

Idaho Partners - Science Standards for Grades 9-12

The Idaho GLOBE Partnership
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647. SCIENCE STANDARDS. . GRADES 9 THROUGH 12, SECTIONS 648 THROUGH 658.

The samples associated with the content standards are meant to illustrate meaning and to represent possible areas of application. They are not intended to be an exhaustive list, but are samples of applications that would demonstrate learning.

648. UNIFYING CONCEPTS OF SCIENCE.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
<ul style="list-style-type: none">• Understand systems, order, and organization.	<ul style="list-style-type: none">• Know the scientific meaning and application of the concepts of system,	<ul style="list-style-type: none">• ESS poster activity

	order, and organization.	
<ul style="list-style-type: none"> Understand concepts and processes of evidence, models, and explanation. 	<ul style="list-style-type: none"> Know that observations and data are evidence on which to base scientific explanations. 	<ul style="list-style-type: none"> ESS poster activity Base predictions off of accumulations of GLOBE weather data
	<ul style="list-style-type: none"> Use models to explain how things work. 	<ul style="list-style-type: none"> Build and demonstrate a model of the water cycle.
	<ul style="list-style-type: none"> Develop scientific explanations based on scientific knowledge, logic, and analysis. 	<ul style="list-style-type: none"> Through research explain the value of a recycling program.
<ul style="list-style-type: none"> Understand constancy, change, and measurement. 	<ul style="list-style-type: none"> Identify constancy in some concepts in science that do not change with time such as the speed of light. 	<ul style="list-style-type: none"> n/a
	<ul style="list-style-type: none"> Recognize that change occurs in and among systems and 	<ul style="list-style-type: none"> Atmosphere protocols Soils protocols

	change can be measured.	
	<ul style="list-style-type: none"> • Measure in both the metric and U.S. customary system. 	<ul style="list-style-type: none"> • Record Celsius and Fahrenheit temperature readings over a period of time.
<ul style="list-style-type: none"> • Understand the theory that evolution is a process that relates to the gradual changes in the universe and of equilibrium as a physical state. 	<ul style="list-style-type: none"> • Know that the present arises from materials and forms of the past. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Understand evolution as a series of changes, some gradual and some sporadic, that account for present form and function of objects, organisms, and natural or mechanical systems. 	<ul style="list-style-type: none"> • GLOBE bird activity • Macroinvertebrate activity.
	<ul style="list-style-type: none"> • Know that equilibrium is a physical state in which forces and changes occur in opposite 	<ul style="list-style-type: none"> • n/a

	and offsetting directions.	
<ul style="list-style-type: none"> Understand concepts of form and function. 	<ul style="list-style-type: none"> Know that form refers to function and function refers to form. 	<ul style="list-style-type: none"> GLOBE bird activity Macroinvertebrate activity

649. CONCEPTS OF SCIENTIFIC INQUIRY.

Standard - The student will:	Content Knowledge and Skills:	Samples of Applications:
<ul style="list-style-type: none"> Understand scientific inquiry and develop critical thinking skills. 	<ul style="list-style-type: none"> Identify questions and concepts that guide scientific investigations. 	<ul style="list-style-type: none"> GLOBE student research projects.
	<ul style="list-style-type: none"> Design and conduct scientific investigations. 	<ul style="list-style-type: none"> GLOBE student research projects
	<ul style="list-style-type: none"> Use technology and mathematics to improve investigations and communication. 	<ul style="list-style-type: none"> Students use GLOBE website to communicate and collaborate with other schools.
	<ul style="list-style-type: none"> Formulate and revise scientific explanations and models using logic and evidence. 	<ul style="list-style-type: none"> Students will predict weather data based on previous GLOBE atmosphere data Students will predict water

		test values based on previous GLOBE hydrology data.
	<ul style="list-style-type: none"> Recognize and analyze alternative explanations and models. 	i. Students will be presented hydrology values from stream site and will be asked to explain the results
	<ul style="list-style-type: none"> Communicate and defend a scientific argument. 	i. GLOBE student research projects
	<ul style="list-style-type: none"> Know the differences among observations, hypotheses, and theories. 	<ul style="list-style-type: none"> n/a

