TOWNSHIP OF UNION PUBLIC SCHOOLS

Environmental Science

Revised December 18, 2018

Mission Statement

The mission of the Township of Union Public Schools is to build on the foundations of honesty, excellence, integrity, strong family, and community partnerships. We promote a supportive learning environment where every student is challenged, inspired, empowered, and respected as diverse learners. Through cultivation of students' intellectual curiosity, skills and knowledge, our students can achieve academically and socially, and contribute as responsible and productive citizens of our global community.

Philosophy Statement

The Township of Union Public School District, as a societal agency, reflects democratic ideals and concepts through its educational practices. It is the belief of the Board of Education that a primary function of the Township of Union Public School System is formulation of a learning climate conductive to the needs of all students in general, providing therein for individual differences. The school operates as a partner with the home and community

UHS Environmental Science CURRICULUM

Course Description

The Environmental course is designed as a science elective, to fulfill the third year science requirement, or for students wishing to take an additional science course during their senior year. The course is inquiry based and utilizes laboratory investigations, internet research, and projects, to develop science knowledge that will be interesting and applicable to the student seeking to gain a greater understanding of environmental issues, as well as human impact on the environment. In addition, students will develop skills such as: identifying problems; forming hypotheses; data collection & data analysis; and making inferences. The curriculum introduces relevant topics in studies of the study of earth's resources and pollution; human populations and their impact; renewable and non-renewable energy sources; and climate change. These topics have been aligned with the New Generation Science Standards.

Goal

The goal of Environmental Science is to produce students that have a basic understanding of their environment, relevant to their lives, and to understand causes and effects of the impact of human activities on the earth.

Recommended Textbooks

Withgott, Jay. (2011). Environmental Science. Pearson, Upper Saddle River, New Jersey.

Course Proficiencies

Students will be able to…

1. Improve writing skills through comprehensive written lab reports.
2. Differentiate the steps of the Scientific Method and utilize it as a model for all types of problem solving especially by conducting experiments and performing labs in effective collaborative groups.
3. Utilize mathematical skills, including measuring, using the metric system, performing calculations, interpreting formulas, graphing, and data analysis.
4. Assess the economics & policy that has been put in place to govern human use of the environment
5. Display an understanding of soil, agriculture, and food use, production, and impact.
6. Explore how forestry is integral in everyday life and ways to use it sustainably.
7. Identify the role that minerals play in human production and the impact that mining can cause.
8. Display an understanding of water resources, their supply, usage, and pollution.
9. Research and define what biodiversity is and how its role is integrated in the ecology of the world.
10. Develop a basic understanding of the atmosphere, how it's impacted and the conditions that are a direct result of humans.
11. Explore how human populations are changing and its relation to a nation's ecological footprint.
12. Understand how land is being used and the growing urbanization trend seen worldwide.
13. Assess the state of environmental health and toxicology of the natural resources humans use.
14. Identify the forms of waste produced by humans, their potential hazards, and clean up.
15. Understand the impact that climate change has on our planet. Relate cause and effect of climate change and meteorological trends.
16. Display an understanding of non-renewable energy, its limits, conservation, and its impacts
17. Explore renewable energy, its future, limits, and its potential impacts.
18. Explore ways of reducing our carbon footprint.

Pacing Guide- Course

Content		Number of Days
Unit 1:	Defining Environmental Science	30
Unit 2:	Study of Resources	60
Unit 3:	Human Populations & Impacts	45
Unit 4:	Atmosphere & Climate Change & Energy	45

UHS Environmental Science CURRICULUM			
CONTENT AREA: Environmental Science	**Grade: HS**	**UNIT #: 1**	**UNIT NAME: Defining Environmental Science**

Unit 1 Defining Environmental Science

This unit will explain the unintended consequences of harvesting natural resources from an ecosystem. The student will compare over time the impact of human activity on the cycling of matter and energy through ecosystems. The student will assess (using scientific, economic, and other data) the potential environmental impact of large-scale adoption of emerging technologies (e.g., wind farming, harnessing geothermal energy). Students will define how policy, law, and economics pertain to Environmental Science.

