

Curriculum Map: Earth & Environment (Pavlick)

Course: EARTH & ENVIRONMENT Sub-topic: General

Grade(s): 9 to 10

Course Description: Students will learn content from different branches of science including biology, ecology, earth science, and chemistry to better understand the world around them. They will engage in activities that build skills such as measuring techniques, collecting and recording data, creating and interpreting graphs, completing mathematical equations, and other additional skills related with science. This course includes eligible content and assessment anchors for the Biology Keystone Exam (Evolution and Ecology).

Course Textbooks, Workbooks, Materials Citations: Holt Environmental Science (2004)

Unit: Experimental Design and Chapter 2: What is Science?

Timeline: 2 Weeks

Unit Description: In this unit students will investigate the process of science. This includes reviewing the scientific method, key characteristics of experimental design, and the mathematical tools needed in analyzing scientific data.

Unit Essential Questions: SCIENCE LONG TERM TRANSFER GOALS (PDESAS)

1. Approach science as a reliable and tentative way of knowing and explaining the natural world.
2. Weigh evidence and use scientific approaches to ask questions, investigate, and make informed decisions.
3. Make and use observations to analyze relationships and patterns in order to explain phenomena, develop models, and make predictions.
4. Evaluate systems, in order to connect how form determines function and how any change to one component affects the entire system.
5. Explain how the natural and designed worlds are interrelated and the application of scientific knowledge and technology can have beneficial, detrimental, or unintended consequences.

Unit Big Ideas: SCIENCE LONG TERM TRANSFER GOALS (PDESAS)

1. Approach science as a reliable and tentative way of knowing and explaining the natural world.
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Unit Key Terminology & Definitions :

- Scientific Method
- Observation
- Hypothesis
- Prediction
- Experiment
- Control Group
- Experimental Group
- Independent Variable
- Dependent Variable
- Controlled Variables
- Data Quantitative Data Qualitative Data Inferences Bias
- Scientific Theory Correlation Statistics Mean/Average Distribution Probability
- Risk

STANDARDS: STANDARDS

STATE: Pennsylvania State Anchors (2010)
S11.A.1 (Advanced) Reasoning and Analysis

S11.A.1.1 (Advanced)	Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems.	
S11.A.1.1.1 (Advanced)	Compare and contrast scientific theories, scientific laws, and beliefs (e.g., the universal law of gravitation, how light travels, formation of moons, stages of ecological succession).	
S11.A.1.1.2 (Advanced)	Analyze and explain the accuracy of scientific facts, principles, theories, and laws.	
S11.A.1.1.3 (Advanced)	Evaluate the appropriateness of research questions (e.g., testable vs. not-testable).	
S11.A.1.1.4 (Advanced)	Explain how specific scientific knowledge or technological design concepts solve practical problems	
	(e.g., momentum, Newton's universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, ideal gas laws).	
S11.A.1.1.5 (Advanced)	Analyze or compare the use of both direct and indirect observation as means to study the world and the universe (e.g., behavior of atoms, functions of cells, birth of stars).	
S11.A.1 (Advanced)	Reasoning and Analysis	
S11.A.1.3 (Advanced)	Describe and interpret patterns of change in natural and human-made systems.	
S11.A.1.3.1 (Advanced)	Use appropriate quantitative data to describe or interpret change in systems (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).	
S11.A.1.3.2 (Advanced)	Describe or interpret dynamic changes to stable systems (e.g., chemical reactions, human body, food webs, tectonics, homeostasis).	
S11.A.1.3.3 (Advanced)	Describe how changes in physical and biological indicators (e.g., soil, plants, animals) of water systems reflect changes in these systems (e.g. changes in bloodworm populations reflect changes in pollution levels in streams).	
S11.A.1.3.4 (Advanced)	Compare the rate of use of natural resources and their impact on sustainability.	
S11.A.2 (Advanced)	Processes, Procedures, and Tools of Scientific Investigations	
S11.A.2.1 (Advanced)	Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process.	
S11.A.2.1.1 (Advanced)	Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design.	
S11.A.2.1.2 (Advanced)	Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design.	
S11.A.2.1.3 (Advanced)	Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.	
S11.A.2.1.4 (Advanced)	Critique the results and conclusions of scientific inquiry for consistency and logic.	
S11.A.2.1.5 (Advanced)	Communicate results of investigations using multiple representations.	
S11.A.2.2 (Advanced)	Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide.	
S11.A.2.2.1 (Advanced)	Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality).	

Topic: Section 1: Experimental Design and the Scientific Method

Topic: Section 2: Tools for Science: Probability and Statistics

Unit: Chapter 1: What is Environmental Science?

Timeline: 2 Weeks

STANDARDS: STANDARDS

NGSS Arranged by Topic - Science (2013)

MS-ESS3-2 (Advanced)	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.	
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MS-ESS3-3 (Advanced)	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	
MS-ESS3-4 (Advanced)	Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.	
HS-ESS3-1 (Advanced)	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.	
HS-ESS3-2 (Advanced)	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.	
HS-ESS3-3 (Advanced)	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.	
HS-ESS3-4 (Advanced)	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.	
HS-ESS3-6 (Advanced)	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.	

Topic: Section 1: Understanding Our Environment

Topic: Section 2: The Environment and Society

Unit: Chapter 3: What Systems Create Our Dynamic Earth?