650. CONCEPTS OF PHYSICAL SCIENCE.

<u>Standard - The student will:</u>	<u>Content Knowledge and Skills:</u>	<u>Samples of Applications:</u>
<ul style="list-style-type: none"> Understand the structure of atoms. 	<ul style="list-style-type: none"> Know the function and location of protons, neutrons, and electrons. 	<ul style="list-style-type: none"> n/a
	<ul style="list-style-type: none"> Understand the processes of fission and fusion. 	<ul style="list-style-type: none"> n/a

	<ul style="list-style-type: none"> • Know the characteristics of isotopes. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know the basic electrical properties of matter. 	<ul style="list-style-type: none"> • n/a
<ul style="list-style-type: none"> • Understand the structure and function of matter and molecules and their interactions. 	<ul style="list-style-type: none"> • Know how atoms interact with one another by transferring or sharing electrons. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know how bonds between atoms are created when electrons are shared or transferred to form molecules or ionic substances. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know how the physical properties of compounds reflect the nature of the interactions among its molecules. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know how solids, liquids, and gases differ in the energy that bonds them together. 	<ul style="list-style-type: none"> • n/a
<ul style="list-style-type: none"> • Understand chemical reactions. 	<ul style="list-style-type: none"> • Know that chemical reactions may release or consume energy. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that chemical reactions can occur in time periods that vary 	<ul style="list-style-type: none"> • n/a

	from very fast to very slow and that catalysts can affect the rate of a chemical reaction.	
	<ul style="list-style-type: none"> Identify chemical reactions that are occurring all around us. 	<ul style="list-style-type: none"> n/a
<ul style="list-style-type: none"> Understand concepts of motion and forces. 	<ul style="list-style-type: none"> Know that gravitational force and electrical force are universal forces. 	<ul style="list-style-type: none"> n/a
	<ul style="list-style-type: none"> Know that objects change their motion only when a net force is applied. 	<ul style="list-style-type: none"> n/a
	<ul style="list-style-type: none"> Understand that moving electrical charges produce magnetic forces, and moving magnets produce electrical forces. 	<ul style="list-style-type: none"> n/a
<ul style="list-style-type: none"> Understand that the total energy in the universe is constant. 	<ul style="list-style-type: none"> Understand that energy can be transferred but it can neither be destroyed nor created. 	<ul style="list-style-type: none"> n/a
	<ul style="list-style-type: none"> Know that energy can be classified as either potential energy, kinetic energy, or energy contained by a field. 	<ul style="list-style-type: none"> n/a
	<ul style="list-style-type: none"> Know that heat is evidenced by random motion and the 	<ul style="list-style-type: none"> n/a

	vibrations of atoms, molecules, and ions.	
	<ul style="list-style-type: none"> • Know that energy is transferred by various types of waves and by electrons flowing through matter. 	<ul style="list-style-type: none"> • n/a

651. CELLULAR AND MOLECULAR CONCEPTS.

<u>Standard - The student will:</u>	<u>Content Knowledge and Skills:</u>	<u>Samples of Applications:</u>
<ul style="list-style-type: none"> • Understand the cell is the basis of form and function for all living things and how living things carry out their life functions. 	<ul style="list-style-type: none"> • Know that cells have particular structures that underlie their functions. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that most cell functions involve chemical reactions. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that cells store and use information in the form of DNA to guide their functions. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that cell functions are regulated by expressed genes that provide code for the synthesis of proteins. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that cellular differentiation is regulated through the expression of different genes. A single cell 	n/a

	<p>can differentiate to form many specialized cells, tissues, and organs.</p>	
<ul style="list-style-type: none"> Understand the form and function of DNA. 	<ul style="list-style-type: none"> Know that the instructions for specifying the characteristics of the organism are carried in DNA. 	<ul style="list-style-type: none"> n/a
	<ul style="list-style-type: none"> Know that genetic information is both encoded in genes and replicated. 	<ul style="list-style-type: none"> n/a
	<ul style="list-style-type: none"> Know that most of the cells in a human contain 23 pairs of chromosomes, and that transmission of chromosomal information to offspring occurs through the combination of egg and sperm cells. 	<ul style="list-style-type: none"> n/a
	<ul style="list-style-type: none"> Know that changes in DNA (mutations) occur spontaneously at low rates. Some of these changes make no difference to the organism whereas others can change cells and organisms. Only mutations in gametes can create the variation that changes an organism's off-spring. 	<ul style="list-style-type: none"> n/a
	<ul style="list-style-type: none"> Know that DNA plays a major role in health issues. Through the development of new technologies we have discovered new information 	<ul style="list-style-type: none"> n/a

	about the human genome, medical disorders, and forensic sciences.	
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652. INTERDEPENDENCE OF ORGANISMS AND BIOLOGICAL CHANGE.

