

Nebraska Science Standards Edited for Environmental Science Grades 9-12  
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<http://www.nde.state.ne.us/ndestandards/sciencedrft.htm>

Senior high students should be able to understand scientific inquiry at increasingly higher levels of sophistication. Questions and issues relevant to students should form the basis of investigations. An adequate knowledge base and an understanding of the concepts that guide inquiry are needed to assure success. Students should learn how to analyze evidence and evaluate their own explanations and those of scientists.

## **12.1 Unifying Concepts and Processes**

Unifying concepts and processes help students think about and integrate a range of basic ideas which builds an understanding of the natural world.

12.1.1 By the end of twelfth grade, students will develop an understanding of systems, order, and organization.

Example Indicators

- Predict and evaluate how change within a system affects that system.
- Design solutions to problems identified within a system.

12.1.2 By the end of twelfth grade, students will develop an understanding of evidence, models, and explanation.

Example Indicators

- Create a physical, mental, or mathematical model to show how objects and processes are connected.
- Test the usefulness of a model by comparing its predictions to actual observations.
- Understand that the way data are displayed affects interpretation.
- Evaluate the reasonableness of answers to problems.
- Understand that larger well-chosen samples produce more accurate estimates of the characteristics of the total population.
- Understand that a correlation between two variables doesn't mean that either one causes the other.

12.1.3 By the end of twelfth grade, students will develop an understanding of change, constancy, and measurement.

Example Indicators

- Use powers of ten to represent large and small numbers
- Compare data for two groups by using averages and ranges of values.
- Understand that measurement errors may affect results of calculations.
- Describe rate of change by comparing one measured quantity to another measured quantity.
- Investigate and describe how different characteristics, properties, or relationships within a system change as their dimensions increase or decrease.

12.1.4 By the end of twelfth grade, students will develop an understanding of form and function.

Example Indicator

- Explain function by referring to form and explaining form by referring to function.

12.1.5 By the end of twelfth grade, students will develop an understanding of change over a period of time.

#### Example Indicators

- Identify the series of changes that occur in objects, organisms, and natural and human designed systems.
- Explain how a system at equilibrium is affected by change.

### **12.2 Science as Inquiry**

Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.

12.2.1 By the end of twelfth grade, students will develop the abilities needed to do scientific inquiry.

#### Example Indicators

- Formulate questions and identify concepts that guide scientific investigations.
- Design and conduct scientific investigations.
- Use technology and mathematics to improve investigations and communications.
- Formulate and revise scientific explanations and models using logic and evidence.
- Recognize and analyze alternative explanations and models.
- Communicate and defend a scientific argument.

### **12.3 Physical Sciences (Does not pertain to Environmental Science Class.)**

#### **12.4 Life Science**

Life science focuses on the science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use

12.4.1-12.4.3 Do not pertain to Environmental Science Class.

12.4.4 By the end of twelfth grade, students will develop an understanding of the interdependence of organisms.

#### Example Indicators

- Investigate and understand that atoms and molecules cycle among living and nonliving components of the biosphere.
- Investigate and describe the flow of energy through ecosystems, in one direction, from producers to herbivores to carnivores and decomposers.
- Investigate and cite examples of organisms cooperating and competing in ecosystems.
- Investigate and understand that interactions among organisms are affected by the conflict between an organism's capacity to produce infinite populations and the finite amount of resources.
- Investigate and describe how humans modify the ecosystem as a result of population growth, technology, and consumption.

12.4.5 By the end of twelfth grade, students will develop an understanding of matter, energy, and organization in living systems.

#### Example Indicators

- Investigate and understand that living systems require a constant input

- of energy to maintain their chemical and physical organization.
- Investigate and understand that producers use solar energy to combine molecules of carbon dioxide and water into organic compounds.
- Investigate and explain how distribution and abundance of different organisms in ecosystems are limited by the availability of matter and energy and the ability of the ecosystem to recycle materials.

12.4.6 By the end of twelfth grade, students will develop an understanding of the behavior of organisms.

Example Indicators

- Investigate and describe how nervous systems function in multicellular animals.
- Investigate and describe how organisms respond to internal changes and external stimuli.
- Investigate and explain how the behavioral patterns of organisms have evolved through natural selection.
- Investigate and understand that behavioral biology relates to humans since it provides links to psychology, sociology, and anthropology.