STANDARDS: STANDARDS

NGSS Arranged by Topic - Science (2013)

5-ESS2-1 (Advanced)	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	
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STATE: Pennsylvania State Anchors (2010)

S11.D.1 (Advanced)	Earth Features and Processes that Change Earth and Its Resources	
S11.D.1.1 (Advanced)	Explain and analyze the forces in the lithosphere that continually shape Earth.	
S11.D.1.1.2 (Advanced)	Explain the processes that take place at plate boundaries and how these processes continue to shape Earth (e.g., volcanic activity, earthquakes, mountain building, mid-ocean ridges, deep-sea trenches, new land being formed).	
S11.D.1.1.3 (Advanced)	Analyze features caused by the interaction of processes that change Earth's surface (e.g., wind and moving water help break down rock into soil; plate movement, earthquakes, and volcanic activity help cause mountains and valleys to form; flowing water and deposition of material help form deltas).	
S11.D.1.2 (Advanced)	Analyze how human-made systems impact the management and distribution of natural resources.	
S11.D.1.2.1 (Advanced)	Evaluate factors affecting availability, location, extraction, and use of natural resources.	
S11.D.1.2.2 (Advanced)	Explain the impact of obtaining and using natural resources for the production of energy and materials (e.g., resource renewal, amount of pollution, deforestation).	
S11.D.1.3 (Advanced)	Explain the significance and contribution of water as a resource to living things and the shaping of the land.	
S11.D.2.1.1 (Advanced)	Describe how changes in concentration of minor components (e.g., O ₂ , CO ₂ , dust, pollution) in Earth's atmosphere may be linked to climate change.	
S11.D.2.1.2 (Advanced)	Compare the transmission, reflection, absorption, and radiation of solar energy to and by Earth's surface under different environmental conditions (e.g., major volcanic eruptions, greenhouse effect, reduction of ozone layer, increased global cloud cover).	
S11.D.2.1.3 (Advanced)	Explain weather patterns and seasonal changes using the concepts of heat and density.	

Topic: Section 1: The Geosphere

Topic: Section 2: The Atmosphere

Topic: Section 3: The Hydrosphere and Biosphere

Unit: Hydrology

STANDARDS: STANDARDS

STATE: Pennsylvania State Anchors (2010)

S11.D.1.3 (Advanced)	Explain the significance and contribution of water as a resource to living things and the shaping of the land.	
S11.D.1.3.1 (Advanced)	Explain the multiple functions of different water systems in relation to landforms (e.g., buffer zones, nurseries, food production areas, habitat, water quality control, biological indicators).	
S11.D.1.3.2 (Advanced)	Explain relationships among physical characteristics, vegetation, topography, and flow as it relates to water systems.	
S11.D.1.3.3 (Advanced)	Explain factors (e.g., nutrient loading, turbidity, rate of flow, rate of deposition, biological diversity) that affect water quality and flow through a water system.	

Topic: Section 1: Watersheds and Sources of Water

Topic: Section 2: Mapping Watersheds

Topic: Section 3: Measuring Water Quality

Unit: Keystone Evolution

STANDARDS: STANDARDS

STATE: Pennsylvania State Anchors (2010)

S11.B.2.1 (Advanced)	Explain the mechanisms of the theory of evolution.	
S11.B.2.1.1 (Advanced)	Explain the theory of evolution by interpreting data from fossil records, similarities in anatomy and physiology, or DNA studies that are relevant to the theory of evolution.	
S11.B.2.1.2 (Advanced)	Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population.	
S11.B.2.1.3 (Advanced)	Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population.	
S11.B.2.1.4 (Advanced)	Explain why natural selection can act only on inherited traits.	
S11.B.2.2 (Advanced)	Describe how genetic information is inherited and expressed.	

Topic: Section 1: Scientific Terminology

Topic: Section 2: Contributor's to Evolutionary Thought

Topic: Section 3: Natural Selection

Topic: Section 4: Evidence for Evolution

Topic: Section 5: Speciation

Unit: Keystone Ecology

STANDARDS: STANDARDS

STATE: Pennsylvania State Anchors (2010)

S11.B.3 (Advanced)	Ecological Behavior and Systems	
S11.B.3.1 (Advanced)	Use evidence or examples to explain the characteristics of and interactions within an ecosystem.	
S11.B.3.1.1 (Advanced)	Explain the significance of diversity in ecosystems.	
S11.B.3.1.2 (Advanced)	Explain the biotic (i.e., plant, animal, and microbial communities) and abiotic (i.e., soil, air, temperature, and water) components of an ecosystem and their interaction.	
S11.B.3.1.3 (Advanced)	Describe how living organisms affect the survival of one another.	

S11.B.3.1.5 (Advanced)	Predict how limiting factors (e.g., physical, biological, chemical) can affect organisms.	
S11.B.3.2 (Advanced)	Analyze patterns of change in natural or human-made systems over time.	
S11.B.3.2.1 (Advanced)	Use evidence to explain how cyclical patterns in population dynamics affect natural systems.	
S11.B.3.2.2 (Advanced)	Explain biological diversity as an indicator of a healthy environment.	

Topic: Section 1: Ecological Levels of Organization

Topic: Section 2: Species Relationships

Topic: Section 3: Relationships for Survival

Topic: Section 4: Matter and Energy in Ecosystems

Topic: Section 5: Biomagnification

Topic: Section 6: Nutrient Cycling

Topic: Section 7: Succession

Topic: Section 8: Population Dynamics