Blackhawk School District

CURRICULUM

Course Title:	**Environmental Science**
Grade Level(s):	**Eleventh-Twelfth**
Length of Course:	**Daily (42 minutes)**
Faculty Author(s):	**Theresa Adams**
Date:	**Fall 2008/ Revised May 2009 and October 2012**

MISSION STATEMENT:
The goal of science education is to develop within students an understanding of the world around us by fostering curiosity, developing inquiry skills, and creating an excitement for learning science.

COURSE DESCRIPTION:
Environmental Science utilizes an ecosystem approach to the study, understanding and solution of environmental problems. Topic selection is based on major themes of modern environmental sciences: humans and sustainability; science and ecological principles; sustaining biodiversity and natural resources; and sustaining environmental quality and human societies. Students will also gain an awareness of the importance of Earth's systems in sustaining our daily lives.

PA Common Core Standards for Reading and Writing in Science and Technical Subjects:
Pennsylvania Department of Education has released standards that describe what students in the science and technical subjects' classrooms should know and be able to do with the English language in reading and writing, grade 6 through 12. The standards provide the targets for instruction and student learning essentials for success in all academic areas, not just language arts classrooms. Although the standards are not a curriculum or a prescribed series of activities, Blackhawk School District has used them to develop this science curriculum.
The standards for Reading are available at:
http://static.pdesas.org/content/documents/PA_Common_Core_Standards_for_Reading_in_Science_And_Technical_Subjects_8-7-12.pdf

The standards for Writing are available at:
http://static.pdesas.org/content/documents/PA_Common_Core_Standards_for_Writing_in_Science_and_Technical_Subjects_8-7-12_rev_2.pdf

ESSENTIAL QUESTIONS:

Essential questions are the heart of the curriculum. Essential questions are conceptual commitments that teachers will use to guide instructional decision-making. In addition, they are kid friendly so that students can easily understand them. Essential questions are meant to be shared with students in either discussion or posting in the classroom. Essential questions provide the focus for teaching and learning. The following are the Essential Questions for this class:

1. **How can your actions today contribute to a greener/more sustainable environment tomorrow?**
2. **How do the choices you make impact the success or failure of your society as a sustainable environment?**
3. **Explain how the structure of the Earth and its cyclical processes directly effect the composition and temperature of the atmosphere.**
4. **How do humans impact the structure of the Earth and the natural occurrences that take place?**
5. **How do abiotic and biotic factors determine the success or failure of a species under stressful environmental conditions?**
6. **How does the shape of the biomass pyramid relate to the structure of ecosystems and the flow of energy through them?**
7. **What impact do humans have on the cycling of nutrients through ecosystems?**
8. **How would your life be different if you inhabited a biome different than were you live now?**
9. **How do humans impact the major terrestrial biomes?**
10. **How do we classify biomes based on temperature, precipitation, and their location on the globe?**
11. **What impacts do humans have on aquatic ecosystems?**
12. **Why can you find an organism in a freshwater ecosystem but the same organism wouldn't be found in a marine ecosystem?**
13. **How do the choices we make effect the rate of population growth?**
14. **How do humans affect the types of interactions between other species?**
15. **Would the number of threatened/endangered species be different if humans weren't around?**
16. **How important is the role of biodiversity in contributing to sustainable ecosystems?**
17. **How important is the role of biodiversity in our lives as humans?**
18. **What ways do we impact the water around us? Freshwater and salt water?**
19. **What would happen to us and other species if there was no clean usable water sources available?**
20. **How do we impact air quality with the choices we make each day?**
21. **How would the composition of the air/atmosphere be different if the industrial revolution and the invention of the automobile had never occurred?**
22. **Is global warming fact or fiction?**
23. **How would our use of energy sources be different if the industrial revolution never occurred?**
24. **Would the use of nuclear energy have less of a long-term impact on our environment than fossil fuels?**
25. **What are the most promising alternative energy sources for future use?**
26. **How would the composition of the atmosphere and the condition of our water sources be different if all we utilized were alternative energy sources?**
27. **How do we play an important role on our own health based upon our interactions with the environment?**

Assessing Essential questions is key to a robust curriculum. If Essential Questions are the focal point of learning, how then do we assess students? The following is an overview of recommended assessments to the Essential Questions. In addition, Differentiated learning opportunities are embedded as well (noted by DI).

