Secondary Curriculum Maps

Cumberland Valley School District

Soaring to Greatness, Committed to Excellence

Environmental Science

CVSD *Environmental Science* Curriculum Map ~ *Grade 9*

CV Priority Standard/PA Academic Standard
4.5.10.C Analyze real world data and explain how point and non-point source pollution can be detected and eliminated.
Taught in Unit(s)
Unit 2 Population dynamics and human population growth impact Unit 4 Climate Dynamics Unit 5 The atmosphere and air pollution Unit 6 Soil and agriculture Unit 7 Renewable and Non-Renewable resources Unit 8 Student Centered Learning (Solid waste management)
Explanation/Example of Standard
Human activities have significantly altered the biosphere. Pollution can have an immediate or long term effect on both the environment and human health. Society should minimize pollution produced and impacts created. The consequences of increases in human populations and consumption of natural resources are described by science. Even though science does not decide upon the actions societies take, science can help predict the consequences of those actions. Ex-Changing ecological footprint of the average American - Different sources of fossil fuels and the CO_2 released per unit of energy - Equipment and techniques to reduce both indoor and environmental air pollution (acid rain/mercury) - Erosion control measures - Nutrient use and changing agricultural practices to reduce runoff - Changes to mining operation to protect local communities and the environment. -Reduce, reuse, recycle in product consumption and waste disposal
Common Misconceptions
Most students hold the misconception that air pollution and water pollution affect a limited area. In fact, air pollution can fall to the ground in precipitation, seep into watersheds, and run into bodies of water. Water pollution can evaporate into the air, all the while being carried to larger and larger areas. Everyday experience, as well as the portrayal of pollution in the news, give students an understanding that all pollution is visible. Teachers should help students expand their understanding of pollutants to include materials that are not visible and that can travel across systems—air, water, soil.

Big Idea(s)	Essential Question(s)
The Earth processes affect and are affected by human activities Human societies consume resources and produce pollution, but there are ways to reduce the amount of pollution that is produced. Pollution can harm the health of the environment and the health of humans.	• How do Earth's processes and human activities affect each other? • How does a growing population impact the environment? • How does our use of fossil fuels affect the biosphere? • What are the main types and sources of outdoor air pollution? • How is human health affected by air pollution? • Explain mitigation and its role in maintaining environmental health. • Why are there problems with pesticide use? • Why is organic and IPM preferred over traditional farming and pesticide use? • How are ecosystems affected by acid mine drainage?

	• How does energy extraction affect the environment? • How can we reduce the environmental impact of landfills and incinerators?
Assessments	
See unit map for specific unit common assessments.	
Concepts (what students need to know)	**Skills** (what students must be able to do)
• Human activities have can cause both local and global impacts. • Pollution affects the health of the environment. • Pollution affects the health of humans. • Pollution impacts can be economically reduced.	• Identify sources of pollution. • Describe effects of pollution on the environment • Describe effects of pollution on humans. • Evaluate different control methods to reduce the impact of pollution.

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CV Priority Standard/PA Academic Standard
4.5.10.D. Research practices that impact biodiversity in specific ecosystems. **4.1.8.D** - Use the theory of natural selection to examine the causes and consequences of **extinction.**
Taught in Unit(s)
Unit 3 Biodiversity and extinction Unit 6 Soil and agriculture
Explanation/Example of Standard
Biological diversity at all levels (genetic, species, ecological) increases the resilience and stability of systems. It allows ecosystems to adapt to change without collapse. There have been 5 previous mass extinctions recorded in the geologic record, we are currently in the 6th We will analyze the relationship between habitat changes to plant and animal population fluctuations
Common Misconceptions
Extinction is a natural process that humans have little influence. Losing species is not important to human existence.

Big Idea(s)	**Essential Question(s)**
Evolution by natural selection creates biodiversity. Biodiversity is important for stability, resilience, and ecological services of ecosystems. Keystone species increase biodiversity, while invasive species decreases biodiversity. Describe the impact humans have on habitat loss, invasive species, population growth, pollution, climate change, and over fishing (HIPPCO).	• How do you measure biological diversity? • Why does biodiversity vary around the planet? • How is biological diversity created? • Why is biological diversity important to ecosystems and to humans? • How do humans affect biological diversity? • Explain the effect of HIPPCO on the 6th mass extinction?

Assessments	
See unit map for specific unit common assessments	
Concepts (what students need to know)	**Skills** (what students must be able to do)
• Biodiversity is not uniform around the world. • Plate tectonics creates varied habitats. • Natural selection builds biodiversity. • Interactions between species in ecosystems are complex and contribute to biodiversity. • Humans benefit directly and indirectly from increased biodiversity. • Human actions have been reducing biodiversity and can be remembered through H.I.P.P.C.O. • Endemic species are particularly susceptible to extinction. • Current extinction rates are 1000 to 10,000 times the normal background rate as measured in the geologic record.	• Evaluate how ecosystems are changed by adding or removing species. • Interpret trends in data sets, propose reasons, predict consequences.

