Earth/Space Science – (one semester)
High School
Standards, Supporting Skills, Assessments, and Resources

Indicator 1: Analyze the various structures and processes of the Earth system.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Comprehension)	**9-12.E.1.1. Students are able to explain how elements and compounds cycle between living and non-living systems.** • Diagram and describe the N, C, O and H_2O cycles. • Describe the importance of the N, C, O and H_2O cycles to life on this planet. Examples: water cycle including evaporation, cloud formation, condensation.	Water Cycle • Changes - lithosphere - hydrosphere - atmosphere of the earth • Geochemical cycles in the Earth System Explain changes occurring within the earth • Lithosphere • Hydrosphere • Atmosphere		

(Application)	**9-12.E.1.2. Students are able to describe how atmospheric chemistry may affect global climate.** **Examples**: Greenhouse Effect, ozone depletion, ocean's effects on weather	Investigate how interactions among Earth's crust, oceans, atmosphere, and organisms have resulted in the ongoing change of Earth System		
(Analysis)	**9-12.E.1.3. Students are able to assess how human activity has changed the land, ocean, and atmosphere of Earth.** **Examples**: forest cover, chemical usage, farming, urban sprawl, grazing	Changes in land, ocean and atmosphere • Human activity - Forest cover - Chemical usage		

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Rsources
(Comprehension)	**9-12.E.2.1. Students are able to recognize how Newtonian**	The origin of modern astronomy • motions of the solar system		

	mechanics can be applied to the study of the motions of the solar system. • Given a set of possible explanations of orbital motion (revolution), identify those that make use of gravitational forces and inertia.	- Newtonian mechanics		

Core High School Earth/Space Science
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • predict the effect of an interruption in a given cycles; • predict how human activity may change the land, ocean, and atmosphere of Earth.
Proficient	**High school students performing at the proficient level:** • explain how H_20, N, C, and O cycle between living and non-living systems; • recognize how Newtonian mechanics can be applied to the study of the motions of the solar system; • describe how various factors may affect global climate; • explain how human activity changes the land, ocean, and atmosphere of Earth.
Basic	**High school students performing at the basic level:** • given pictorial representations of the H_20 and C cycles, explain how elements and compounds move between living and nonliving systems; • identify the forces that cause motion in the solar system; • describe one factor that may affect global climate; • give an example of human activity that changes the land, ocean, or atmosphere of Earth.

Advanced High School Earth/Space Science
Standards, Supporting Skills, Assessments, and Resources

Indicator 1: Analyze the various structures and processes of the Earth system.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Application)	**9-12.E.1.1A. Students are able to explain how elements and compounds cycle between living and non-living systems.** • Diagram and describe the P, S, and Ca cycles.			
(Analysis)	**9-12.E.1.2A. Students are able to compare, quantitatively and qualitatively, methods used to determine geological time.** **Examples**: fossil record, radioactive decay, tree rings, geologic stratification, South Dakota geology Construct a geologic time scale over the past 4.8 billion years.	Compare characteristics of isotopes of the same element Describe the use of isotopic dating in determining the ages of fossils Analyze evidence found in fossil records		

Indicator 2: Analyze essential principles and ideas about the composition and structure of the universe.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Analysis)	**9-12.E.2.1A. Students are able to describe the evidence supporting the Big Bang theory.** • Describe the four fundamental forces. • Describe the organization of the solar system, the Milky Way galaxy, and the universe of galaxies. • Examine the changing model of the universe using historical experimental evidence.	Explore the position and motion of the solar system Examine the changing model of the universe using historical experimental evidence Identify the arrangement of bodies found within and outside the galaxy Explain the position and motion of the solar system in the universe Analyze and compare various scientific theories on how the universe was formed • Big Bang Theory Identify the arrangement of bodies found within and outside the galaxy		
(Analysis)	**9-12.E.2.2A. Students are able to describe the physical and nuclear dynamics involved in the formation, evolution, and death of a star.**	Determine the life stages of a star using H-R diagram Describe the physical and nuclear dynamics involved in the formation, evolution and death of a star		