<u>Standard - The student will:</u>	<u>Content Knowledge and Skills:</u>	<u>Samples of Applications:</u>
<ul style="list-style-type: none"> Understand the theory of biological evolution. 	<ul style="list-style-type: none"> Know that the theory of evolution explains how species evolve over time and how evolution is the consequence of interactions of: <ul style="list-style-type: none"> - Potential of a species to increase its numbers; - Genetic variability; - A finite supply of resources; - Selection by the environment of those offspring better able to survive and leave offspring. 	<ul style="list-style-type: none"> GLOBE bird activity GLOBE macro invertebrates activity Explain why some species have changed little over time and others have become extinct.
	<ul style="list-style-type: none"> Know that natural selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life forms, as well as for the striking molecular similarities observed among the 	n/a

	diverse species of organisms.	
	<ul style="list-style-type: none"> • Know that the theory of evolution explains how different species of plants, animals, and microorganisms that live on earth today are related by descent from common ancestors. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that biological classifications are based on similarities, which reflect their evolutionary relationships. 	<ul style="list-style-type: none"> • Classify an tree using a dichotomous key.
<ul style="list-style-type: none"> • Understand the interdependence of organisms. 	<ul style="list-style-type: none"> • Know that atoms and molecules cycle among the living and nonliving components of the biosphere. 	<ul style="list-style-type: none"> • Diagram the water cycle. • Diagram a food web
	<ul style="list-style-type: none"> • Trace energy flows through ecosystems in one direction, from photosynthetic organisms to herbivores to carnivores and decomposers. 	<ul style="list-style-type: none"> • Explain a food chain.
	<ul style="list-style-type: none"> • Know that organisms both cooperate and compete in ecosystems. 	<ul style="list-style-type: none"> • Explain niches in an ecosystem.

	<ul style="list-style-type: none"> • Know that living organisms have the capacity to produce populations of infinite size, but environments and resources are finite. 	<p>i. List limiting factors of a population in a closed environment.</p>
	<ul style="list-style-type: none"> • Know that human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. 	<p>i. Conduct an extended investigation of a local land cover area affected by human actions.</p>

653. MATTER, ENERGY, AND ORGANIZATION IN LIVING SYSTEMS.

<u>Standard - The student will:</u>	<u>Content Knowledge and Skills:</u>	<u>Samples of Applications:</u>
<ul style="list-style-type: none"> • <u>Understand the relationship between matter, energy, and organization to trace matter as it cycles and energy as it flows through living systems and between living systems and the environment.</u> 	<ul style="list-style-type: none"> • Know that all matter tends toward more disorganized states. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that living systems require a continuous input of energy to maintain 	<ul style="list-style-type: none"> • n/a

	<p>their chemical and physical organization.</p>	
	<ul style="list-style-type: none"> • Know that the energy for life is primarily derived from the sun through photosynthesis. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Understand cellular respiration and the synthesis of macromolecules. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that chemical bonds of food molecules contain energy, which is released when the bonds are broken. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that cells usually store energy as Adenosine Triphosphate (ATP). 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that the distribution and abundance of organisms and populations in ecosystems are limited by the availability of matter and energy. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Trace how matter cycles and energy flows through 	<ul style="list-style-type: none"> • Construct a food web for a community of

