

# Warren County School District

## PLANNED INSTRUCTION

### COURSE DESCRIPTION

**Course Title:** Introduction to Environmental Science

**Course Number:** 00308

**Course Prerequisites:** \_\_\_\_\_

Course Description: (Include “no final exam” or “final exam required”)

This course focuses on the principals of ecology and the interdependence of natural and human systems. Students will develop skills in making informed decisions and taking constructive actions. Relevant lab activities will be incorporated throughout, utilizing scientific inquiry and appropriate technology.

**Suggested Grade Level:** Grade 9

**Length of Course:** X One Semester        Two Semesters        Other  
(Describe)

**Units of Credit:** .5 (Insert *NONE* if appropriate.)

**PDE Certification and Staffing Policies and Guidelines (CSPG) Required Teacher Certification(s)**  
(Insert certificate title and CSPG#) Biology, Chemistry, Earth and Space, Environmental Ed, General Science, Physics

Certification verified by WCSD Human Resources Department:

X Yes

No

Board Approved Textbooks, Software, Materials:

Title:

Publisher:

ISBN #:

Copyright Date:

Date of WCSD Board Approval:

## **BOARD APPROVAL:**

**Date Written:** \_\_\_\_\_ September 2009

**Date Approved:** \_\_\_\_\_

**Implementation Year:** \_\_\_\_\_

Suggested Supplemental Materials: (List or insert None)

### ***Course Standards***

PA Academic Standards: (List by Number and Description)

#### **3.1.10 Unifying Themes**

- A. Discriminate among the concepts of systems, subsystems, feed back and control in solving technological problems.
- B. Describe concepts of models as a way to predict and understand science and technology.
- C. Apply patterns as repeated processes or recurring elements in science and technology.
- D. Apply scale as a way of relating concepts and ideas to one another by some measure.
- E. Describe patterns of change in nature, physical and man made systems.

#### **3.2.10 Inquiry and Design**

- A. Apply knowledge and understanding about the nature of scientific and technological knowledge.
- B. Apply process knowledge and organize scientific and technological phenomena in varied ways.
- C. Apply the elements of scientific inquiry to solve problems.
- D. Identify and apply the technological design process to solve problems.

#### **3.5.10 Earth Sciences**

- B. Explain sources and uses of earth resources
- D. Assess the value of water as a resource.

#### **3.7.10 Technological Design**

- A Identify and safely use a variety of tools, basic machines, materials and techniques to solve problems and answer questions.
- B Apply appropriate instruments and apparatus to examine a variety of objects and processes.
- C Identify and explain why adaptations can lead to specialization.

#### **3.8.10 Science Technology and Human Endeavors**

- B Analyze how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.
- C Evaluate possibilities, consequences and impacts of scientific and technological solutions.

#### **4.1.10 Watersheds and Wetlands**

- A Describe changes that occur from a stream's origin to its final outflow.
- B Explain the relationship among landforms, vegetation and the amount and speed of water.
- C Describe the physical characteristics of a stream and determine the types of organisms found in aquatic environments.
- D Describe the multiple functions of wetlands.

#### **4.1.12 Watersheds and Wetlands**

- A. Categorize stream order in a water watershed.
- B. Explain the relationships that exist within watersheds in the United States.
- C. Analyze the parameters of a watershed.
- D. Analyze the complex and diverse ecosystems of wetlands.

#### **4.2.10 Renewable and Nonrenewable Resources**

- A. Explain that renewable and nonrenewable resources supply energy and materials.
- B. Evaluate factors affecting a availability of natural resources.
- C. Analyze how man-made systems have impacted the management and distribution of natural resources.
- D. Explain different management alternatives involved in recycling and solid waste management.

#### **4.2.10 Renewable and Nonrenewable Resources**

- A. Analyze the use of renewable and nonrenewable resources.
- B. Analyze factors affecting the availability of renewable and nonrenewable resources.
- C. Analyze factors that influence the availability of natural resources.
- D. Evaluate solid waste management practices.

#### **4.3.10 Environmental Health**

- A. Describe environmental health issues.
- B. Explain how multiple variables determine the effects of pollution on environmental health, natural processes and human practices.
- C. Explain biological diversity as an indicator of a healthy environment.

#### **4.3.12 Environmental Health**

- A. Analyze the complexity of environmental health issues.
- B. Analyze the local, regional and national impacts of environmental health.
- C. Analyze the need for a healthy environment.