## **12.5 Earth and Space Science (Does not pertain to Environmental Science Class.)**

### **12.6 Science and Technology**

An understanding of science and technology establishes connections between the natural and designed world, linking science to technology.

12.6.1 By the end of twelfth grade, students will develop an understanding of technological design.

Example Indicators

- Propose designs and choose between alternative solutions of a problem.
- Implement the selected solution.
- Evaluate the solution and its consequences.
- Communicate the problem, process, and solution.

12.6.2 By the end of twelfth grade, students will develop an understanding about science and technology.

Example Indicators

- Explain how science advances with the introduction of new technology.
- Understand creativity, imagination, and a good knowledge base are all needed to advance the work of science and engineering.
- Contrast the reasons for the pursuit of science and the pursuit of technology.
- Contrast the reporting of scientific knowledge and the reporting of technical knowledge.

### **12.7 Science in Personal and Social Perspectives**

A personal and social perspective of science helps a student understand and act on personal and social issues. This perspective builds a foundation for future decision making.

12.7.1 By the end of twelfth grade, students will develop an understanding of personal and community health.

Example Indicators

- Investigate and describe the effect of nutritional balance on growth, development, and personal well-being.
- Investigate and explain how diseases are prevented, controlled, and cured.
- Investigate and explain how genetics traits affect a person's health.
- Investigate and analyze risks and benefits in making decisions about personal and community health.

12.7.2 By the end of twelfth grade, students will develop an understanding of the effects of population change.

Example Indicators

- Investigate and identify causes of population growth or decline.
- Investigate and explain how various factors influence birth rates and death rates.
- Investigate and predict how population change may impacts resource use and environments.

12.7.3 By the end of twelfth grade, students will develop an understanding of natural resources.

Example Indicators

- Investigate and explain how human populations use environmental resources to maintain and improve their existence.
- Investigate and understand that the earth has renewable and finite resources.
- Investigate and understand the limitations of natural systems to renew and recycle resources.

12.7.4 By the end of twelfth grade, students will develop an understanding of environmental quality.

Example Indicators

- Investigate and describe how the positive and negative consequences of human intervention or nonintervention impacts the ecosystem.
- Investigate and explain factors which may influence environmental quality.

12.7.5 By the end of twelfth grade, students will develop an understanding of natural and human-induced hazards.

Example Indicators

- Investigate and describe how human activities increase or reduce the potential for hazards.
- Investigate and distinguish between slowly and rapidly occurring natural hazards and their impact on the environment.

12.7.6 By the end of twelfth grade, students will develop an understanding of the role of science and technology in local, national, and global challenges.

Example Indicators

- Understand that knowledge of basic concepts about scientific and technological challenges should precede active debate.
- Investigate and understand that social issues and challenges may affect advancements in science and technology.
- Understand that science and technology are essential social enterprises that indicate what could happen, but not what should happen.

## **12.8 History and Nature of Science**

The history and nature of science illustrates different aspects of scientific inquiry, the human aspects of science, and the role that science has played in the development of various cultures.

12.8.1 By the end of twelfth grade, students will develop an understanding of science as a human endeavor.

Example Indicators

- Demonstrate ethical scientific practices (e.g., informing research subjects about risks and benefits, humane treatment of animals, truthful reporting, public disclosure of work, and peer review).
- Examine and understand the societal, cultural, and personal beliefs that influence scientists.
- Recognize science as one way of answering questions and explaining the natural world.

12.8.2 By the end of twelfth grade, students will develop an understanding of the nature of scientific knowledge.

Example Indicators

- Demonstrate the use of empirical standards, logical arguments, and skepticism in science.
- Create scientific explanations consistent with experimental and observational evidence; make accurate predictions; strive to be logical; respect the rules of evidence; accept criticism; report methods and procedures; and make knowledge public.
- Understand that all scientific knowledge is, in principle, subject to change as new evidence becomes available.

12.8.3 By the end of twelfth grade, students will develop an understanding of the history of science.

Example Indicators

- Investigate and describe the contributions of diverse cultures to scientific knowledge and technological inventions.
- Understand that changes in scientific knowledge evolve over time and almost always build on earlier knowledge.
- Understand that some advancements in science and technology have long-lasting effects on society.