Grade 11 Threshold Performance Level Descriptors Physical Science			
DCI	**Level 2**	**Level 3**	**Level 4**
PS1: Matter and Its Interactions	***Students should be able to demonstrate knowledge:***		
	• of subatomic particles, their interactions, and the involvement of energy in these interactions • and understanding of how collisions between molecules affect reaction rates • that some reactions are reversible • that atoms are conserved during reactions • that nuclear processes involve energy	• of atomic properties and patterns through the use of the periodic table, as well as different types of particle interactions and the energy involved • of the factors that affect reaction rates and equilibrium systems • of the energy involved in the rearranging of atoms and molecules • of the different types of reactions and how to make predictions about them • that energy and matter is conserved in nuclear processes	• of varying atomic structures • of how the periodic table models the patterns of the properties and electron structure of the elements • of how particle interactions affect bulk properties of substances • of how collisions lead to changes in the sum of all the bond energies • of how atom conservation and chemical properties can be used to make predictions on chemical reactions • of multiple nuclear processes
PS2: Motion and Stability: Forces and Interactions	***Students should be able to demonstrate knowledge:***		
	• of quantified acceleration and momentum • of types of fields and attractive/repulsive forces of gravitational and/or electric fields • that electrical energy can be stored or transmitted	• (quantified knowledge) of factors that affect Newton's 2nd Law, single object momentum systems, and conservation of momentum • of how interactions happen at a distance due to fields • of electrical interactions at the atomic level • of the difference between magnetic and electric fields **OR** • (quantified knowledge) of Coulomb's law and Newton's universal law of gravitation • of how electrical energy can be stored in a battery or transmitted by electric currents	• (quantified knowledge) of outside interactions that affect the momentum and acceleration of a single or multiple object system • of how to predict changes in electrical and gravitational forces • of how to describe fields as force and energy fields and predict the effect of electrical and/or magnetic fields due to interactions between the two fields

Grade 11 Threshold Performance Level Descriptors Physical Science			
DCI	**Level 2**	**Level 3**	**Level 4**
PS3: Energy	***Students should be able to demonstrate knowledge:***		
	• of how different types of energy can be transferred • of systems in which energy is conserved and how the availability of energy restricts what is possible in a closed system • of the nature of the relationship between two objects interacting in a field using the energy prospective • of how energy can be converted to different forms	• of how energy manifests itself at the microscopic and macroscopic scale and how energy transfers in a system • (quantified knowledge) of energy transfers in and out of a system **OR** • of possible and impossible events based on energy availability, and define stable states • of how the distance between two objects affects the energy of a field • of how energy can be converted to less useful forms • of how solar energy can be captured and used for other processes, such as photosynthesis	• of the amount of various types of energy in a given situation and how microscopic changes affect macroscopic manifestations of energy • of how to evaluate changes in the physical amounts in a system using the conservation of energy • of how to predict changes in energy in a field based on the position and nature of objects • of the importance of energy conservation and efficiency
PS4: Waves and Their Applications in Technologies for Information Transfer	***Students should be able to demonstrate knowledge:***		
	• of how a wave travels through a medium, understanding of examples of digitized information, and qualitative understanding of superposition principle • of the wave and particle models of electromagnetic radiation, the absorption of electromagnetic radiation, and the relationship between frequency and energy of light • of everyday experiences that involve waves and how wave signals are produced, transmitted, and captured	• (quantified knowledge) of the relationship among frequency, wavelength, and speed in a real world phenomenon **OR** • of the advantages and disadvantages of digitizing information • of the effect of absorption of electromagnetic waves, features of electromagnetic radiation that can be explained by either the wave or particle model, and the nature of photoelectric materials • of technologies used to produce, transmit, and/or capture signals and technologies used to store and interpret information	• of waves in various media and how combining waves of different frequencies can make a wide variety of patterns and thereby encode and transmit information • of the difference between the wave- and particle-like behavior of electromagnetic radiation and how either the wave or particle model can be used to explain how an electron is emitted and how it can damage living cells • of how technology can be used to store and/or interpret information