Chapter 1
EQ: How can your actions today contribute to a greener/more sustainable environment tomorrow?
How do the choices you make impact the success or failure of your society as a sustainable environment?
EQ Assessment: On each exam, the student will identify green practices/ways they can live a more sustainable life.

Chapter 2
EQ: How can analyzing statistics and utilizing the scientific method be helpful in evaluating information about the environment?
EQ Assessment: Shannon-Weiner Index of Biodiversity outdoor lab activity.

Chapter 3
EQ: Explain how the structure of the Earth and its cyclical processes directly effect the composition and temperature of the atmosphere.
How do humans impact the structure of the Earth and the natural occurrences that take place?
EQ Assessment: Article Discussion and 25 word summary

Chapter 4
EQ: How do abiotic and biotic factors determine the success or failure of a species under stressful environmental conditions?
EQ Assessment: Golf Course Impacts group activity.

Chapter 5
EQ: How does the shape of the biomass pyramid relate to the structure of ecosystems and the flow of energy through them?
What impact do humans have on the cycling of nutrients through ecosystems?
DI and EQ Assessment: Biomass Pyramid Activity, Design a food chain activity, carbon/nitrogen/phosphorus cycle Presentations (make a cartoon, video, and diagram)

Chapter 6
EQ: How would your life be different if you inhabited a biome different than were you live now?
How do humans impact the major terrestrial biomes?
How do we classify biomes based on temperature, precipitation, and their location on the globe?
DI and EQ Assessment: Biome project (Differentiated by students choosing PowerPoint or poster of a biome and all students will do a research paper), Students will identify specific environmental issues involved with their biomes and solution to those problems.

Chapter 7
EQ: What impacts do humans have on aquatic ecosystems?
Why can you find an organism in a freshwater ecosystem but the same organism wouldn't be found in a marine ecosystem?
EQ Assessment: Tracing a pathway through the water cycle on exam.

Chapter 8
EQ: How do the choices we make effect the rate of population growth?
How do humans affect the types of interactions between other species?
EQ Assessment: Population cause and effect graphic organizer

Chapter 10
EQ: Would the number of threatened/endangered species be different if humans weren't around?
How important is the role of biodiversity in contributing to sustainable ecosystems?
How important is the role of biodiversity in our lives as humans?
DI and EQ Assessment: Threatened/endangered species report, including "How do humans impact species?" (Differentiated by choice of visual aid ("wanted" poster, brochure, or commercial and using a differentiated scoring rubric)

Chapter 11
EQ: What ways do we impact the water around us? Freshwater and salt water?
What would happen to us and other species if there was no clean usable water sources available?
EQ Assessment: Discussion, Exit Slip, Exam Questions, Essay Questions

Chapter 12
EQ: How do we impact air quality with the choices we make each day?
How would the composition of the air/atmosphere be different if the industrial revolution and the invention of the automobile had never occurred?
EQ Assessment: Cause and Effect chart, Essay, Article Discussion

Chapter 13
EQ: Is global warming fact or fiction?
EQ Assessment: Report on Global Warming

Chapter 17
EQ: How would our use of energy sources be different if the industrial revolution never occurred?
Would the use of nuclear energy have less of a long-term impact on our environment than fossil fuels?
EQ Assessment: Poster on positives and negatives of energy source.

Chapter 18
EQ: What are the most promising alternative energy sources for future use?
How would the composition of the atmosphere and the condition of our water sources be different if all we utilized were alternative energy sources?
DI and EQ Assessment: Alternative energy projects (Students will choose a project based on interest: Choice of report, brochure, PowerPoint, video, poster, song), essay questions, article summaries

Chapter 20:
EQ: How do we play an important role on our own health based upon our interactions with the environment?
EQ Assessment: Essay question on exam

ROBUST VOCABULARY:
Robust vocabulary words are Tier 2 words, meaning that they are complex, powerful, and generalizable. Robust vocabulary words support language development of both lower and high level learners. In addition, robust vocabulary instruction helps prepare students for SATs, upper level high school classes, and college. "Studies showed that robust instruction was quite effective not only for learning the meanings of words but also for affecting reading comprehension." (p. 2 *Bringing Words to Life)*

Teachers are asked to commit to teaching and students USING these words throughout the entire year. Using a variety of instructional strategies, students will learn the meaning of these word in a deep and meaningful way in this content and across other content areas.