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING PE
1	**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.** [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]	**HS-ESS3-1**
2	**Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.** [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [*Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.*]	**HS-ESS3-3**
3	**Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*** [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]	**HS-ESS3-4**

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4	**Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.** [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [*Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.*]	**HS-ESS3-6**

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UHS Environmental Science CURRICULUM

CONTENT AREA: Environmental Science	Grade: HS	UNIT #: 1	UNIT NAME: Defining Environmental Science

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Analyzing and Interpreting Data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-3), (HS-ESS-4), (HS, ESS-6)

Using Mathematics and Computational Thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-ESS3-3)
- Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific knowledge, principles, and

Disciplinary Core Ideas

ESS3.A: Natural Resources

- Resource availability has guided the development of human society. (HS-ESS3-1)
- All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS-ESS3-1), (HS-ESS3-4)

ESS3.C: Human Impacts on Earth Systems

- The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3)
- Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)

ETS1.B: Developing Possible Solutions

- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. *(secondary to HS-ESS3-2),(secondary HS-ESS3-4)*

Crosscutting Concepts

Stability and Change (pp. 98-101)

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-ESS1-6)
- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS2-1)

Cause and Effect (pp. 87-89)

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3-1)

Systems and System Models

- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3-6)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- Modern civilization depends on major technological systems. (HS-ESS3-1),(HS-ESS3-3)
- Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to

theories.

- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1)
- Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Engaging in Argument from Evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-4)

Connections to Nature of Science

Scientific Investigations Use a Variety of Methods

- Science investigations use diverse methods and do not always use the same set of procedures to obtain data. (HS-ESS3-5)

increase benefits while decreasing costs and risks. (HS-ESS3-3),(HS-ESS3-4)

- New technologies can have deep impacts on society and the environment, including some that were not anticipated. (HS-ESS3-3)
- Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS3-2)

Connections to Nature of Science

Science is a Human Endeavor

- Science is a result of human endeavors, imagination, and creativity. (HS-ESS3-3)

Science Addresses Questions About the Natural and Material World

- Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. (HS-ESS3-4)
- Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. (HS-ESS3-4)
- Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. (HS-ESS3-4)

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• New technologies advance scientific knowledge. (HS-ESS3-5) **Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based on empirical evidence. (HS-ESS3-5) • Science arguments are strengthened by multiple lines of evidence supporting a single explanation. (HS-ESS3-5)		

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Connections to other DCIs in this grade-band:

HS.PS1.B (HS-ESS3-3); **HS.LS2.A** (HS-ESS3-3); **HS.LS2.B** (HS-ESS3-3), (HS-ESS3-6); **HS.LS2.C** (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6); **HS.LS4.D** (HS-ESS3-3),(HS-ESS3-4),(HS-ESS3-6); **HS.ESS2.A** (HS-ESS3-3), (HS-ESS3-6); **HS.ESS2.E** (HS-ESS3-3)

Common Core State Standards Connections:

ELA/Literacy -

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS3-1), (HS-ESS3-4)

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-4)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1)

Mathematics -

MP.2 Reason abstractly and quantitatively. (HS-ESS3-1), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6)

MP.4 Model with mathematics. (HS-ESS3-3), (HS-ESS3-6)

HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-6)

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-6)

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-6)

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CONTENT AREA: Environmental Science	**Grade: HS**	**UNIT #: 1**	**UNIT NAME: Defining Environmental Science**

Sample Activities, Lessons, and Lab
Define and Explore the Community of Science (Environmental Science Txt Section 1-2)
Explore and correlate the community of science to the Nature of Science (Environmental Science Txt Section 1-3)
Define and differentiate the types of Environmental Economics (Environmental Science Txt Section 2-1)
Research and explore the Environmental Policy of the United States (Environmental Science Txt Section 2-2)
Research and explore International Policy and how it correlates and influences the United States (Environmental Science Txt Section 2-3)
Model and explain the concept of the Tragedy of the Commons
Examine examples and model the concept of Carrying Capacity, Non-Renewable Energy, and Renewable Energy
LAB: Perform observations of the environment Lab and examine observations of the environment
LAB: Carry out a research lab with measurements and calculations of the Ecological Footprints of various countries
LAB: Examine and Model the Tragedy of the commons lab with beans and spoons to simulate fishing resources
LAB: Pearson's Ch 2 Working Trees Lab to Model how policy can affect economic savings with tree placement when building or planting
LAB: Pearson's Choose an Approach when students examine, define, and determine the proper Environmental policy approach to a problem
LAB: Pearson's Pending Law Lab where student research and determine the proper follow up for a pending Environmental Law

UHS Environmental Science CURRICULUM

CONTENT AREA: Environmental Science	Grade: HS	UNIT #: 2	UNIT NAME: Unit 2: Study of Resources