Grade 11 Threshold Performance Level Descriptors Life Science			
DCI	**Level 2**	**Level 3**	**Level 4**
LS1: From Molecules to Organisms: Structures and Processes	***Students should be able to demonstrate knowledge:***		
	• of how multicellular organisms utilize feedback mechanisms and have specialized cells that are organized and function according to the proteins coded by the DNA • of the role of cellular division (mitosis) in creating genetically identical cells that differentiate into complex multicellular organisms • of photosynthesis and cellular respiration as the chemical processes of life that produce or utilize carbon based molecules that are recombined into different products of living systems	• of how positive and negative feedback mechanisms are beneficial to multicellular organisms, which have systems of specialized cells that perform essential life functions expressed through proteins coded for by genes • of how mitosis and differentiation produce and maintain complex organisms from a single cell • of the chemistry behind photosynthesis, how cellular respiration uses energy to maintain the organism, and how the products of these processes are used to build larger molecules	• of how changing genes (mutation) can lead to functional changes of a protein and how positive and/or negative feedback helps maintain the equilibrium of an organism • of how genetic material from two variants of each chromosome pair is maintained as a single cell (fertilized egg) grows to a multicellular organism • of the interdependence of photosynthesis and cellular respiration and their role in the growth and maintenance of living systems
LS2: Ecosystems: Interactions, Energy, and Dynamics	***Students should be able to demonstrate knowledge:***		
	• of both living and non-living factors that contribute to the carrying capacity of the ecosystem • of how food webs often have photosynthetic producers at the lowest level, how a small amount of matter and energy will transfer upward in the food web reducing the amount of organisms that can exist at higher levels, and how this relates to the carbon cycle • of how ecosystems have interactions that keep the population numbers stable, and ecosystems are resilient to modest changes, but humans can disrupt ecosystems and species survival • of how group behavior has evolved to increase individual and group survival	• of how carrying capacity is affected by challenges and/or availability of resources • of how photosynthesis and cellular respiration are connected and use carbon in maintaining life processes, that the matter and energy of a food web are used and restructured by the organisms in the food web, and that a small amount is used by the next levels of the food web • of complex ecosystem interactions and their effects on population size including biological and physical disturbances, extreme fluctuations, and the ways human activity can have an effect on an ecosystem • of how group behaviors can increase the chances of survival for individuals and their genetic relatives	• of how carrying capacity affects the population size of a given species within an ecosystem • of how carbon and matter are used in the maintenance of life processes (including photosynthesis and both anaerobic and aerobic respiration) through the food web, including how carbon cycles through earth's spheres • of how changes to populations and environments caused by human interactions and other physical events within ecosystems can result in changes that affect both the organisms and the environment • of how changes to the group or conditions can affect the survival of individuals and their genetic relatives

Grade 11 Threshold Performance Level Descriptors Life Science			
DCI	**Level 2**	**Level 3**	**Level 4**
LS3: Heredity: Inheritance and Variation of Traits	***Students should be able to demonstrate knowledge:***		
	• of how all cells have the same DNA containing genes that are the organisms' characteristics, but not all DNA codes for protein • of the processes within meiosis, errors that can occur during DNA replication, and mutations due to environmental factors that can create genetic diversity, which may be passed to future generations	• that chromosomes contain genes that code for proteins and regions that do not code for proteins, and that different cells express different genes • that while the process of DNA replication is tightly regulated and highly accurate, errors still occur, and combined with mutations due to environmental factors, DNA replication can create genetic diversity that may affect survivability and the transmission of traits to future generations	• of the mechanisms of gene regulation and different possible functions of segments of non-protein coding DNA • of the mechanisms within meiosis that create genetic diversity as well as the effects of environmental factors on DNA replication and the impact of the changes to DNA on genetic diversity within populations
LS4: Biological Evolution: Unity and Diversity	***Students should be able to demonstrate knowledge:***		
	• of the different types of evidence of evolution • of how natural selection allows inheritable advantageous traits to become more common if they increase chances of survival within populations • that natural selection selects for inheritable traits that provide a survival advantage for a particular environment • that changes to the environment may cause the selection of different traits leading to changes in the population called adaptation • that the frequency of traits depends on natural selection forces that can change with a changing environment • of how biodiversity increases or decreases and how humans need resources and biodiversity but are having adverse effects on biodiversity	• of how different sources of evidence for evolution can support each other • of how gene expression and genetic variation in the individual leads to differences in performance of the individuals in a population, and positively selected traits are more common in a population because they increase survival • that evolution occurs when there is genetic variation, competition, and selective reproduction of organisms with desirable genetic traits • that organisms with desirable traits will become more common, but as the environment changes, different traits may provide the selective advantages • that some populations may increase while others may go extinct • of specific results of human activities that affect the environment and biodiversity and reasons why preservation of biodiversity is desirable	• of how DNA sequences, amino acid sequences, and anatomical and embryological evidence support that evolution has occurred • of how natural selection leads to different levels of performance of the individual • that factors affecting natural selection work together creating changes in the diversity within populations and ecosystems. Changing environments cause changes in selection pressures that result in further adaptation or extinction • of ways that humans can maintain or increase biodiversity while meeting the needs of humanity and why this is beneficial to life on Earth

