

Alignment to State (Illinois and Indiana) and National Science Standards



Ecology/Environmental Science Lesson-P²D²

Alignment to Illinois State Goals

STATE GOAL 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.

Illinois Learning Standards:

LEARNING STANDARD A. Know and apply the concepts, principles and processes of scientific inquiry.

LEARNING STANDARD B. Know and apply the concepts, principles and processes of technological design.

Illinois Assessment Framework Objectives:

BENCHMARK:

- 11.A.4a Formulate hypotheses referencing prior research and knowledge.
- 11.A.4b Conduct controlled experiments or simulations to test hypotheses.
- 11.A.4c Collect, organize and analyze data accurately and precisely.
- 11.A.4e Formulate alternative hypotheses to explain unexpected results.
- 11.A.4f Using available technology, report, display and defend to an audience conclusions drawn from investigations.
- 11.B.4a Identify a technological design problem inherent in a commonly used product.
- 11.B.4b Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time.
- 11.B.4d Determine the criteria upon which the designs will be judged, identify, advantages and disadvantages of the designs and select the most promising design.
- 11.B.4e Develop and test a prototype or simulation of the solution design using available materials, instruments and technology.
- 11.B.4f Evaluate the test results based on established criteria, note sources of error and recommend improvements.
- 11.B.4g Using available technology, report to an audience the relative success of the design based on the test results and criteria.
- 11.A.5a Formulate hypotheses referencing prior research and knowledge.
- 11.A.5b Design procedures to test the selected hypotheses.
- 11.A.5c Conduct systematic controlled experiments to test the selected hypotheses.
- 11.A.5d Apply statistical methods to make predictions and to test the accuracy of results.
- 11.A.5e Report, display and defend the results of investigations to audiences that may include professionals and technical experts.
- 11.B.5a Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs.
- 11.B.5b Select criteria for a successful design solution to the identified problem.
- 11.B.5c Build and test different models or simulations of the design solution using suitable materials, tools and technology.
- 11.B.5d Choose a model and refine its design based on the test results.
- 11.B.5e Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements.
- 11.B.5f Using available technology, prepare and present findings of the tested design solution to an audience that may include professional and technical experts.

BENCHMARK:

- 13.A.5a Design procedures and policies to eliminate or reduce risk in potentially hazardous science activities.
- 13.A.5b Explain criteria that scientists use to evaluate the validity of scientific claims and theories.
- 13.A.5c Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies.
- 13.A.5d Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims.
- 13.B.5a Analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence).
- 13.B.5b Analyze and describe the processes and effects of scientific and technological breakthroughs.
- 13.B.5c Design and conduct an environmental impact study, analyze findings and justify recommendations.
- 13.B.5d Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access).
- 13.B.5e Assess how scientific and technological progress has affected other fields of study, careers and job markets and aspects of everyday life.

STATE GOAL 12: Understand the fundamental concepts, principles, and interconnections of the life, physical, and earth/space sciences.

Illinois Learning Standards:

LEARNING STANDARD: A. Know and apply concepts that explain how living things function, adapt and change.

LEARNING STANDARD B. Know and apply concepts that describe how living things interact with each other and with their environment.

Illinois Assessment Framework Objectives:

BENCHMARK:

12.B.4a Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms.

12.B.4b Simulate and analyze factors that influence the size and stability of populations within ecosystems (e.g., birth rate, death rate, predation, migration patterns).

12.A.5a Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy).

STATE GOAL 13: Understand the relationships among science, technology and society in historical and contemporary contexts.

Illinois Learning Standards:

LEARNING STANDARD A. Know and apply the accepted practices of science.

LEARNING STANDARD B. Know and apply concepts that describe the interaction between science, technology and society.

Illinois Assessment Framework Objectives:

BENCHMARK:

13.A.4a Estimate and suggest ways to reduce the degree of risk involved in science activities.

13.A.4b Assess the validity of scientific data by analyzing the results, sample set, sample size, similar previous experimentation, possible misrepresentation of data presented and potential sources of error.

13.A.4c Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers).

13.A.4d Explain how peer review helps to assure the accurate use of data and improves the scientific process.

13.B.4a Compare and contrast scientific inquiry and technological design as pure and applied sciences.

13.B.4b Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science.

13.B.4c Analyze ways that resource management and technology can be used to accommodate population trends.

13.B.4d Analyze local examples of resource use, technology use or conservation programs; document findings; and make recommendations for improvements.

13.B.4e Evaluate claims derived from purported scientific studies used in advertising and marketing strategies.

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Alignment to Indiana State Science Standards

Principles of Environmental Science-- Standard 1

Environmental Systems

- Env.1.4 Understand and explain that human beings are part of Earth's ecosystems and give examples of how human activities can, deliberately or inadvertently, alter ecosystems.
- Env.1.8 Recognize/ describe the difference between systems in equilibrium and systems in disequilibrium.
- Env.1.10 Identify and measure biological, chemical, and physical factors within an ecosystem.

Natural Resources

- Env.1.28 Understand and describe the concept and the importance of natural and human recycling in conserving our natural resources

Environmental Hazards

- Env.1.31 Understand and explain that waste management includes considerations of quantity, safety, degradability, and cost.
- Env.1.34 Differentiate between natural pollution and pollution caused by humans; give examples of each.

Principles of Biology-- Standard 1

Ecology

- B.1.41 Recognize that and describe how human beings are part of Earth's ecosystems. Note that human activities can, deliberately or inadvertently, alter the equilibrium in ecosystems.
- B.1.43 Understand that and describe how organisms are influenced by a particular combination of living and nonliving components of the environment.
- B.1.44 Describe the flow of matter, nutrients, and energy within ecosystems.
- B.1.45 Recognize that and describe how the physical or chemical environment may influence the rate, extent, and nature of the way organisms develop within ecosystems.

Advanced Life Science: Animals Standards—Standard 4

Animal Genetics and the Environment

Ecology

- AS.4.20 Explain the role of resources in every ecosystem. Define trophic level. Explain the concept of energy flow: primary producers, primary consumers, secondary and tertiary consumers, and decomposers.
- AS.4.21 Describe the impact humans have on the capacity of any system to support life. List the factors that limit the capacity of an ecosystem. Discuss the interactions that occur between birth rate, population growth, and carrying capacity of the ecosystem.
- AS.4.22 Explain difference between exponential and logistic growth curves. Define carrying capacity. Describe the impact of carrying capacity on an ecosystem (community ecology). Predict the impacts of overcrowding, disease, and waste on animal health