#### **4.4.10 Agriculture and Society**

- A. Describe the importance of agriculture to society.
- B. Assess the influence of agricultural science on farming practices.
- C. Explain the functions of the components of the food and fiber system.
- D. Analyze the efforts of increased efficiency in agriculture through technology.

#### **4.4.12 Agriculture and Society**

- A. Analyze the management practices in the agriculture business.
- B. Describe how agricultural science has influenced biotechnology.
- C. Analyze and research the social, political and economic factors that affect agricultural systems.
- E. Analyze research and development activities as they relate to agriculture.

#### **4.5.10 Integrated Pest Management**

- A. Identify similar classifications of pests that may or may not have similar effects on different regions.
- B. Analyze health benefits and risks associated with integrated pest management.
- C. Determine the effects of integrated pest management practices on society over time.

#### **4.5.12 Integrated Pest Management**

- A. Research integrated pest management systems.
- B. Research and analyze integrated pest management practices globally.
- C. Analyze the historical significance of integrated pest management on society.

#### **4.6.10 Ecosystems and their Interactions**

- A. Explain the biotic and abiotic components of an ecosystem and their interaction.
- B. Explain how cycles affect the balance in an ecosystem.
- C. Explain how cycles change over time.

#### **4.6.12 Ecosystems and their Interactions**

- A. Analyze the interdependence of an ecosystem.
- B. Analyze the impact of cycles on the ecosystem.
- C. Analyze how human action and natural changes affect the balance within an ecosystem.

#### **4.7.10 Threatened, Endangered and Extinct Species**

- A. Explain the significance of diversity in ecosystems.
- B. Explain how structure, function and behavior of plants and animals affect their ability to survive.
- C. Identify and explain why adaptations can lead to specialization.

#### **4.7.12 Threatened, Endangered and Extinct Species**

- A. Analyze biological diversity as it relates to the stability of an ecosystem.
- B. Examine the effects of extinction, both natural and human caused, on the environment.
- C. Analyze the effects of threatened, endangered or extinct species on human and natural systems.

#### **4.8.10 Humans and the Environment**

- A. Analyze how society's needs relate to the sustainability of natural resources.
- B. Analyze the relationship between the use of natural resources and sustaining society.
- C. Analyze how human activities may cause changes in an ecosystem.
- D. Explain how the concept of supply and demand affects the environment.

#### **4.8.12 Humans and the Environment**

- A. Explain how technology has influenced the sustainability of natural resources over time.
- B. Analyze technology's role on natural resource sustainability.
- C. Analyze how pollution has changed the quality variety and toxicity as the United States developed its industrial bases.
- D. Analyze the internal implications of environmental occurrences.

#### **4.9.10 Environmental Laws and Regulations**

- A. Explain why environmental laws and regulations are developed and enacted.

#### **4.9.12 Environmental Laws and Regulations**

- A. Analyze environmental laws and regulations as they relate to environmental issues.

WCSD Academic Standards: **(List or None)**

None

Industry or Other Standards: **(List, Identify Source or None)**

None

### **WCSD EXPECTATIONS**

WCSD K-12 Expectations for instruction in writing, reading, mathematics and, technology have been developed and revised annually. The teacher will integrate all WCSD Expectations into this planned instruction.

### **SPECIAL EDUCATION AND GIFTED REQUIREMENTS**

The teacher shall make appropriate modifications to instruction and assessment based on a student's Individual Education Plan (IEP) or Gifted Individual Education Plan (GIEP).

### **SPECIFIC EDUCATIONAL OBJECTIVES/CORRESPONDING STANDARDS AND ELIGIBLE CONTENT WHERE APPLICABLE**

**(List Objectives, PA Standards #'s, Other Standards (see samples at end))**

## S11.A The Nature of Science

### S11.A.1 Reasoning and Analysis

S11.A.1.1 Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems.

#### PA Standards References: 3.1.10.A, 3.2.10.A, 3.1.10.E

X – performance assessed during that semester

	Performance Indicators	1	2	Assessment
A.	<b>S11.A.1.1.1</b> Compare and contrast scientific theories, scientific laws, and beliefs (i.e., the law of universal gravitation, how light travels, formation of moons, stages of ecological succession).			
B.	<b>S11.A.1.1.2</b> Analyze and explain the accuracy of scientific facts, principles, theories, and laws.			
C.	<b>S11.A.1.1.3</b> Evaluate the appropriateness of research questions (e.g., testable vs. not-testable).			
D.	<b>S11.A.1.1.4</b> 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).			
E.	<b>S11.A.1.1.5</b> 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.1.2 Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications.

