2021 Introduction	2017 Introduction
(1) Integrated Physics and Chemistry. In Integrated Physics and Chemistry, students conduct laboratory and field investigations, use engineering practices, use scientific practices 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. By the end of Grade 12, students are expected to gain sufficient knowledge of the scientific and engineering practices across the disciplines of science to make informed decisions using critical thinking and scientific problem solving. **(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 currently scientifically testable. **(3)** Scientific hypotheses and theories. Students are expected to know that **(A)** hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and **(B)** 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. **(4)** Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without	***(1)*** *Integrated Physics and Chemistry. In Integrated Physics and Chemistry, students conduct laboratory and field investigations, use scientific practices 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 are not currently scientifically testable.* ***(3)*** *Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific practices 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.* ***(6)*** *Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.*

2021 Introduction (continued)	2017 Introduction (continued)
making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified. **(A)** Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models. **(B)** Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models. **(5)** Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. 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). **(6)** Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. 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, while models allow for boundary specification and provide a tool for understanding the ideas presented. 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. **(7)** Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.	

2021	2017
Scientific and Engineering Practices	***Scientific Processes***
(1) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:	***(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) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;	*NEW*
(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;;	*(2)(B) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting equipment and technology*
(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency approved safety standards;	*(1)(A) demonstrate safe practices during laboratory and field investigations, including the appropriate use of safety showers, eyewash fountains, safety goggles or chemical splash goggles, as appropriate, and fire extinguishers; and*
(D) use appropriate tools such as data-collecting probes, software applications, the internet, standard laboratory glassware, metric rulers, meter sticks, spring scales, multimeters, Gauss meters, wires, batteries, light bulbs, switches, magnets, electronic balances, mass sets, Celsius thermometers, hot plates, an adequate supply of consumable chemicals, lab notebooks or journals, timing devices, models, and diagrams;	*NEW*
(E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence;	*(2)(C) collect data and make measurements with accuracy and precision*
(F) organize quantitative and qualitative data using labeled drawings and diagrams, graphic organizers, charts, tables, and graphs;	*(2)(D) organize, analyze, evaluate, make inferences, and predict trends from data; and*
(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and	*NEW*
(H) distinguish among scientific hypotheses, theories, and laws	*NEW*
	REMOVED *(1)(B) know specific hazards of chemical substances such as flammability, corrosiveness, and radioactivity as summarized on the Safety Data Sheets (SDS); and* *(1)(C) demonstrate an understanding of the use and conservation of resources and the proper disposal of recycling materials.*

2021	2017
(2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:	***(2) Scientific processes. The student uses scientific practices during laboratory and field investigations. The student is expected to:***
(A) identify advantages and limitations of models such as their size, scale, properties, and materials;	*NEW*
(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;	*(2)(D) organize, analyze, evaluate, make inferences, and predict trends from data; and*
(C) use mathematical calculations to assess quantitative relationships in data; and	*NEW*
(D) evaluate experimental and engineering designs.	*NEW*
	REMOVED *(2)(A) know the definition of science and understand that is has limitations, as specified in subsection (b)(2) of this section;* *(3)(C) draw inferences based on data related to promotional materials for products and services;*
(3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:	***(3) Scientific processes. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions. The student is expected to:***
(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;	*NEW*
(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and	*(2)(E) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphs, journals, summaries, oral reports, and technology based reports.*
(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.	*NEW*
(4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to:	**NEW**
(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;	(3)(A) analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;

2021	*2017*
(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content; and	*(3)(D) evaluate the impact of research on scientific thought, society, and the environment;* *(3)(F) research and describe the history of physics and chemistry and contributions of scientists.*
(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers.	*(3)(E) describe connections between physics and chemistry and future careers; and*
	REMOVED *(3)(B) communicate and apply scientific information extracted from various sources such as current events, published journal articles, and marketing materials;* *(3)(C) draw inferences based on data related to promotional materials for products and services;*
Science Concepts	***Science Concepts***
(5) Science concepts. The student knows the relationship between force and motion in everyday life. The student is expected to:	***(4) Science concepts. The student knows concepts of force and motion evident in everyday life. The student is expected to***
(A) investigate, analyze, and model motion in terms of position, velocity, acceleration, and time using tables, graphs, and mathematical relationships;	*(4)(A) describe and calculate an object's motion in terms of position, displacement, speed, and acceleration* *(4)(B) measure and graph distance and speed as function of time;*
(B) analyze data to explain the relationship between mass and acceleration in terms of the net force on an object in one dimension using force diagrams, tables, and graphs;	*NEW*
(C) apply the concepts of momentum and impulse to design, evaluate, and refine a device to minimize the net force on objects during collisions such as those that occur during vehicular accidents, sports activities, or the dropping of personal electronic devices;	*(4)(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,* *(4)(D) describe and calculate the relationship between force, mass, and acceleration using equipment such as dynamic carts, moving toys, vehicles, and falling objects* *(4)(E) explain the concept of conservation of momentum using action and reaction forces*
(D) describe the nature of the four fundamental forces: gravitation; electromagnetic; the strong and weak nuclear forces, including fission and fusion; and mass-energy equivalency; and	*(4)(F) describe the gravitational attraction between objects of different masses at different distances; and* *(4)(G) examine electrical force as a universal force between any two charged objects.* *(7)(E) describe types of nuclear reactions such as fission and fusion and their roles in applications such as medicine and energy production; and*