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CV Priority Standard/PA Academic Standard
4.1.10.E Analyze how humans influence the pattern of natural changes (e.g. primary/secondary **succession** and **desertification**) in **ecosystems** over time.
Taught in Unit(s)
Unit 2 - Population dynamics Unit 3- Biodiversity and extinction Unit 4- Climate dynamics Unit 6- Agriculture and soils
Explanation/Example of Standard
Human actions to maintain society and meet their own survival needs affect the environment in which they live, affecting the pace and timing of natural cycles of change. Many times these disruptions accelerate a natural change to a rate that is many hundreds, or even thousands, of times faster than background. Ex. – CO_2 levels in the atmosphere over the last 250 years - Ocean acidification over the last 100 years compared to last several million years - Temperature change (i.e. "hockey stick" graph) - Extinction rate world wide
Common Misconceptions
Animal and the plant life make-up the majority of life on Earth in comparison to humans. Humans (individually or in groups) cannot significantly impact the whole planet? Many students think that organisms are able to change body structure to best exploit their habitats, or that organisms respond to a changed environment by leaving to seek a better one. Students also often think that adaptations result from a purpose or design, or as a conscious process. Changes we are seeing are natural, occurring in the past, and will occur in the future, so humans cannot impact these natural changes (positively or negatively).

Big Idea(s)	**Essential Question(s)**
Human actions can significantly modify the functioning of cycles in the natural world.	**How do human actions impact the _____ cycle in nature?** **note: because this is taught in multiple units the _____ is to be filled in with the appropriate word for that unit.*

Assessments
See unit map for specific unit common assessments.

Concepts (what students need to know)	**Skills** (what students must be able to do)
• nature operates in cycles that involve positive and negative feedback loops for regulation • cycles can reach "tipping points" which drastically alter their functioning • human actions impact these cycles	• identify parts of a cycle • describe how parts are connected to make a functioning cycle • interpret how human actions will alter/impact the natural functioning of the cycle

CVSD *Environmental Science* Curriculum Map ~ *Grade 9*

CV Priority Standard/PA Academic Standard
4.5.10.A –Explain how public policy encourages or discourages the sustainable use of **natural resources**
Taught in Unit(s)
Unit 4- Climate dynamics Unit 5 – The atmosphere & air pollution Unit 6 – Soil and agriculture Unit 7 – Renewable and Non-Renewable resources Unit 8 - Student Centered Learning (land use planning)
Explanation/Example of Standard
Actions taken on public policy directly affects the choices that members of a society make in response to those actions in regards to the consumption of both renewable and nonrenewable resources. Students need to understand the link between policy decisions, research/data and societal consumption choices.
Common Misconceptions
Unfavorable outcomes for humanity are unpredictable and unforeseeable. Public policies to safeguard the environment and encourage sustainable use of resources are detrimental to the economy.

Big Idea(s)	**Essential Question(s)**
• Actions by elected officials determine the choices and course of society • "True cost" to the environment should be a factor in both economic and political decisions in regards to sustainability of human activities.	• Why do people differ on climate change? • What does data and research tell us about climate change? • Compare and contrast how human practices affect the health of the environment? • Explain how managing natural resources with man-made systems has both limits and economic impacts. • Why are fertilizers and other chemicals important to modern agriculture? • Why do consumers prefer organic produce? • How is land use distributed for different types of agriculture and how can food production be more sustainable? • Why is private and public land use regulated? • How can zoning regulations be used to maintain a sustainable environment? • Why are regulations regarding mining's impact on the environment and human health needed? • What can be done to reduce the effect of mining on the environment? • How can we use mineral resources more sustainably?

Assessments
See unit map for specific unit common assessments

Concepts (what students need to know)	**Skills** (what students must be able to do)
• Short term gains often runs counter to long term	• Evaluate evidence used in making a decision

sustainability. • Negative consequences of environmental choices many times are not immediately obvious. • Every human action has benefits and costs, which do not occur with equal probability. • Environmental choices should be made using the "precautionary principle"	• Based on data, predict environmental changes resulting from policy formation. • Research laws and policies that address the **sustainable** use of **natural resources** ○ (e. g. tax subsidies to fossil fuel companies and the consumption of fossil fuels, solid and liquid waste management, mandatory recycling legislation, agriculture industry and enterprise)

CVSD Science Curriculum Map ~ Environmental Science

Common Core State Standard	PA Core Standard
CCSS.ELA-LITERACY.RST.9-10.7	CC.3.5.9-10.G: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

Taught in Unit(s)

All units

Explanation/Example of Standard

Scientific work requires the organization of both qualitative and quantitative data in order to facilitate the analysis of the results in order to achieve valid and reliable conclusions.

Common Misconceptions

Figures (e.g. pie charts, bar graphs, line graphs) are interchangeable, and chosen based upon the developer's preference.
Scientific data is open to interpretation based upon one's own point-of-view.

Big Idea(s)	Essential Question(s)
The organization and presentation of data allows an observer to make valid and reliable conclusions about the meaning of data sets.	• How does a scientist record the data that is produced during a scientific investigation? • How does a scientist match the appropriate figure to a given data set?