#### PA Standard References: 3.2.10.A, 4.3.10.B

X – performance assessed during that semester

	Performance Indicators	1	2	Assessment
A.	<b>S11.A.1.2.1</b> Explain and apply scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy).			
B.	<b>S11.A.1.2.2</b> Use case studies (e.g., Wright brothers’ flying machine, Tacoma Narrows Bridge, Henry Petoskey’s Design Paradigms) to propose possible solutions and analyze economic and environmental implications of solutions for real-world problems.			

S11.A.1.3 Describe and interpret patterns of change in natural and human-made systems.

#### PA Standard References: 3.1.10.C, 3.1.10.E, 4.8.10.A

X – performance assessed during that semester

	Performance Indicators	1	2	Assessment
A.	<b>S11.A.1.3.1</b> Use appropriate quantitative data to describe or interpret change in systems (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).			
B.	<b>S11.A.1.3.2</b> Describe or interpret dynamic changes to stable systems (e.g., chemical reactions, human body, food webs, tectonics, homeostasis).			
C.	<b>S11.A.1.3.3</b> Describe how changes in physical and biological indicators (e.g., soil, plants, or animals) of water systems reflect changes in these systems (e.g. changes in bloodworm populations reflect changes in pollution levels in streams).			
D.	<b>S11.A.1.3.4</b> Compare the rate of use of natural resources and their impact on sustainability.			

## **S11.A.2 Processes, Procedures and Tools of Scientific Investigations**

S11.A.2.1 Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process.

### **PA Standard References: 3.2.10.B, 3.2.10.D**

X – performance assessed during that semester

	<b>Performance Indicators</b>	<b>1</b>	<b>2</b>	<b>Assessment</b>
A.	<b>S11.A.2.1.1</b> 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.			
B.	<b>S11.A.2.1.2</b> Critique the elements of the design process (e.g., identify the problem, understand criteria, create solutions, select solution, test/evaluate, and communicate results) applicable to a specific technological design.			
C.	<b>S11.A.2.1.3</b> Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.			
D.	<b>S11.A.2.1.4</b> Critique the results and conclusions of scientific inquiry for consistency and logic.			
E.	<b>S11.A.2.1.5</b> Communicate results of investigations using multiple representations.			

S11.A.2.2 Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide.

### **PA Standard References: 3.7.10.B, 3.8.10.B**

X – performance assessed during that semester

	<b>Performance Indicators</b>	<b>1</b>	<b>2</b>	<b>Assessment</b>
A.	<b>S11.A.2.2.1</b> Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality).			
B.	<b>S11.A.2.2.2</b> Explain how technology (e.g., GPS, spectroscope, scanning electron microscope, pH meters, probe interface, imaging technology, telescope) is used to extend human abilities and precision.			

## **S11.A.3 Systems, Models and Patterns**

S11.A.3.1 Analyze the parts of a simple system, their roles, and their relationships to the system as a whole.

### **PA Standard References: 3.1.10.A, 3.1.10.E, 4.3.10.C**

X – performance assessed during that semester

	<b>Performance Indicators</b>	<b>1</b>	<b>2</b>	<b>Assessment</b>
A.	<b>S11.A.3.1.1</b> Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain to explain a system and its parts.			
B.	<b>S11.A.3.1.2</b> Analyze and predict the effect of making a change in one part of a change in one part of a system on the system as a whole.			
C.	<b>S11.A.3.1.3</b> Use appropriate quantitative data to describe or interpret a system (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).			
D.	<b>S11.A.3.1.4</b> Apply the universal systems model of inputs, processes,			

	outputs, and feedback to a working system (e.g. heating, motor, food production) and identify the resources necessary for operation of the system.			
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S11.A.3.2 Compare observations of the real world to observations of a constructed model.

**PA Standard References: 3.1.10.B, 3.2.10.B, 4.1.10.B, 4.6.10.A**

X – performance assessed during that semester

	<b>Performance Indicators</b>	<b>1</b>	<b>2</b>	<b>Assessment</b>
A.	<b>S11.A.3.2.1</b> Compare the accuracy of predictions represented in a model to actual observations and behavior.			
B.	<b>S11.1.3.2.2</b> Describe advantages and disadvantages of using models to simulate processes and outcomes.			
C.	<b>S11.A.3.2.3</b> Describe how relationships represented in models are used to explain scientific or technological concepts (e.g., dimensions of object within the solar system, life spans, size of atomic particles, topographic maps).			

S11.A.3.3 Compare and analyze repeated processes or recurring elements in patterns.