	• Use the H-R diagram to determine the life stage of a star. • Discuss how gravitational forces and the products of nuclear fusion reactions affect the dynamics of a star.			
(Application)	**9-12.E.2.3A. Students are able to describe various ways data about the universe is collected.** • Describe how information is collected from star light. Examples: star's mass, chemistry, intrinsic brightness, distance, speed, direction, and eventual fate • Describe the use of instruments to collect data. Examples: optical,	Describe various ways data about the universe is collected • Rovers • Space probes • Refracting telescopes • Reflecting telescopes • Radio telescopes • Space telescopes • E-ray telescopes • Spectorscopes • Spectrometers Describe astronomical distance and time using • Parallax		

	radio, and x-ray telescopes, spectrometers, space probes, gamma ray detectors, remote sensing • Describe methods of measuring astronomical distance. Examples: parallax, light years, astronomical units	• Astronomical distances • Light years Describe how information is collected from star light • Star's mass • Chemistry' intrinsic brightness • Distance • Speed • Direction • Eventual		

Core High School Nature of Science
Standards, Supporting Skills, Assessments, and Resources

Indicator 1: Understand the nature and origin of scientific knowledge.

Bloom's Taxonomy Level	Standard	Supporting Skills	Resources	Assessment
(Evaluation)	**9-12.N.1.1. Students are able to evaluate a scientific discovery to determine and describe how societal, cultural, and personal beliefs influence scientific investigations and interpretations.** **Examples**: telescope, birth control pill, penicillin, electricity • Recognize scientific knowledge is not merely a set of static facts but is dynamic and affords the best current explanations. Examples: spontaneous generation, relativity, geologic time			

	• Discuss how progress in science can be affected by social issues.			
(Synthesis)	**9-12.N.1.2. Students are able to describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws.** • Research, communicate, and support a scientific argument. • Recognize and analyze alternative explanations and models. • Evaluate the scientific accuracy of information relevant to a specific issue (pseudo-science).	Differentiate in scientific investigations • Facts • Predictions • Theory • Law/principles Apply basic science process skills • Observing • Classifying • Measuring, communicating • Predicting • inferring		

Indicator 2: Apply the skills necessary to conduct scientific investigations.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Synthesis)	**9-12.N.2.1. Students are able to apply science process skills to design and conduct student investigations.** • Identify the questions and concepts to guide the development of hypotheses. • Analyze primary sources of information to guide the development of the procedure. • Select and use appropriate instruments to extend observations and measurements. • Revise explanations and models based on evidence and logic. • Use technology and mathematic skills to enhance investigations,	Identify questions and concepts to guide the development of hypotheses and or scientific investigations Select and use appropriate instruments to extend observations and measurements • Weather satellites • Navigation satellites • Landsat satellites • Global positioning systems • Very long baseline interferometry • Seismographs Understand technological design to withstand an earthquake force without the loss of property and lives • Buildings • Bridges Analyze evidence that support or refutes past or current scientific theories, hypotheses and or explanations about a specific topic		

	communicate results, and defend conclusions. Examples: Computer-based data collection Graphical analysis and representation Use appropriate technology to display data (i.e. spreadsheets, PowerPoint, web).	• Hypothesis or continental drift • Plate Tectonics theory Analyze how new discoveries may either modify existing theories or result in establishing a new paradigm Analyze how new knowledge and methods emerge from investigations and from public communication among scientist Identify questions and concepts to guide the development of hypotheses and of scientific investigations including the analysis of primary sources of information Formulate and revise scientific explanations and models		
(Application)	**9-12.N.2.2. Students are able to practice safe and effective laboratory techniques.** • Handle hazardous materials properly. • Use safety equipment correctly. • Practice emergency			

	procedure. • Wear appropriate attire. • Practice safe behaviors.			

Core High School Nature of Science
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • given a scientific discovery, evaluate how different societal, cultural, and personal beliefs influenced the investigation and its interpretation; • design and conduct an investigation using an alternative student- developed hypothesis.
Proficient	**High school students performing at the proficient level:** • given a scientific discovery narrative, determine and describe how societal, cultural, and personal beliefs influenced the investigation and its interpretation; • describe the role of observation and evidence in the development and modification of hypotheses, theories, and laws; then apply science process skills to design and conduct student investigations.
Basic	**High school students performing at the basic level:** • describe the role of observation in the development of hypotheses, theories, and laws and conduct student investigations; • given a scientific discovery narrative, identify the cultural and personal beliefs that influenced the investigation.