The Robust Vocabulary for this class are: **Sustainability/Sustain, Stewardship, Role, Impact, Resource, Interact, Diverse, Convert, Nuclear, Controversy, Ethic**

COURSE OUTLINE	OBJECTIVES (PA Anchors)	PROPOSED TIME	RESOURCES	LESSON REFLECTION (for future revisions)
Chapter 1: Science and the Environment a. What is Environmental Science? b. Changes to the Environment over the years. c. Economics and the Environment d. Population and consumption	S11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole. S11.A.3.2.3 Describe how relationships represented in model are used to explain scientific or technological concepts. S11.B.3.1.1 Explain the significance of diversity in ecosystems. S11. B.3.1.3 Describe how living organisms affect the survival of one another. S11.B.3.1.5 Predict how limiting factors (e.g., physical, biological, chemical) can affect organisms. S11. B.3.2.2 Explain biological diversity as an indicator of a healthy environment. S11.B.3.3.2 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. S11.B.3.3.3 Explain the environmental benefits and risks associated with human-made systems (e.g., integrated pest management, genetically engineered organisms, organic food production).	5 days	*Holt Environmental Science Text* – Chapter 1	
Chapter 2: Tools of Environmental Science a. Describing the Experimental Method	S11.A.1.1.2 Analyze and explain the accuracy of scientific facts, principles, theories, and laws. S11.A.1.1.3 Evaluate the appropriateness of	5 days	*Holt Environmental Science Text* – Chapter 2 Butterfly picture	

b. Correlations between two or more events in time. c. Types of models: physical, graphical, conceptual, and mathematical. d. Making informed environmental decisions.	research questions (i.e. testable vs. non-testable). S11.A.2.1.1 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 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 Use data to make inferences and predictions, or to draw conclusions, demonstrating understand of experimental limits. S11.A.2.1.5 Communicate results of investigations using multiple representations. S11.A.2.2.1 Evaluate appropriate methods, instruments, and scales for precise quantitative and qualitative observations (e.g. to compare properties of materials, water quality).		activity	
Chapter 3: The Dynamic Earth a. Composition and structure of Earth and its tectonic plates. b. Relating volcanic eruptions and climate change. c. Describe the composition of the Earth's atmosphere. d. Explain the mechanisms of heat transfer in the atmosphere. e. Explain global warming f. Describe the water cycle g. Describe ocean water and ocean currents h. Explain open and closed systems	S11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g. tectonics, conservation of mass and energy). S11.A.1.3.2 Describe or interpret dynamic changes to stable systems (e.g. food webs, tectonics). S11.A.3.1.4 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.	10-15 days	*Holt Environmental Science Text* – Chapter 3	

	S11.D.1.3.1 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 Explain relationships among physical characteristics, vegetation, topography, and flow as it relates to water systems. S11.D.1.3.3 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. S11.D.2.1.1 Describe how changes in concentration of minor components (e.g., O2, CO2, dust, pollution) in Earth's atmosphere may be linked to climate change. S11.D.2.1.2 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 Explain weather patterns and seasonal changes using the concepts of heat and density. S11.D.2.1.4 Analyze weather maps and weather data (e.g., air masses, fronts, temperature, air pressure, wind speed, wind direction, precipitation) to predict regional or global weather events. S11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions (i.e. weather systems).			