**PA Standard References: 3.1.10.C, 3.2.10.B, 3.5.10.B**

X – performance assessed during that semester

	<b>Performance Indicators</b>	<b>1</b>	<b>2</b>	<b>Assessment</b>
A.	<b>S11.A.3.3.1</b> Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order.			
B.	<b>S11.A.3.3.2</b> Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties.			
C.	<b>S11.A.3.3.3</b> Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves).			

## **S11.B. Biological Sciences**

### **S11.B.1 Structure and Function of Organisms**

S11.B.1.1 Explain structure and function at multiple levels or organization.

**PA Standards Reference: 3.3.10A, 3.3.10.B, 4.6.10.A, 4.7.10.B**

	<b>Performance Indicators</b>	<b>1</b>	<b>2</b>	<b>Assessment</b>
A.	<b>S11.B.1.1.2</b> Compare and contrast the structural and functional similarities and differences among living things (e.g., classify organisms into classification groups, compare systems).			

### **S11.B.3 Ecological Behavior and Systems**

S11.B.3.1 Use evidence or examples to explain the characteristics of and interactions within an ecosystem.

**PA Standard Reference: 4.3.10.C, 4.6.10.A**

X – performance assessed during that semester

	<b>Performance Indicators</b>	<b>1</b>	<b>2</b>	<b>Assessment</b>
A.	<b>S11.B.3.1.1</b> Explain the significance of diversity in ecosystems.			
B.	<b>S11.B.3.1.2</b> 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.			
C.	<b>S11.B.3.1.3</b> Describe how living organisms affect the survival of one another.			
D.	<b>S11.B.3.1.4</b> Compare the similarities and differences in the major biomes (e.g., desert, tropical rain forest, temperate forest, coniferous			

	forest, tundra) and the communities that inhabit them.			
E.	<b>S11.B.3.1.5</b> Predict how limiting factors (e.g., physical, biological, chemical) can affect organisms.			

S11.B.3.2 Analyze patterns of change in natural or human-made systems over time.

**PA Standard Reference: 3.1.10.C, 4.3.10.B, 3.1.10.E, 4.3.10.C**

X – performance assessed during that semester

	<b>Performance Indicators</b>	<b>1</b>	<b>2</b>	<b>Assessment</b>
A.	<b>S11.B.3.2.1</b> Use evidence to explain how cyclical patterns in population dynamics affect natural systems.			
B.	<b>S11.B.3.2.2</b> Explain biological diversity as an indicator of a healthy environment.			
C.	<b>S11.B.3.2.3</b> Explain how natural processes (e.g., seasonal change, catastrophic events, habitat alterations) impact the environment over time.			

S11.B.3.3 Explain how human-made systems impact the management and distribution of natural resources.

**PA Standard Reference: 4.2.10.C, 4.4.10.C, 3.8.10.C, 4.2.10.D**

X – performance assessed during that semester

	<b>Performance Indicators</b>	<b>1</b>	<b>2</b>	<b>Assessment</b>
A.	<b>S11.B.3.3.1</b> Describe different human-made systems and how they use renewable and nonrenewable natural resources (e.g., energy, transportation, distribution, management, and processing).			
B.	<b>S11.B.3.3.2</b> Compare the impact of management practices (e.g., production, processing, research, development, marketing, distribution, consumption, by-products) in meeting the need for commodities locally and globally.			
C.	<b>S11.B.3.3.3</b> Explain the environmental benefits and risks associated with human-made systems (e.g., integrated pest management, genetically engineered organisms, organic food production).			

## S11.C Physical Science

### S11.C.2 Forms, Sources, Conversion, and Transfer of Energy

S11.C.2.2 Demonstrate that different ways of obtaining, transforming, and distributing energy have different environmental consequences.

**PA Standard Reference: 3.4.10.B, 4.8.10.C, 4.2.10.A**

X – performance assessed during that semester

	<b>Performance Indicators</b>	<b>1</b>	<b>2</b>	<b>Assessment</b>
A.	<b>S11.C.2.2.1.</b> Explain the environmental impacts of energy use by various economic sectors (e.g., mining, logging, and transportation) on environmental systems.			
B.	<b>S11.C.2.2.2</b> Explain the practical use of alternative sources of energy (i.e., wind, solar, and biomass) to address environmental problems (e.g., air quality, erosion, resource depletion).			
C.	<b>S11.C.2.2.3</b> Give examples of renewable energy resources (e.g., wind, solar, biomass) and nonrenewable resources (e.g., coal, oil, natural gas) and explain the environmental and economic advantages and disadvantages of their use.			

