Standard	Benchmark	Indicators
	By the end of the 11 – 12 program, Students will . . .	
Earth and Space Sciences Students demonstrate an understanding about how Earth systems and processes interact in the geosphere resulting in the habitability of Earth. This includes demonstrating an understanding of the composition of the universe, the solar system and Earth. In addition, it includes understanding the properties and the interconnected nature of Earth's systems, processes that shape Earth and Earth's history. Students also demonstrate an understanding of how the concepts and principles of energy, matter, motion and forces explain Earth systems, the solar system and the universe. Finally, they grasp an understanding of the historical perspectives, scientific approaches and emerging scientific issues associated with Earth and space sciences.	A. Explain how technology can be used to gather evidence and increase our understanding of the universe. B. Describe how Earth is made up of a series of interconnected systems and how a change in one system affects other systems. C. Explain that humans are an integral part of the Earth's system and the choices humans make today impact natural systems in the future. D. Summarize the historical development of scientific theories and ideas and describe emerging issues in the study of Earth and space sciences.	1. Describe how the early Earth was different from the planet we live on today, and explain the formation of the sun, Earth and the rest of the solar system from a nebular cloud of dust and gas approximately 4.5 billion years ago. 2. Analyze how the regular and predictable motions of Earth, sun and moon explain phenomena on Earth (e.g., seasons, tides, eclipses and phases of the moon). 3. Explain heat and energy transfers in and out of the atmosphere and its involvement in weather and climate (radiation, conduction, convection and advection). 4. Explain the impact of oceanic and atmospheric currents on weather and climate. 5. Use appropriate data to analyze and predict upcoming trends in global weather patterns (e.g., el Niño and la Niña, melting glaciers and icecaps and changes in ocean surface temperatures). 6. Explain how interactions among Earth's lithosphere, hydrosphere, atmosphere and biosphere have resulted in the ongoing changes of Earth's system.

Standard	Benchmark	Indicators
	By the end of the 11 – 12 program, Students will . . .	
		7. Describe the effects of particulates and gases in the atmosphere including those originating from volcanic activity. 8. Describe the normal adjustments of Earth, which may be hazardous for humans. Recognize that humans live at the interface between the atmosphere driven by solar energy and the upper mantle where convection creates changes in Earth's solid crust. Realize that as societies have grown, become stable and come to value aspects of the environment, vulnerability to natural processes of change has increased. 9. Explain the effects of biomass and human activity on climate (e.g., climatic change and global warming). 10. Interpret weather maps and their symbols to predict changing weather conditions worldwide (e.g., monsoons, hurricanes and cyclones). 11. Analyze how materials from human societies (e.g., radioactive waste and air pollution) affect both physical and chemical cycles of Earth.

Standard	Benchmark	Indicators
	By the end of the 11 – 12 program, Students will . . .	
		12. Explain ways in which humans have had a major effect on other species (e.g., the influence of humans on other organisms occurs through land use, which decreases space available to other species and pollution, which changes the chemical composition of air, soil and water). 13. Explain how human behavior affects the basic processes of natural ecosystems and the quality of the atmosphere, hydrosphere and lithosphere. 14. Conclude that Earth has finite resources and explain that humans deplete some resources faster than they can be renewed. 15. Use historical examples to show how new ideas are limited by the context in which they are conceived; are often rejected by the social establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g., global warming, Heliocentric Theory and Theory of Continental Drift). 16. Describe advances in Earth and space science that have important long-lasting effects on science and society (e.g., global warming, Heliocentric Theory and Plate Tectonics Theory).