Core High School Physical Science
Standards, Supporting Skills, Assessments, and Resources

Indicator 1: Describe structures and properties of, and changes in, matter

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Analysis)	**9-12.P.1.1. Students are able to use the Periodic Table to determine the atomic structure of elements, valence number, family relationships, and regions (metals, nonmetals, and metalloids).** • Determine protons, neutrons, electrons, mass number, and atomic number from the Periodic Table. • Determine the number of valence electrons for elements in the main (s&p) blocks of the Periodic Table.			

	• Identify the relative metallic character of an element based on its location on the Periodic Table.			
(Comprehension)	**9-12.P.1.2. Students are able to describe ways that atoms combine.** • Name and write formulas for binary ionic and covalent compounds. Example: sodium chloride (NaCl), carbon dioxide (CO_2) • Compare the roles of electrons in covalent, ionic, and metallic bonding. • Discuss the special nature of carbon covalent bonds.			
(Application)	**9-12.P.1.3. Students are able to predict whether reactions will speed up or slow down as conditions**			

	change. **Examples**: temperature, concentration, surface area, and catalysts			
(Application)	**9-12.P.1.4. Students are able to balance chemical equations by applying the Law of Conservation of Matter.** • Trace number of particles in diagrams and pictures of balanced equations. Example: Write out an equation with symbols: $Mg + 2HCL \rightarrow MgCl_2 + 2H_2$			

(Comprehension)	**9-12.P.1.5. Students are able to distinguish among chemical, physical, and nuclear changes.** • Differentiate between physical and chemical properties used to describe matter. • Identify key indicators of chemical and physical changes. • Describe the effects of changing pressure, volume, or temperature upon gases. • Identify characteristics of a solution and factors that affect the rate of solution formation. • Explain the differences among nuclear, chemical, and physical			

	changes at the atomic level. Examples: solute, solvent, concentrated, dilute, saturated, unsaturated, supersaturated Factors affecting rate: agitation, heating, particle size, pictures of particles			

Indicator 2: Analyze forces, their forms, and their effects on motions.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Analysis)	**9-12.P.2.1. Students are able to apply concepts of distance and time to the quantitative relationships of motion using appropriate mathematical formulas, equations, and units.** • Evaluate speed, velocity, and			

	acceleration both qualitatively and quantitatively. Examples: Identify the sign (+,-, 0) of an object's acceleration based on velocity information. Predict whether an object speeds up, slows down, or maintains a constant speed based on the forces acting upon it. Calculate acceleration using the equation $A_{avg}=\Delta V/\Delta t$. • Given distance and time, calculate the velocity or speed of an object. • Create and interpret graphs of linear			

	motion. Example: Given a velocity-time or a distance-time graph with different slopes, determine the motion of an object. • Distinguish between velocity and acceleration as related to force.			
(Application)	**9-12.P.2.2. Students are able to predict motion of an object using Newton's Laws.** • Describe how inertia is related to Newton's First Law. • Explain the effect of balanced and unbalanced forces.			

	• Identify the forces at work on action/reaction pairs as distinguished from balanced forces. Examples: Draw a linear force diagram for the forces acting on an object in contact with another. Identify action/reaction pairs. • Explain how force, mass, and acceleration are related.			
(Application)	**9-12.P.2.3. Students are able to relate concepts of force, distance, and time to the quantitative**	Interpret wave phenomena using models of transverse and longitudinal		

	relationships of work, energy, and power. • Apply appropriate mathematical formulas and equations to concepts using appropriate units. Examples: Calculate power Given force, distance and time. Calculate work done on an object given force and distance.			

Indicator 3: Analyze interactions of energy and matter.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Application)	**9-12.P.3.1. Students are able to describe the relationships among potential energy, kinetic energy, and work as applied to the Law of Conservation of Energy.** • Describe how energy can be transferred and transformed to produce useful work. Examples: Diagram simple energy transfers, describing the objects and the forms of energy gained and lost. Use simple machines as an example of the transmission of energy. • Given the formulas, calculate the mechanical advantage and efficiency of selected systems. • Explain methods of heat transfer. Examples: conduction, radiation, and convection			

(Comprehension)	**9-12.P.3.2. Students are able to describe how characteristics of waves are related to one another.** • Relate wavelength, speed, and frequency ($v = \lambda f$). • Distinguish between transverse and longitudinal waves. Examples: Discuss changes in frequency of waves using the Doppler Effect. Compare the energy of different frequency ranges of waves with in the electromagnetic spectrum. Describe how different colors of light waves have different amounts of energy.	Analyze the different frequencies and wavelengths in the electromagnetic spectrum using the Doppler Effect		
(Application)	**9-12.P.3.3. Students are able to describe electrical effects in terms of motion and concentrations of charged particles.** • Relate potential difference to current. • Describe how static electricity is different from current electricity. • Interpret and apply Ohm's Law.			