	<p>different levels of organization of living systems - cells, organs, organisms, communities - and between living systems and the physical environment.</p>	<p>organisms and explain how elimination of a particular part of a chain affects the rest of the chain and web. Diagram the carbon and oxygen cycles.</p>
<ul style="list-style-type: none"> Understand the individual behavior of organisms and their interactions in populations and communities as influenced by physiological and environmental factors. 	<ul style="list-style-type: none"> Know that multi-cellular animals have nervous systems that generate behavior. 	<ul style="list-style-type: none"> n/a
	<ul style="list-style-type: none"> Know that the nerve cells communicate with each other by secreting specific excitatory and inhibitory molecules. 	<ul style="list-style-type: none"> n/a
	<ul style="list-style-type: none"> Know that organisms have behavioral responses to internal changes and to external stimuli., The and that broad patterns of behavior have evolved to 	<ul style="list-style-type: none"> i. n/a

	ensure reproductive success.	
	<ul style="list-style-type: none"> • Know that behaviors often have an adaptive logic when viewed in terms of natural selection. 	i. n/a

654. EARTH AND SPACE SYSTEMS.

<u>Standard - The student will:</u>	<u>Content Knowledge and Skills:</u>	<u>Samples of Applications:</u>
<ul style="list-style-type: none"> • Understand scientific theories of origin and subsequent changes in the universe and earth systems. 	<ul style="list-style-type: none"> • Know that current scientific theory suggests that the Sun, the Earth, and the rest of the solar system formed from a nebular cloud of dust and gas. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know methods used to estimate geologic time (observing rock sequences and using fossils to correlate the sequences at various locations). 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that interactions among the solid earth, the oceans, the atmosphere, and organisms have resulted in the ongoing change of the earth system. Some activities are observable 	<ul style="list-style-type: none"> • Explain the processes involved in the formation of Hell.s Canyon or the Snake River Canyon.

	(earthquakes and volcanic eruptions) but many take place over hundreds of millions of years.	<ul style="list-style-type: none"> • Sphere.s activity
	<ul style="list-style-type: none"> • Know that the development of life caused dramatic changes in the composition of the earth.s atmosphere. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that the universe is constantly expanding. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know the life history of stars and galaxies. 	<ul style="list-style-type: none"> • n/a
<ul style="list-style-type: none"> • Understand geo-chemical cycles and energy in the earth system. 	<ul style="list-style-type: none"> • Know that earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of energy. 	<ul style="list-style-type: none"> • n/a
	<ul style="list-style-type: none"> • Know that the two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from the earth.s original formation. 	<ul style="list-style-type: none"> i. n/a
	<ul style="list-style-type: none"> • Know that the outward transfer of earth.s internal heat drives convection circulation in the mantle that propels the plates 	<ul style="list-style-type: none"> i. n/a

	comprising the earth's surface across the face of the globe.	
	<ul style="list-style-type: none"> Know that the heating of the earth's surface and atmosphere by the sun drive convection within the atmosphere and oceans, producing winds and ocean currents. 	i. GLOBE visualizations with El Nino
	<ul style="list-style-type: none"> Know that global climate is determined by energy transfer from the sun at and near the earth's surface. 	<ul style="list-style-type: none"> Explain why many scientists are concerned about the greenhouse effect. ii. ESS poster
	<ul style="list-style-type: none"> Know that the movement of matter through the solid earth, oceans, and atmosphere is driven by the earth's internal and external sources of energy. These movements are often accompanied by a change in the physical and chemical properties of matter. 	i. n/a

655. TECHNOLOGY.

<u>Standard - The student will:</u>	<u>Content Knowledge and Skills:</u>	Samples of Applications:
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<ul style="list-style-type: none"> Understand the relationship between science and technology and develop the abilities of technological design and application. 	<ul style="list-style-type: none"> Know the ways that science advances technology and technology advances science. 	<ul style="list-style-type: none"> i. Write a paper highlighting how GIS technology has advanced science and how science has advanced technology such as the telescope, microscope, computer chips, etc.
	<ul style="list-style-type: none"> Recognize that science and technology are pursued for different purposes and that scientific inquiry is driven by the desire to understand the natural world and technological design is driven by the need to meet human needs and solve human problems. 	<ul style="list-style-type: none"> Compile a case study of a technological development that has had a significant impact on the environment. ii. GLOBE visualizations
	<ul style="list-style-type: none"> Know that critical thinking, creativity, imagination, and a good knowledge base are all required in the work of science and engineering. 	<ul style="list-style-type: none"> i. Using GLOBE data, identify a problem or concern and utilize the scientific process to study the problem or concern and identify what technology is available to assist the process.
	<ul style="list-style-type: none"> Know the elements of technological design, which 	<ul style="list-style-type: none"> Using GLOBE data, identify a problem or concern and utilize the scientific