Standard	Benchmark	Indicators
	By the end of the 11 – 12 program, Students will . . .	
Life Sciences Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes an understanding of the cycling of matter and flow of energy in living systems. An understanding of the characteristics, structure and function of cells, organisms and living systems will be developed. Students will also develop a deeper understanding of the principles of heredity, biological evolution, and the diversity and interdependence of life. Students demonstrate an understanding of different historical perspectives, scientific approaches and emerging scientific issues associated with the life sciences.	A. Explain how processes at the cellular level affect the functions and characteristics of an organism. B. Explain how humans are connected to and impact natural systems. C. Explain how the molecular basis of life and the principles of genetics determine inheritance. D. Relate how biotic and abiotic global changes have occurred in the past and will continue to do so in the future. E. Explain the interconnectedness of the components of a natural system. F. Explain how human choices today will affect the quality and quantity of life on earth. G. Summarize the historical development of scientific theories and ideas within the study of life sciences.	1. Describe how the maintenance of a relatively stable internal environment is required for the continuation of life, and explain how stability is challenged by changing physical, chemical and environmental conditions as well as the presence of pathogens. 2. Recognize that chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Some of this energy is released as thermal energy. 3. Relate how birth rates, fertility rates and death rates are affected by various environmental factors. 4. Examine the contributing factors of human population growth that impact natural systems such as levels of education, children in the labor force, education and employment of women, infant mortality rates, costs of raising children, birth control methods, and cultural norms. 5. Investigate the impact on the structure and stability of ecosystems due to changes in their biotic and abiotic components as a result of human activity.

Standard	Benchmark	Indicators
	By the end of the 11 – 12 program, Students will . . .	
		6. Predict some possible impacts on an ecosystem with the introduction of a non-native species. 7. Show how populations can increase through linear or exponential growth with corresponding effects on resource use and environmental pollution. 8. Recognize that populations can reach or temporarily exceed the carrying capacity of a given environment. Show that the limitation is not just the availability of space but the number of organisms in relation to resources and the capacity of earth systems to support life. 9. Give examples of how human activity can accelerate rates of natural change and can have unforeseen consequences. 10. Explain how environmental factors can influence heredity or development of organisms. 11. Investigate issues of environmental quality at local, regional, national and global levels such as population growth, resource use, population distribution, over-consumption, the capacity of technology to solve problems, poverty, the role of economics, politics and different ways humans view the earth.

Standard	Benchmark	Indicators
	By the end of the 11 – 12 program, Students will . . .	
		12. Recognize that ecosystems change when significant climate changes occur or when one or more new species appear as a result of immigration or speciation. 13. Describe how the process of evolution has changed the physical world over geologic time. 14. Describe how geologic time can be estimated by observing rock sequences and using fossils to correlate the sequences at various locations. Recognize that current methods include using the known decay rates of radioactive isotopes present in rocks to measure the time since the rock was formed.

Standard	Benchmark	Indicators
	By the end of the 11 – 12 program, Students will . . .	
Physical Sciences Students demonstrate an understanding of the composition of physical systems and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes demonstrating an understanding of the structure and properties of matter, the properties of materials and objects, chemical reactions and the conservation of matter. In addition, it includes understanding the nature, transfer and conservation of energy; motion and the forces affecting motion; and the nature of waves and interactions of matter and energy. Students demonstrate an understanding of the historical perspectives, scientific approaches and emerging scientific issues associated with the physical sciences.	A. Explain how variations in the arrangement and motion of atoms and molecules form the basis of a variety of biological, chemical and physical phenomena. B. Recognize that some atomic nuclei are unstable and will spontaneously break down. C. Describe how atoms and molecules can gain or lose energy only in discrete amounts. D. Apply principles of forces and motion to mathematically analyze, describe and predict the net effects on objects or systems. E. Summarize the historical development of scientific theories and ideas within the study of physical sciences.	1. Explain that elements with the same number of protons may or may not have the same mass and those with different masses (different numbers of neutrons) are called isotopes. Some of these are radioactive. 2. Explain that humans have used unique bonding of carbon atoms to make a variety of molecules (e.g., plastics). 3. Describe real world examples showing that all energy transformations tend toward disorganized states (e.g., fossil fuel combustion, food pyramids and electrical use). 4. Explain how electric motors and generators work (e.g., relate that electricity and magnetism are two aspects of a single electromagnetic force). Investigate that electric charges in motion produce magnetic fields and a changing magnetic field creates an electric field.