2021	2017
(E) construct and communicate an explanation based on evidence for how changes in mass, charge, and distance affect the strength of gravitational and electrical forces between two objects.	*(4)(G) examine electrical force as a universal force between any two charged objects.*
(6) Science concepts. The student knows the impact of energy transfer and energy conservation in everyday life. The student is expected to:	***(7) 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) design and construct series and parallel circuits that model real-world circuits such as in-home wiring, automobile wiring, and simple electrical devices to evaluate the transfer of electrical energy;	*(5)(F) evaluate the transfer of electrical energy in series and parallel circuits and conductive materials;*
(B) design, evaluate, and refine a device that generates electrical energy through the interaction of electric charges and magnetic fields;	*(5)(C) demonstrate that moving electric charges produce magnetic forces and moving*
(C) plan and conduct an investigation to provide evidence that energy is conserved within a closed system;	*(5)(D) investigate the law of conservation of energy;*
(D) investigate and demonstrate the movement of thermal energy through solids, liquids, and gases by convection, conduction, and radiation such as weather, living, and mechanical systems;	*(5)(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;*
(E) plan and conduct an investigation to evaluate the transfer of energy or information through different materials by different types of waves such as wireless signals, ultraviolet radiation, and microwaves;	*(5)(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 one another, and are absorbed by materials;*
(F) construct and communicate an evidence-based explanation for how wave interference, reflection, and refraction are used in technology such as medicine, communication, and scientific research; and	
(G) evaluate evidence from multiple sources to critique the advantages and disadvantages of various renewable and nonrenewable energy sources and their impact on society and the environment.	*(5)(H) analyze energy transformations of renewable and nonrenewable resources; and* *(5)(I) critique the advantages and disadvantages of various energy sources and their impact on society and the environment.*
	REMOVED *(5)(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* *(5)(B) recognize and demonstrate common forms of potential energy, including gravitational, elastic, and chemical, such as a ball on an inclined plane, springs, and batteries;*

2021	2017
(7) Science concepts. The student knows that relationships exist between the structure and properties of matter. The student is expected to:	***(6) Science concepts. The student knows that relationships exist between the structure and properties of matter. The student is expected to:***
(A) model basic atomic structure and relate an element's atomic structure to its bonding, reactivity, and placement on the Periodic Table;	*(6)(A) examine differences in physical properties of solids, liquids, and gases as explained by the arrangement and motion of atoms or molecules;* *(6)(B) relate chemical properties of substances to the arrangement of their atoms;*
(B) use patterns within the Periodic Table to predict the relative physical and chemical properties of elements;	*6)(D) relate the placement of an element on the Periodic Table to its physical and chemical behavior, including bonding and classification;*
(C) explain how physical and chemical properties of substances are related to their usage in everyday life such as in sunscreen, cookware, industrial applications, and fuels;	*6)(C) analyze physical and chemical properties of elements and compounds such as color, density, viscosity, buoyancy, boiling point, freezing point, conductivity, and reactivity;*
(D) explain how electrons can transition from a high energy level to a low energy state, emitting photons at different frequencies for different energy transitions;	*NEW*
(E) explain how atomic energy levels and emission spectra present evidence for the wave particle duality; and	*NEW*
(F) plan and conduct an investigation to provide evidence that the rate of reaction or dissolving is affected by multiple factors such as particle size, stirring, temperature, and concentration.	*NEW*
	REMOVED *(6)(E) relate the structure of water to its function as a solvent; and* *(6)(F) investigate the properties of water solutions and factors affecting solid solubility, including nature of solute, temperature, and concentration.*
(8) Science concepts. The student knows that changes in matter affect everyday life. The student is expected to:	***(7) Science concepts. The student knows that changes in matter affect everyday life. The student is expected to:***
(A) investigate how changes in properties are indicative of chemical reactions such as hydrochloric acid with a metal, oxidation of metal, combustion, and neutralizing an acid with a base;	*(7)(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;*
(B) develop and use models to balance chemical equations and support the claim that atoms, and therefore mass, are conserved during a chemical reaction;	*(7)(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;*

2021	2017
(C) research and communicate the uses, advantages, and disadvantages of nuclear reactions in current technologies; and	*(7)(E) describe types of nuclear reactions such as fission and fusion and their roles in applications such as medicine and energy production; and*
(D) construct and communicate an evidence-based explanation of the environmental impact of the end-products of chemical reactions such as those that may result in degradation of water, soil, air quality, and global climate change.	*(7)(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*
	REMOVED *(7)(A) investigate changes of state as it relates to the arrangement of particles of matter and energy transfer;* *(7)(D) classify energy changes that accompany chemical reactions such as those occurring in heat packs, cold packs, and glow sticks as exothermic or endothermic reactions;*