	<p>include the following:</p> <ul style="list-style-type: none"> - Identify a problem or design an opportunity; - Propose designs and choose between alternative solutions; - Implement a proposed solution; - Evaluate the solution and its consequences; - Communicate the problem, process, and solution. 	<p>process to study the problem or concern and identify what technology is available to assist the process.</p>
	<ul style="list-style-type: none"> • Use available technology to assist in solving problems. 	<ul style="list-style-type: none"> i. Use GLOBE computer models to simulate problems and determine "what if" scenarios. ii. Use current computer software to develop reports and other documents to communicate information. (multispec)

656. PERSONAL AND SOCIAL PERSPECTIVES.

<u>Standard - The student will:</u>	<u>Content Knowledge and Skills:</u>	<u>Samples of Applications:</u>
<ul style="list-style-type: none"> • Understand common environmental quality issues, both natural and human induced. 	<ul style="list-style-type: none"> • Identify issues, including but not limited to: 	<ul style="list-style-type: none"> • Using GLOBE data, Compile a case study of a local environmental

	<ul style="list-style-type: none"> - Water quality; - Air quality; - Hazardous waste; - Forest health. 	<p>issue and describe its impact on Idaho's economy.</p>
<ul style="list-style-type: none"> • Understand the causes and effects of population change. 	<ul style="list-style-type: none"> • Understand the impact of technological development and the growth of human population on the living and nonliving environment. 	<p>i. Using GIS and landcover mapping, determine the impact of a changing population on local land use.</p>
	<ul style="list-style-type: none"> • Understand the impact of population change on natural resources and community infrastructure. 	<p>i. Using GIS, develop a model of a community that describes the impact on natural resources and community infrastructure as the population changes.</p>
<ul style="list-style-type: none"> • Understand the importance of natural resources and the need to manage and conserve them. 	<ul style="list-style-type: none"> • Understand the differences between renewable and nonrenewable resources. 	<p>i. n/a.</p>
	<ul style="list-style-type: none"> • Understand the differences between preservation and conservation. 	<p>i. n/a</p>

	<ul style="list-style-type: none"> Understand the role and effect of management of natural resources. 	<ul style="list-style-type: none"> Examine the role one of remote sensing and its role in the management of our public lands. GLOBE Visualizations
<ul style="list-style-type: none"> Understand different uses of technology in science and how they affect our standard of living. 	<ul style="list-style-type: none"> Identify examples of technologies used in scientific fields, including but not limited to: <ul style="list-style-type: none"> - Weather forecasting; - Food production; - Environmental cleanup; - Advances in medicine; - Communications; - The space program. 	<ul style="list-style-type: none"> i. Identify specific technologies used in a particular scientific field and how they have affected our standards of living.

657. HISTORY OF SCIENCE.

<u>Standard - The student will:</u>	<u>Content Knowledge and Skills:</u>	<u>Samples of Applications:</u>
<ul style="list-style-type: none"> Understand the significance of major scientific milestones. 	<ul style="list-style-type: none"> Understand the social and economic impact of historical scientific events. 	<ul style="list-style-type: none"> Watch a video, "Eyes in the Sky"

	<ul style="list-style-type: none"> Understand the contributions of notable scientists. 	<ul style="list-style-type: none"> GLOBE scientists corner
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658. INTERDISCIPLINARY CONCEPTS.

<u>Standard - The student will:</u>	<u>Content Knowledge and Skills:</u>	<u>Samples of Applications:</u>
<ul style="list-style-type: none"> Understand that interpersonal relationships are important in scientific endeavors. 	<ul style="list-style-type: none"> Know the importance of working in interdisciplinary teams to solve scientific problems. 	<ul style="list-style-type: none"> While working in a team, use the information learned in GLOBE to study an environmental issue.
<ul style="list-style-type: none"> Understand technical communication. 	a. Read for information.	<ul style="list-style-type: none"> Conduct advanced GLOBE protocols.
	b. Write and articulate technical information.	i. GLOBE student research project

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