Chapter 4: The Organization of Life a. Abiotic and biotic factors in an ecosystem b. Population vs. species c. Evolution by natural selection, artificial selection, and resistance	S11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g. tectonics, conservation of mass and energy, theory of evolution). S11.B.3.1.2 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 Describe how living organisms affect the survival of one another.	10-15 days	*Holt Environmental Science Text* – Chapter 4	
Chapter 5: How Ecosystems Work a. Transfer of energy through ecosystems b. Energy transfer through food chains, food webs, and trophic levels. c. Mapping out the carbon, nitrogen, and phosphorus cycles. d. Changing ecosystems: ecological succession, primary succession, and secondary succession.	S11.A.1.3.1 Use appropriate quantitative data to describe or interpret change in systems (e.g. biological indices). S11.A.1.3.2 Describe or interpret dynamic changes to stable systems (e.g. food webs, tectonics). S11.A.1.3.3 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.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole. S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g. life spans). S11.B.1.1.3 Compare and contrast cellular processes (e.g. photosynthesis and respiration).	10 days	*Holt Environmental Science Text* – Chapter 5 Carbon Cycle Cartoon	

	S11.B.3.1.5 Predict how limiting factors (e.g. physical, biological, chemical) can affect organisms. S11.B.3.2.1 Use evidence to explain how cyclical patterns in population dynamics affect natural systems. S11.B.3.2.3 Explain how natural processes (e.g. seasonal changes, catastrophic events, habitat alterations) impact the environment over time. S11.D.2.1.1 Describe how changes in concentration of minor components (e.g., O2, CO2, dust, pollution) in Earth's atmosphere may be linked to climate change.			
Chapter 6: Biomes a. Classifying biomes based on vegetation, temperature, and precipitation. b. Major types of biomes: tropical rainforests, temperature deciduous forests, taiga, grasslands, chaparral, deserts, tundra	S11.B.3.1.4 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. S11.B.3.1.5 Predict how limiting factors (e.g. physical, biological, chemical) can affect organisms. S11.B.3.2.1 Use evidence to explain how cyclical patterns in population dynamics affect natural systems. S11.B.3.2.2 Explain biological diversity as an indicator of a healthy environment.	15 days	*Holt Environmental Science Text* – Chapter 6 Biome PowerPoint Project 3-D Biome Project	
Chapter 7: Aquatic Ecosystems a. Describe freshwater ecosystems b. Littoral and benthic zones making up a lake or pond c. Describing wetlands d. Describing salt marshes and mangrove swamps	S11.D.1.3.1 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).	10 days	*Holt Environmental Science Text* – Chapter 7	

e. Describing threats to coral reefs and ocean organisms.	S11.D.1.3.2 Explain relationships among physical characteristics, vegetation, topography, and flow as it relates to water systems. S11.D.1.3.3 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.			
Chapter 8: Understanding Populations a. Properties of populations b. Reproduction and population growth c. Regulation of populations d. Interactions among species: competition, predation, parasitism, mutualism, commensalism, symbiosis.	S11.B.3.1.1 Explain the significance of diversity in ecosystems. S11.B.3.1.3 Describe how living organisms affect the survival of one another. S11.B.3.1.4 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. S11.B.3.1.5 Predict how limiting factors (e.g. physical, biological, chemical) can affect organisms. S11.B.3.2.1 Use evidence to explain how cyclical patterns in population dynamics affect natural systems.	10 days	*Holt Environmental Science Text* – Chapter 8	
Chapter 10: Biodiversity a. Diversity of species b. Benefits of biodiversity c. Threatened and endangered species d. Areas of critical biodiversity	S11.B.3.1.1 Explain the significance of diversity in ecosystems. S11.A.1.2.1 Explain and apply scientific concepts to societal issues using case studies (e.g. deforestation, environmental health, energy). S11.B.1.1.2 Compare and contrast the structural and functional similarities and differences among living things (e.g. classify organisms into classification groups, compare systems).	15 days	*Holt Environmental Science Text* – Chapter 10	