Assessments

See unit map for specific unit common assessments

Concepts (what students need to know)	Skills (what students must be able to do)
• Line graphs are used to show a change over time, bar graphs are used to compare several things, and pie charts show the percentage composition of something. • All figures and tables must be appropriately captioned such that they can stand alone without further explanation; tables are captioned above, while figures are captioned beneath.	• Accurately record the data and observations that are produced during a scientific investigation • Select an appropriate figure, and then present a given data set in a manner that facilitates analysis and conclusion making • Analyze a given figure or mathematical model and make valid conclusions

CVSD Science Curriculum Map ~ Environmental Science

Common Core State Standard	PA Core Standard
CCSS.ELA-LITERACY.RST.9-10.3	CC.3.5.9-10.C: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Taught in Unit(s)

All units

Explanation/Example of Standard

Scientific protocols convey information and procedures that must be applied with precision and accuracy in order to achieve expected outcomes.

Common Misconceptions

Scientific protocols can be followed one step at a time, without looking ahead for potential issues or relevant preparations.

Big Idea(s)	Essential Question(s)
In order to effectively follow a protocol, a scientist must have knowledge of the subsequent stages of the work in order to effectively anticipate and prepare for the use of specific ingredients or complex apparatuses.	• How does one prepare to follow a scientific protocol?

Assessments

See unit map for specific unit common assessments

Concepts (what students need to know)	Skills (what students must be able to do)
• Scientific protocols require reactants and equipment that often must be prepared in advance of their intended use • Quantities of reactants, the timing of steps, and the manner in which apparatuses are used can greatly affect the outcomes of scientific protocols	• Plan the use of equipment and supplies in advance of their intended use • Decipher scientific units and convert them to other scales, when necessary • Practice the use of equipment and apparatuses prior to their use

CVSD Science Curriculum Map ~ Environmental Science

Common Core State Standard	PA Core Standard
CCSS.ELA-LITERACY.RST.9-10.1	CC.3.5.9-10.A: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

Taught in Unit(s)

All units

Explanation/Example of Standard

Scientific writing is technical and full of vocabulary terms that have a precise meaning; in order to make meaning from a scientific text and apply it to authentic questions or problems, learners must approach their reading purposefully and with a willingness to revisit the text several times in search of specific details that are relevant to their work.

Common Misconceptions

A misconception that many students have is that science texts are impossible to comprehend; in truth, they are generally dense, and full of esoteric vocabulary terms, but with the use of context clues and supplemental sources, students can decipher even the most complex offerings.

Big Idea(s)	Essential Question(s)
Scientific writing relies upon vocabulary terms which have precise meanings; in order to process this text, the reader must be willing to approach it systematically and with a specific purpose in mind.	• How does one sort through the content in a science text in order to identify and apply key details?

Assessments

See unit map for specific unit common assessments

Concepts (what students need to know)	Skills (what students must be able to do)
• Scientific texts use vocabulary terms with specific meanings that are not easily replaced with common words • Vocabulary terms can often be deciphered via context clues • In order to convey the meaning of scientific concepts, precise vocabulary usage is essential	• Identify a purpose for reading, and choose well-suited reading strategies • Use context clues to decipher the meaning of scientific vocabulary • Demonstrate an understanding of science concepts by identifying key information and relating it to questions and problems

Grade: 9			Environmental Science (S)
Unit	**Timeline**	**Topics**	**Priority Standards**
Science and Scientific Theories	20 days	scientific method	4.1.10.F, 4.2.10.C, 4.3.10.D, ,4.4.10E,4.5.10F
		experimental design	All refer to Science as Inquiry Standadrs
		current environmental issues	
		importance of sustainability	
Population Dynamics	25 days	factors that affect population size and change	4.1.10.E
		causes of human population growth	4.5.10.C
		impacts of human population growth	
		future human population growth	
Biodiversity	24 days	biodiversity and how is it measured	4.1.10.E
		how is biodiversity created	4.5.10.D
		why is biodiversity important ecosystems/ humans	
		humans impacting biodiversity, 6th mass extinction	
Climate Dynamics	28 days	sturcture of atmosphere	4.1.10.E
		climate vs. weather	4.5.10.A
		Earth's energy budget and moving heat around	4.5.10.C
		enhanced greenhouse effect science evidence	
		human impact on enhanced greenhouse effect	
The Atmosphere and Air Pollution	23 days	types and sources of outdoor air pollution	4.5.10.A
		health effects of air pollution	4.5.10.C
		envrironmental effects of air pollution	
		controlling of air pollution	
		indoor air pollution and its impact	
Soils and Agriculture	16 days	soil characteristics and formation	4.1.10.E
		erosion types and prevention	4.5.10.A
		how food is produced	4.5.10.C
		pesticides and IPM	
Renewable and Non-renewable Resources	19 days	nonrenewable energy and resources	4.5.10.A
		renewable energy and resources	4.5.10.C
		energy efficiency	
Student Centered Learning	10 days	Solid waste management	4.5.10.C
		aquatic ecosystems, wetlands	4.5.10.A
		land use and planning	4.1.10.E