Core High School Physical Science
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • predict the type of bonds formed as elements combine; • balance chemical equations involving polyatomic ions; • analyze and solve a problem involving velocity, acceleration, force, work, energy, or power; • construct or design a model that illustrates the Law of Conservation of Energy to show energy changes from potential to kinetic in doing work; • describe electrical effects in terms of motion and concentrations of charged particles.
Proficient	**High school students performing at the proficient level:** • use the Periodic Table to determine the properties of elements and the ways they combine; • given a variable, predict whether reactions will speed up or slow down as conditions change; • balance simple chemical equations; • describe chemical, physical, and nuclear changes at the atomic and macroscopic levels; • calculate velocity, acceleration, force, work, energy, and power given the formulas; • given the forces acting on an object, predict its motion using Newton's Laws; • apply the Law of Conservation of energy to show energy changes from potential to kinetic in doing work; • describe how characteristics of waves are related to one another; • describe electrical effects in terms of motion and concentrations of charged particles.
Basic	**High school students performing at the basic level:** • use the Periodic Table to determine the properties of the 1st 18 elements; • provide the coefficients for an unbalanced synthesis or decomposition equation; • identify chemical and physical changes at the macroscopic level; • calculate velocity and force given the formulas; • given an example, identify which of Newton's Laws is illustrated; • identify the characteristics of waves; • identify electricity as movement of charged particles.

Core High School Life Science
Standards, Supporting Skills, Assessments, and Resources

Indicator 1: Understand the fundamental structures, functions, classifications, and mechanisms found in living things.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Analysis)	**9-12.L.1.1. Students are able to relate cellular functions and processes to specialized structures within cells.** • Transport Examples: cell membrane, homeostasis • Photosynthesis and respiration Examples: ATP-ADP energy cycle Role of enzymes Mitochondria Chloroplasts • Storage and transfer of genetic information Examples: replication, transcription, and			

	translation • Cell life cycles Examples: somatic cells (mitosis), germ cells (meiosis)			
(Application)	**9-12.L.1.2. Students are able to classify organisms using characteristics and evolutionary relationship of major taxa.** • Kingdoms Examples: animals, plants, fungi, protista, monera • Phyla Examples: invertebrates, vertebrates, divisions of plants Note: There is an ongoing scientific debate about the number of groupings and which organisms should be included in each.			
(Analysis)	**9-12.L.1.3. Students are able to identify structures and**			

	function relationships within major taxa. **Examples**: Relate how the layers in a leaf support leaf function. Interaction of agonist and antagonist muscles to support bone movement			

Indicator 2: Analyze various patterns and products of natural and induced biological change.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Application)	**9-12.L.2.1. Students are able to predict inheritance patterns using a single allele.** • Solve problems involving simple dominance, co-dominance, and sex-linked traits using Punnett squares for F1 and F2 generations. Examples: color			

	blindness, wavy hair • Discuss disorders resulting from alteration of a single gene. Example: hemophilia, cystic fibrosis			
(Synthesis)	**9-12.L.2.2. Students are able to describe how genetic recombination, mutations, and natural selection lead to adaptations, evolution, extinction, or the emergence of new species.** **Examples**: behavioral adaptations, environmental pressures, allele variations, bio-diversity • Use comparative anatomy to support evolutionary relationships.			

Indicator 3: Analyze how organisms are linked to one another and the environment.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Comprehension)	**9-12.L.3.1. Students are able to identify factors that can cause changes in stability of populations, communities, and ecosystems.** • Define populations, communities, ecosystems, niches and symbiotic relationships. • Predict the results of biotic and abiotic interactions. Examples: Responses to changing of the seasons Tolerances (temperature, weather, climate) Dormancy and migration Fluctuation in available resources	Describe and explain scientific factors that affect population size and growth • Birth Rate • Death rate Explore and analyze the effects of natural events and of human influences on ecosystems Describe biotic and abiotic factor that affect the ability of the environment to support life		

	(water, food, shelter) Human activity Biogeochemical cycles Energy flow Cooperation and competition in ecosystems Response to external stimuli			