	S11.B.3.1.3 Describe how living organisms affect the survival of one another. S11.B.3.1.5 Predict how limiting factors (e.g. physical, biological, chemical) can affect organisms. S11.B.3.2.2 Explain biological diversity as an indicator of a healthy environment.			
Chapter 11: Water a. Distribution of Earth's water resources b. Explore the relationship between groundwater and surface water c. Classifying water pollutants: pathogens, organic matter, organic chemicals, inorganic chemicals, heavy metals, and physical agents. d. Comparing point-source and nonpoint-source pollution.	S11.A.2.2.1 Evaluate appropriate methods, instruments, and scales for precise quantitative and qualitative observations (e.g. to compare properties of materials, water quality). S11.A.2.2.2 Explain how technology (e.g. pH meter, probe) is used to extend human abilities and precision. S11.A.3.1.1 Apply systems analysis, showing relationships (e.g. flowcharts, concept maps), input and output, and measurements to explain a system and its parts.	10 days	*Holt Environmental Science Text* – Chapter 11 *Water Cycle Game* *Water Flow Model*	
Chapter 12: Air a. Air pollutants b. Formation of smog c. Describing the process of thermal invasion. d. What is acid precipitation? e. Effects of acid precipitation on plants, soils, and aquatic ecosystems	S11.D.1.2.2 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.1.3.3 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. S11.D.2.1.1 Describe how changes in concentration of minor components (e.g., O2, CO2, dust, pollution) in Earth's atmosphere may be linked to climate change.	10-15 days	*Holt Environmental Science Text* – Chapter 12	

	S11.D.2.1.2 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.)			
Chapter 13: Atmosphere and Climate Change a. Distinguishing between weather and climate b. Atmospheric and oceanic circulation patterns c. What is the ozone layer and how is it damaged? d. The greenhouse effect and global warming e. Consequences of global warming	S11.B.3.2.3 Explain how natural processes (e.g. seasonal changes, catastrophic events, habitat alterations) impact the environment over time. S11.D.2.1.1 Describe how changes in concentration of minor components (e.g., O2, CO2, dust, pollution) in Earth's atmosphere may be linked to climate change. S11.D.2.1.2 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 Explain weather patterns and seasonal changes using the concepts of heat and density.	10 days	*Holt Environmental Science Text* – Chapter 13	
Chapter 17: Nonrenewable Energy a. Energy resources and fossil fuels b. Generating electricity by fuels c. Formation and use of fossil fuels d. Production and utilization of nuclear energy e. Advantages and disadvantages of nuclear energy	S11.B.3.3.1 Describe different human-made systems and how they use renewable and nonrenewable natural resources (I.e. energy, transportation, distribution, management, and processing). S11.C.2.2.3 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.	15- days	*Holt Environmental Science Text* – Chapter 17	

	S11.D.1.2.1 Evaluate factors affecting availability, location, extraction, and use of natural resources.			
Chapter 18: Renewable Energy a. Advantages and disadvantages of renewable energies such as solar, wind, biomass, hydroelectricity, and geothermal energy b. Differences between passive solar heating, active solar heating, and photovoltaic energy. c. Describing hydroelectric energy, geothermal energy, and geothermal heat pumps. d. Describing alternative energy technologies such as tidal power, ocean thermal energy, and hydrogen power. e. Exploring energy efficiency and energy conservation.	S11.A.2.2.1 Evaluate appropriate methods, instruments, and scales for precise quantitative and qualitative observations (e.g. to compare properties of materials, water quality). S11.C.2.2.3 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. S11.D.1.2.1 Evaluate factors affecting availability, location, extraction, and use of natural resources. S11.D.1.2.2 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.2.1.4 Analyze weather maps and weather data (e.g., air masses, fronts, temperature, air pressure, wind speed, wind direction, precipitation) to predict regional or global weather events. S11.C.2.2.2 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).	15 days	*Holt Environmental Science Text* – Chapter 18 The Great Energy Debate	
Chapter 20: The Environment and Human Health a. Exploring pollutants, their sources, and their possible effects on human health.	S11.B.3.3.2 Compare the impact of management practices (e.g. production, processing, research, development, marketing, distribution consumption, by-products) in meeting the need	10-15 days	*Holt Environmental Science Text* – Chapter 20	

b. Describing the relationship between waste, pollution, and human health. c. Changes in the environment that can lead to the spread of infectious diseases.	for commodities locally and globally. S11.B.3.3.3 Explain the environmental benefits and risks associates with human-made systems (e.g. integrated pest management, genetically engineered organisms, organic food production). S11.C.2.2.1 Explain the environmental impacts of energy use by various economic sectors (e.g., mining, logging, transportation) on environmental systems.			