Grade 11 Threshold Performance Level Descriptors Earth and Space Science			
DCI	**Level 2**	**Level 3**	**Level 4**
	Students should be able to demonstrate knowledge:		
ESS1: Earth's Place in the Universe	• of the Big Bang, which allowed for the creation of galaxies and stars, where many elements are created • of identifying properties of orbits, factors that affect the orbit, and how the orbit affects the stellar body • of plate tectonics and erosion which cause the destruction of early rock records on earth and that we have to rely on other objects in the solar system for information on Earth's formation	• that light spectra emitted from stars can give information about its life cycle, composition, and distance • of features of motion of orbital objects, what changes that motion, and the effects of changing the motion of the stellar body • of the fact that that while there is a range in the age of the rocks on Earth, the early rock history has been destroyed, and we rely on studying other stellar bodies to explain how the earth formed	• of the life cycle of stars and explain how the characteristics of a star can support the Big Bang Theory • of the laws explaining motions of orbiting objects, their changes, and the changes to the stellar bodies as a result of those changes • of why different areas of the Earth have rocks of different ages and the processes that are erasing the early rock history
	Students should be able to demonstrate knowledge:		
ESS2: Earth's Systems	• of how Earth has a series of interacting dynamic systems • that Earth's surface is in motion, and that motion can create physical features on the Earth's surface • of the properties of water that are essential to Earth's dynamics • of Earth's atmosphere and how it undergoes temperature changes • that dynamic and delicate feedbacks between the Earth's systems and biosphere exist	• of methods of investigation of Earth's dynamic systems and how the data can be used to describe the effects of these systems • that Earth's surface is in motion due to convection, creating physical features that have changed throughout history • of how the properties of water are essential to Earth's processes • of how Earth's atmosphere undergoes short-term and long-term temperature changes at the global scale due to changes in the biosphere, including human activities • of how dynamic and delicate feedbacks between the Earth's systems and biosphere cause a continual co-evolution of Earth's surface and the life that exists on it	• of Earth's dynamic systems in explaining the effects of these systems and the development of the currently accepted model of the structure of the planet • of the theory of plate tectonics allowing for the prediction of future plate movements and interpretations of Earth's geologic history • of how the properties of water can be used to explain Earth's processes • of why Earth's atmosphere undergoes short-term and long-term temperature changes at the global scale • of how positive and/or negative feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it

Grade 11 Threshold Performance Level Descriptors Earth and Space Science			
DCI	**Level 2**	**Level 3**	**Level 4**
	Students should be able to demonstrate knowledge:		
ESS3:	• that new technologies have associated costs, risks, and benefits • that natural hazards have shaped human history • that human activities can have both positive and negative impacts on biodiversity • of humans' abilities to use technology to model, predict, and mange current and future impacts	• that new technologies have associated costs, risks, and benefits at the economic, social, environmental, and/or geopolitical level • of how natural hazards and geological events have shaped human history through changes in the human population including through migration at the local, regional, and/or global scale • that human impacts on biodiversity can be mitigated by the development of new technologies and/or responsible resource management • of technologies that allow modeling, predicting, and managing of current and future impacts on oceans, the atmosphere, and the biosphere	• of new technologies in order to explain their associated costs, risks, and benefits at the economic, social, environmental, and/or geopolitical level • of how natural hazards affect human population and migration at the local, regional, and global scale • of new technologies and responsible resource management to predict their effects on biodiversity • to explain how humans' abilities to model, predict, and manage current and future impacts have increased alongside the magnitudes of human impacts