Core High School Life Science
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • explain the steps of photophosphorylation and the Calvin Cycle; • analyze chemical reaction and chemical processes involved in the Calvin Cycle and Krebs Cycle; • predict the function of a given structure; • predict the outcome of changes in the cell cycle; • explain how protein production is regulated; • predict how homeostasis is maintained within living systems; • predict how traits are transmitted from parents to offspring; • construct an original dichotomous key.
Proficient	**High school students performing at the proficient level:** • describe and give examples of chemical reactions required to sustain life (hydrolysis, dehydration synthesis, photosynthesis, cellular respiration, ADP/ATP, role of enzymes); • describe the relationship between structure and function (cells, tissues, organs, organ systems, and organisms); • compare and contrast the cell cycles in somatic and germ cells;

	• tell how DNA determines protein formation; • explain how homeostasis is maintained within living systems; • explain how traits are transmitted from parents to offspring; • predict the impact of genetic changes in populations (mutation, natural selection and artificial selection, adaptation/extinction); • predict how life systems respond to changes in the environment; • classify organisms using a dichotomous key.
Basic	**High school students performing at the basic level:** • name chemical reactions required to sustain life (hydrolysis, dehydration synthesis, photosynthesis, cellular respiration, ADP/ATP, role of enzymes); • recognize that different structures perform different functions; • describe the life cycle of somatic cells; • identify DNA as the structure that carries the genetic code; • define homeostasis; • identify that genetic traits can be transmitted from parents to offspring; • know the purpose of a dichotomous key.

Core High School Science, Technology, Environment, and Society
Standards, Supporting Skills, Assessments, and Resources

Indicator 1: Analyze various implications/effects of scientific advancement within the environment and society.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Application)	**9-12.S.1.1. Students are able to explain ethical roles and responsibilities of scientists and scientific research.** **Examples:** Sharing of data Accuracy of data Acknowledgement of sources Following laws Animal research Human research Managing hazardous materials and wastes			

(Evaluation)	**9-12.S.1.2. Students are able to evaluate and describe the impact of scientific discoveries on historical events and social, economic, and ethical issues.** **Examples**: cloning, stem cells, gene splicing, nuclear power, patenting new life forms, emerging diseases, AIDS, resistant forms of bacteria, biological and chemical weapons, global warming, and alternative fuels			

Indicator 2: Analyze the relationships/interactions among science, technology, environment, and society.

Bloom's Taxonomy Level	Standard	Supporting Skills	Assessments	Resources
(Evaluation)	**9-12.S.2.1. Students are able to describe immediate and long-term consequences of potential solutions for technological issues.** **Examples**: environmental,			

	communication, internet, entertainment, construction, manufacturing, power and transportation, energy sources, health technology, and biotechnology issues • Describe how the pertinent technological system operates. Example: waste management facility			
(Analysis)	**9-12.S.2.2. Students are able to analyze factors that could limit technological design**. **Examples**: ethics, environmental impact, manufacturing processes, operation, maintenance, replacement, disposal, and liability			

(Synthesis)	**9-12.S.2.3. Students are able to analyze and describe the benefits, limitations, cost, and consequences involved in using, conserving, or recycling resources.** **Examples**: mining, agriculture, medicine, school science labs, forestry, energy, disposable diapers, computers, tires	Analyze the benefits, limitation, cost and consequences involved in using conserving or recycling resources		

Core High School Science Technology, Environment, and Society
Performance Descriptors

Advanced	**High school students performing at the advanced level:** • modify a technology taking into consideration limiting factors of design; • given a narrative of a scientific discovery, defend a position on the impact of the ethical issues.
Proficient	**High school students performing at the proficient level:** • given a narrative of a scientific discovery, identify and evaluate the immediate and long-term consequences of scientific issues; • identify and explain ethical roles and responsibilities of scientists conducting a given research project.; • evaluate factors that could limit technological design; • given a narrative description of a resource, analyze and describe the benefits, limitations, cost, and consequences involved in its use, conservation, or recycling.
Basic	**High school students performing at the basic level:** • given a narrative of a scientific discovery, identify the immediate consequences of scientific issues; • identify ethical roles and responsibilities concerning a given research project; • identify factors that could limit technological design; • given a narrative description of a resource, describe a benefit and limitation involved in its use, conservation, or recycling.