its forms, including kinetic, potential, chemical, and thermal energies;	Verb change from understand to describe for clarification of scope and ability to assess. Currently understand is a VERY broad term, describe will reduce the scope for teachers.
(B)	describe ~~understand~~ the law of conservation of energy and the processes of heat transfer using calorimetry;	Verb change from understand to describe for clarification of scope and ability to assess. Currently understand is a very broad term, describe will reduce the scope for teachers. Merge 11E to 11B to reduce calculation scope
(C)	classify reactions as exothermic or endothermic and represent energy changes that occur in chemical reactions ~~use~~ using thermochemical equations or graphical analysis ~~calculate energy changes that occur in chemical reactions and classify reactions as exothermic or endothermic~~; and	Removing calculate from the SE allows teachers to decide how they want to represent energy changes, either by calculating and/or by using graphical analysis to limit the scope. Survey data supported a modified version of this standard.
(D)	perform calculations involving heat, mass, temperature change, and specific heat~~; and~~.	
(E)	~~use calorimetry to calculate the heat of a chemical process.~~	Merge 11E to 11B to reduce calculation scope Survey strongly supports deletion of this SE

(12)	**Science concepts. The student understands the basic processes of nuclear chemistry. The student is expected to:**	This SE was left in to support introduction statements 1, 4 and 5. Not overlapped in physics Survey data strongly suggests deletion as it was originally worded.
(A)	describe the characteristics of alpha, beta, and gamma ~~radiation~~ radioactive decay processes using of balanced nuclear equations; and~~;~~	MV: some think to cut B (prior to move) completely and only keep A (in original form) and C.
(B)	~~describe radioactive decay process in terms of balanced nuclear equations; and~~	Merged: To make it clear that only alpha, beta and gamma only need to be discussed to match CCRS K1
(C)	compare fission and fusion reactions.	

§112.39. Physics, Beginning with School Year 2010-2011.

	TEKS with edits	Committee Comments
(a)	**General requirements.** Students shall be awarded one credit for successful completion of this course. Algebra I is suggested as a prerequisite or co-requisite. This course is recommended for students in Grade 9, 10, 11, or 12.	
(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.	Streamlining committee has reviewed the introduction and feels like no changes are necessary. This decision was supported by the survey results.
(2)	Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.	
(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.	
(4)	Science and social ethics. Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods and ethical and social decisions that involve the application of scientific information.	
(5)	Scientific systems. A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.	
(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:**	Streamlining committee has reviewed (c)(1) and feels like no changes are necessary. This decision was supported by the survey results.

(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;	If limitations of science are not part of the definition of science in subsection (b)2 and are explained later on, the phrase about limitation does not need to be included in this SE
(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;~~	Theories are defined both in 2(c) and 2(b) so we will delete the one in 2(b) because it is not as clear a definition and is redundant.
(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;~~	Not necessary to define and limit how theories can change.
(D)	~~distinguish between scientific hypotheses and scientific theories;~~	Duplicated with 2(B) and (C)
(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, and identifying ~~and quantify~~ causes and effects of uncertainties in measured data;	Moved up "identify…" from 2(I) because it completes the experimental process. Deleted "quantify" uncertainty because it is an advanced physics skill
(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;~~	Due to economic restraints in educational funding in some districts, we felt it necessary to streamline the equipment list. These basic pieces of remaining equipment on this list can adequately be used to teach all areas of physics without dictating methodology. Some equipment was moved from 2(F) to 2(G). These changes were supported by the survey results.

(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, tuning forks, hand-held visual spectroscopes, discharge tubes with power supply (H, He, Ne, Ar), electromagnetic spectrum charts, laser pointers, micrometer, caliper, ~~radiation monitor,~~ computer, data acquisition probes, scientific calculators, graphing technology, ~~ballistic pendulum,~~ electrostatics kits, electroscope, inclined plane, optics bench, optics kit, polarized film, prisms, pulley with table clamp, motion detectors, photogates friction blocks, ballistic carts or equivalent, resonance tube, ~~ring stand screen, four inch ring,~~ stroboscope, ~~graduated cylinders, and ticker timer;~~ resistors, copper wire, switches, and iron filings;	Motion detectors and photogates is mentioned in 4(A) and therefore should be in the supply list These changes were supported by the survey results.
(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;~~	Merged to 2(E)
(J)	Organize, ~~and~~ evaluate, ~~data~~ and make inferences from data, including the use of tables, charts, and graphs;	Clarification
(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.	Manipulating physical quantities from lab data is an advanced level physics skill. However, manipulating relationships symbolically is appropriate, which is why we moved the term “manipulate” to 3(F).
(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~~;	Clarification These changes were supported by the survey results.
(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;~~	Duplicate of 3(B) and not needed. These changes were supported by the survey results.
(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, manipulate, 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.	The term "manipulate" came from 2(L). Mathematical problem solving shouldn't be limited to two specific examples. Graphical vector addition has moved to 4(C).
(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 investigations using the use of real-time technology such as motion detectors or photogates;	Using motion detectors and photogates are two examples of investigations.
(B)	describe and analyze motion in one dimension using equations with the concepts of distance, displacement, speed, average velocity, instantaneous velocity, frames of reference and acceleration;	"Frames of reference" merged from 4(F)
(C)	analyze and describe accelerated motion in two dimensions using equations, including graphical vector addition, projectile and circular examples; and	Graphical vector addition moved from 3(F) to streamline 2D motion. "Using equations" is not needed. These changes were supported by the survey results.
(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 using free-body force diagrams;.	Clarify and merged SE 4(D) and 4(E)
(E)	develop and interpret free-body force diagrams; and	Merged to 4(D)
(F)	identify and describe motion relative to different frames of reference.	Merged to 4(B) These changes were supported by the survey results.
(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;	Historical development is redundant with 3(D) These changes were supported by the survey results.
(B)	describe and calculate how the magnitude of the gravitational force between two objects depends on their masses and the distance between their centers;	
(C)	describe and calculate how the magnitude of the electrical force between two objects depends on their charges and the distance between them their centers;	Clarification to be consistent with 5(B)
(D)	identify and describe examples of electric and magnetic forces and fields in everyday life such as generators, motors, and transformers;	Merged with 5(G) These changes were supported by the survey results.