## S22.D Earth and Space Science

### S11.D.1 Earth Features and Processes that Change the Earth and its Resources

S11.D.1.2 Analyze how human-made systems impact the management and distribution of natural resources.

**PA Standard Reference: 4.2.10.C, 3.5.10.B, 3.6.10.A**

*X – performance assessed during that semester*

A.	<b>S11.D.1.2.1</b> Evaluate factors affecting availability, location, extraction, and use of natural resources.			
B.	<b>S11.D.1.2.2</b> Explain the impact of obtaining and using natural resources for the production of energy and materials (e.g., resource renewal, amount of pollution, deforestation).			

## ASSESSMENTS

**PSSA Assessment Anchors Addressed:** The teacher must be knowledgeable of the PDE Assessment Anchors and/or Eligible Content and incorporate them into this planned instruction. Current assessment anchors can be found at [pde@state.pa.us](mailto:pde@state.pa.us).

**Suggested Formative Assessments:** The teacher will develop and use standards-based assessments throughout the course.

- Pre-Assessments of prior knowledge (e.g. entrance cards or KWL chart)
- Labs/lab reports
- Bell ringers/Problems of the Day(PODs)
- Discussions
- Teacher observation/Questioning
- Graphic organizers (e.g. Venn diagrams, word mapping, webbing, KWL chart, etc.)
- Summarizing
- Retelling
- Notetaking
- Problem-based learning modules
- Authentic assessment
- Oral presentations
- Outlining
- Journaling
- Student presentations/projects
- Open-ended response
- Quizzes/tests
- Activities
- Classroom Performance System (CPS)
- White boards

### **Suggested Summative Assessments:**

- Essays
- Open-Ended Responses
- Projects
- Quizzes/tests
- Student presentations
- Portfolios

- Lab Practical
- Lab Report

### **District Approved Assessment Instruments**

- PSSA Tests-Grades 4, 8 and 11 only

### **Differentiated Instructional Assessment Strategies**

**Portfolio Assessment:**        \_\_\_\_\_ Yes      X   No

**District-wide Final Examination Required:**        \_\_\_\_\_ Yes      X   No

Course Challenge Assessment (Describe):

### **REQUIRED COURSE SEQUENCE AND TIMELINE**

(Content must be tied to objectives)

**This is a topical outline. Specific content is identified in the assessment anchors.**

<u>Content Sequence</u>	<u>Dates</u>
I. Nature of Science	<b>2 weeks</b>
II. Ecology	<b>5 weeks</b>
A. Biotic/Abiotic	
B. Habitat, Niche	
C. Energy Flow	
1. Food Chains/Webs	
2. Pyramid	
D. Biomes-Types of Ecosystems	
E. Succession	
F. Population Ecology	
G. Biodiversity	
1. Endangered/Threatened Species	
2. Introduced/Invasive Species	
III. Integrated Pest Management	<b>1 week</b>
IV. Resource Use	<b>2 weeks</b>
A. Renewable/Nonrenewable	
B. Sustainability	
V. Energy	<b>4 weeks</b>
A. Fossil Fuels	

## B. Alternative/Renewable Sources

## VI. Environmental Health-Air, Water, Land, Indoor 4 weeks

### Objectives:

1. Conduct scientific investigations by formulating hypotheses, collecting and analyzing data, and drawing conclusions using appropriate tools.
- 2.. Describe the characteristics of and interactions within an ecosystem.
3. Analyze how populations grow and change and how population dynamics affect natural systems.
4. Analyze biological diversity as it relates to the stability of an ecosystem and how humans impact biodiversity.
5. Explain how humans impact management and distribution of natural resources.
6. Describe the environmental risks and benefits of integrated pest management.
7. Demonstrate that different ways of obtaining, transforming and distributing energy have different environmental consequences.
8. Describe environmental health and how humans impact it.

**WRITING TEAM:** Tina Toole, Rob Musi, Laura Dorunda, John Fedak

## WCSD STUDENT DATA SYSTEM INFORMATION

1. Is there a required final examination? X Yes      No
2. Does this course issue a mark/grade for the report card?  
     X Yes      No
3. Does this course issue a Pass/Fail mark?      Yes      X No
4. Is the course mark/grade part of the GPA calculation?  
     X Yes      No
5. Is the course eligible for Honor Roll calculation?      X Yes      No
6. What is the academic weight of the course?  
     No weight/Non credit      X Standard weight  
     Enhanced weight (Describe)