Grade 11 SEP Threshold Performance Level Descriptors			
SEP	**Level 2**	**Level 3**	**Level 4**
INVESTIGATING **Asking Questions and Defining Problems (AQDP):**	***Students should be able to:***		
A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world(s) works and which can be empirically tested. Engineering questions clarify problems to determine criteria for successful solutions and identify constraints to solve problems about the designed world. Both scientists and engineers also ask questions to clarify ideas. *Asking questions and defining problems in 9-12 progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.*	• ask relevant questions or define problems in different contexts, based on unexpected results, independent and dependent variables, models, theories, etc.	• ask relevant and testable questions that arise from careful observation of phenomena, unexpected results, or models or theories for the purpose of determining relationships, providing an explanation, or clarifying and refining a design	• analyze, evaluate, and/or revise questions that arise from careful observation of phenomena, unexpected results, or models or theories for the purpose of determining relationships, providing an explanation, or clarifying and refining a design
SENSEMAKING **Developing and Using Models (DUM):**	***Students should be able to:***		
A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations. Modeling in 9–12 progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).	• use a model to generate data that test the model's reliability and/or evaluates its merits and limitations	• develop simple models and revise different types of models that test and/or predict relationships among systems/phenomena based on the models' merits and limitations	• develop or revise complex models that test and/or predict relationships/phenomena based on the models' merits and limitations
(INVESTIGATING) **Planning and Carrying Out Investigations (PACI):**	***Students should be able to:***		
Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Their investigations are systematic and require clarifying what counts as data and identifying variables or parameters. Planning and carrying out investigations in 9-12 progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.	• identify ways to conduct an investigation (including making a directional hypothesis) or test a design solution through manipulating variables or acquiring data	• plan and/or conduct an investigation (including making a directional hypothesis) or test a design solution through manipulating variables or acquiring data	• revise and/or evaluate an investigation in which an independent variable is manipulated or an unsatisfactory performance is found

Grade 11 SEP Threshold Performance Level Descriptors			
SEP	**Level 2**	**Level 3**	**Level 4**
(SENSEMAKING) Analyzing and Interpreting Data (AID):	***Students should be able to:***		
Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis. Analyzing data in 9–12 progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.	• identify the appropriate statistics and/or data and/or their limitations when providing evidence for claims, design solutions, or solving problems	• apply and/or analyze data and statistics to identify or solve scientific and engineering problems or to make scientific claims	• evaluate the use of data and statistics and/or their limitations to solve problems, make claims, or design solutions
(INVESTIGATING) Using Mathematics and Computational Thinking (UMCT):	***Students should be able to:***		
In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; statistically analyzing data; and recognizing, expressing, and applying quantitative relationships. Mathematical and computational thinking in 9-12 progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.	• apply/use mathematical concepts to describe conclusions that may require deciding when to use qualitative vs quantitative data	• apply/use mathematical computational representations to see if a model is viable or decide if qualitative or quantitative data meet criteria for success	• through the use of evaluation of mathematical computations, create a model or justify the choice of qualitative vs quantitative data
(SENSEMAKING) Constructing Explanations (for science) and Designing Solutions (for engineering) (CEDS):	***Students should be able to:***		
The products of science are explanations and the products of engineering are solutions. Constructing explanations and designing solutions in 9–12 progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.	• identify and describe appropriate data and/or evidence for supporting claims, solving problems, constructing explanations, or designing solutions	• make or revise claims, explanations, or solutions by applying appropriate data and/or evidence	• evaluate, design, or construct claims, explanations, or solutions by applying appropriate data, evidence and/or scientific theories and laws

Grade 11 SEP Threshold Performance Level Descriptors			
SEP	**Level 2**	**Level 3**	**Level 4**
(CRITIQUING) Engaging in Argument from Evidence (EAE):	***Students should be able to:***		
Argumentation is the process by which explanations and solutions are reached. Engaging in argument from evidence in 9–12 progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.	• identify and/or describe the main points of an argument or claim that is based on scientific evidence	• evaluate and/or defend a claim or argument—or choose between competing arguments—related to currently accepted explanations or solutions	• construct and/or critique an argument or claim by using scientific evidence
(CRITIQUING) Obtaining, Evaluating, and Communicating Information (OECI):	***Students should be able to:***		
Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity. Obtaining, evaluating, and communicating information in 9–12 progresses to evaluating the validity and reliability of the claims, methods, and designs.	• read and compare sources of information to describe patterns in evidence and/or evidence for solving problems or answering scientific questions	• integrate information from multiple sources to gather valid and reliable evidence for solving problems or answering scientific questions	• evaluate information from multiple sources and determine the usefulness of evidence, ensuring it is valid and reliable, for solving problems or answering scientific questions