Standard	Benchmark	Indicators
	By the end of the 11 – 12 program, Students will . . .	
Science and Technology Students recognize that science and technology are interconnected and that using technology involves assessment of the benefits, risks and costs. Students should build scientific and technological knowledge, as well as the skill required to design and construct devices. In addition, they should develop the processes to solve problems and understand that problems may be solved in several ways.	A. Predict how human choices today will determine the quality and quantity of life on Earth.	1. Identify that science and technology are essential social enterprises but alone they can only indicate what can happen, not what should happen. Realize the latter involves human decisions about the use of knowledge. 2. Predict how decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment and/or humans. 3. Explore and explain any given technology that may have a different value for different groups of people and at different points in time (e.g., new varieties of farm plants and animals have been engineered by manipulating their genetic instructions to reproduce new characteristics). 4. Explain why basic concepts and principles of science and technology should be a part of active debate about the economics, policies, politics and ethics of various science-related and technology-related challenges. 5. Investigate that all fuels (e.g., fossil, solar and nuclear) have advantages and disadvantages; therefore society must consider the trade-offs among them (e.g., economic costs and environmental impact).

Standard	Benchmark	Indicators
	By the end of the 11 – 12 program, Students will . . .	
		6. Research sources of energy beyond traditional fuels and the advantages, disadvantages and trade-offs society must consider when using alternative sources (e.g., biomass, solar, hybrid engines, wind and fuel cells).

Standard	Benchmark	Indicators
	By the end of the 11 – 12 program, Students will . . .	
Scientific Inquiry Students develop scientific habits of mind as they use the processes of scientific inquiry to ask valid questions and to gather and analyze information. They understand how to develop hypotheses and make predictions. They are able to reflect on scientific practices as they develop plans of action to create and evaluate a variety of conclusions. Students are also able to demonstrate the ability to communicate their findings to others.	A. Make appropriate choices when designing and participating in scientific investigations by using cognitive and manipulative skills when collecting data and formulating conclusions from the data.	1. Formulate testable hypotheses. Develop and explain the appropriate procedures, controls and variables (dependent and independent) in scientific experimentation. 2. Evaluate assumptions that have been used in reaching scientific conclusions. 3. Design and carry out scientific inquiry (investigation), communicate and critique results through peer review. 4. Explain why the methods of an investigation are based on the questions being asked. 5. Summarize data and construct a reasonable argument based on those data and other known information.

Standard	Benchmark	Indicators
	By the end of the 11 – 12 program, Students will . . .	
Scientific Ways of Knowing Students realize that the current body of scientific knowledge must be based on evidence, be predictive, logical, subject to modification and limited to the natural world. This includes demonstrating an understanding that scientific knowledge grows and advances as new evidence is discovered to support or modify existing theories, as well as to encourage the development of new theories. Students are able to reflect on ethical scientific practices and demonstrate an understanding of how the current body of scientific knowledge reflects the historical and cultural contributions of women and men who provide us with a more reliable and comprehensive understanding of the natural world.	A. Explain how scientific evidence is used to develop and revise scientific predictions, ideas or theories. B. Explain how ethical considerations shape scientific endeavors. C. Explain how societal issues and considerations affect the progress of science and technology.	1. Analyze a set of data to derive a hypothesis and apply that hypothesis to a similar phenomenon (e.g., biome data). 2. Apply scientific inquiry to evaluate results of scientific investigations, observations, theoretical models and the explanations proposed by other scientists. 3. Demonstrate that scientific explanations adhere to established criteria, for example a proposed explanation must be logically consistent, it must abide by the rules of evidence and it must be open to questions and modifications. 4. Explain why scientists can assume that the universe is a vast single system in which the basic rules are the same everywhere. 5. Recognize that bias affects outcomes. People tend to ignore evidence that challenges their beliefs but accept evidence that supports their beliefs. Scientist attempt to avoid bias in their work. 6. Describe the strongly held traditions of science that serve to keep scientists within the bounds of ethical professional behavior.

Standard	Benchmark	Indicators
	By the end of the 11 – 12 program, Students will . . .	
		7. Explain how theories are judged by how well they fit with other theories, the range of included observations, how well they explain observations and how effective they are in predicting new findings. 8. Explain that the decision to develop a new technology is influenced by societal opinions and demands and by cost benefit considerations. 9. Explain how natural and human-induced hazards present the need for humans to assess potential danger and risk. Many changes in the environment designed by humans bring benefits to society as well as cause risks. 10. Describe costs and trade-offs of various hazards – ranging from those with minor risk to a few people, to major catastrophes with major risk to many people. The scale of events and the accuracy with which scientists and engineers can (and cannot) predict events are important considerations. 11. Research the role of science and technology in careers that students plan to pursue.