(E)	characterize materials as conductors or insulators based on their electric~~al~~ properties; and	Consistency
(F)	~~design, construct,~~ investigate and calculate ~~in terms of~~ current through, potential difference across, resistance of, and power used by electric circuit elements connected in both series and parallel combinations~~;~~.	Investigate doesn't dictate the methodology of instruction and also includes design and construct.
(G)	~~investigate and describe the relationship between electric and magnetic fields in applications such as generators, motors, and transformers; and~~	Merged to 5(D). These changes were supported by the survey results.
(H)	~~describe evidence for and effects of the strong and weak nuclear forces in nature.~~	Duplicate of 5(A) These changes were supported by the survey results.
(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:**	Chemistry and Physics streamlining committees met and determined there is no overlap in SEs.
(A)	investigate and calculate quantities using the work-energy theorem in various situations;	No changes were supported by the survey results.
(B)	investigate examples of kinetic and potential energy and their transformations;	No changes were supported by the survey results.
(C)	calculate the mechanical energy of, power generated within, impulse applied to, and momentum of a physical system;	No changes were supported by the survey results.
(D)	demonstrate and apply the laws of conservation of energy and conservation of momentum in one dimension; and	No changes were supported by the survey results.
(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;~~	Duplication of chemistry standards 11(A)(D)(E) Duplication of 6(G) These changes were supported by the survey results.
(F)	~~contrast and give examples of different processes of thermal energy transfer, including conduction, convection, and radiation; and~~	Merged to 6(G) These changes were supported by the survey results.
(G)	~~analyze and~~ explain everyday examples that illustrate the laws of thermodynamics~~, including the law of conservation of energy and the law of entropy~~ and the processes of thermal energy transfer.	Merged from 6(F) Streamlined content and met the needs expressed in the survey.

(7)	**Science concepts. The student knows the characteristics and behavior of waves. The student is expected to:**	Chemistry and Physics streamlining committees met and determined there is no overlap in SEs.
(A)	examine and describe oscillatory motion and wave propagation in various types of media;	
(B)	investigate and analyze characteristics of waves, including velocity, frequency, amplitude, and wavelength, and calculate using the relationship between wavespeed, frequency, and wavelength;	
(C)	compare characteristics and behaviors of transverse waves, including electromagnetic waves and the electromagnetic spectrum, and characteristics and behaviors of longitudinal waves, including sound waves;	
(D)	investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, and the Doppler effect; and	
(E)	describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens~~; and~~.	
(F)	~~describe the role of wave characteristics and behaviors in medical and industrial applications.~~	Redundant with 3(D) and (E) These changes were supported by the survey results.
(8)	**Science concepts. The student knows simple examples of atomic, nuclear, and quantum phenomena. The student is expected to:**	Chemistry and Physics streamlining committees met and determined there is no overlap in SEs.
(A)	describe the photoelectric effect and the dual nature of light;	
(B)	compare and explain the emission spectra produced by various atoms;	
(C)	describe the significance of mass-energy equivalence; and ~~apply it in explanations of phenomena such as nuclear stability, fission, and fusion; and~~	Application of explanation of mass-energy phenomena are an advanced level physics topic Merged to 8(D) These changes were supported by the survey results.
(D)	give examples of applications of atomic and nuclear phenomena using the standard model such as nuclear stability, fission, and fusion, radiation therapy, diagnostic imaging, and nuclear power and examples of applications of quantum phenomena ~~such as digital cameras~~.	"Using the standard model" is a clarification Merged from 8(C) "Nuclear stability, fission and fusion" more developmental appropriate for this SE. Digital cameras - not needed These changes were supported by the survey results.