Unit 2 Study of the Terrestrial Ecosystem

- This unit will explain the unintended consequences of harvesting natural resources from an ecosystem. The student will compare over time the impact of human activity on the cycling of matter and energy through the natural resources of; Soil & Agriculture, Forestry, Minerals, Water, and Biodiversity.
- The student will assess (using scientific, economic, and other data) the potential environmental impact of
  - The role humans undertake in agriculture, livestock raising, and food production, its impact and possible sustainability concepts
  - how forestry is integral in everyday life and ways to use it sustainably.
  - Identifying the role that minerals play in human production and the impact that mining can cause.
  - Display an understanding of water resources, their supply, usage, and pollution.
  - The use and conservation of biodiversity resources and how their use plays an essential role in human health

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING PE
1	**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.** [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]	HS-ESS3-1
2	**Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.*** [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]	HS-ESS3-2
3	**Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.** [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [*Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.*]	HS-ESS3-3

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CONTENT AREA: Environmental Science	**Grade: HS**	**UNIT #: 2**	**UNIT NAME: Unit 2: Study of Resources**

4	**Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.** [Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).]	**HS-ESS2-5**
5	**Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.** [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] *[Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.]*	**HS-LS2-1**
6	**Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.** [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [*Assessment Boundary: Assessment is limited to provided data.*]	**HS-LS2-2**
7	**Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*** [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]	**HS-LS2-7**
8	**Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*** [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]	**HS-LS4-6**

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CONTENT AREA: Environmental Science	**Grade: HS**	**UNIT #: 2**	**UNIT NAME: Unit 2: Study of Resources**

9	**Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*** [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]	**HS-ESS3-4**
10	**Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.** [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [*Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.*]	**HS-ESS3-6**
11	**Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.**	**HS-ETS1-1**
12	**Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.**	**HS-ETS1-2**
13	**Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.**	**HS-ETS1-3**

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CONTENT AREA: Environmental Science	Grade: HS	UNIT #: 2	UNIT NAME: Unit 2: Study of Resources

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Analyzing and Interpreting Data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-3), (HS-ESS3-4), (HS, ESS3-6)

Asking Questions and Defining Problems

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (HS-ETS1-1)

Using Mathematics and Computational Thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-

Disciplinary Core Ideas

ESS2.D: Weather and Climate

- Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. *(secondary to HS-ESS3-6)*

ESS3.A: Natural Resources

- Resource availability has guided the development of human society. (HS-ESS3-1)
- All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS-ESS3-2)

ESS2.C: The Roles of Water in Earth's Surface Processes

- The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. (HS-ESS2-5)

LS2.A: Interdependent Relationships in Ecosystems

- Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges

Crosscutting Concepts

Scale, Proportion, and Quantity

- The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1)
- Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2)

Stability and Change (pp. 98-101)

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-7)
- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-3)
- Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4)

Structure and Function

- The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. (HS-ESS2-5)

Cause and Effect (pp. 87-89)

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3-1), (HS-LS4-6)

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CONTENT AREA: Environmental Science	Grade: HS	UNIT #: 2	UNIT NAME: Unit 2: Study of Resources

ESS3-3)

- Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1)
- Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2)
- Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-ESS2-5)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific knowledge, principles, and theories.

- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that

such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HS-LS2-2)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2)
- Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7)

LS4.D: Biodiversity and Humans

- Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). *(secondary to HS-LS2-7)*
- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to

Systems and System Models

- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3-6)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- Modern civilization depends on major technological systems. (HS-ESS3-1),(HS-ESS3-3)
- Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS-ESS3-2),(HS-ESS3-4)
- New technologies can have deep impacts on society and the environment, including some that were not anticipated. (HS-ESS3-3), (HS-ETS1-1), (HS-ETS1-3)
- Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS3-2)

Connections to Nature of Science

Science is a Human Endeavor

- Science is a result of human endeavors,

theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1)

- Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)
- Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-LS2-7)
- Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)
- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3)

Engaging in Argument from Evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-6)

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supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.*(secondary to HS-LS2-7) (Note: This Disciplinary Core Idea is also addressed by HS-LS4-6.)*

ESS3.B: Natural Hazards

- Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1)

ESS3.C: Human Impacts on Earth Systems

- The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3)
- Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)

ETS1.A: Defining and Delimiting Engineering Problems

- Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1)
- Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)

ETS1.B: Developing Possible Solutions

- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, imagination, and creativity. (HS-ESS3-3)

Science Addresses Questions About the Natural and Material World

- Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. (HS-ESS3-2)
- Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. (HS-ESS3-2)
- Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. (HS-ESS3-2)

UHS Environmental Science CURRICULUM

CONTENT AREA: Environmental Science	Grade: HS	UNIT #: 2	UNIT NAME: Unit 2: Study of Resources

Connections to Nature of Science **Scientific Knowledge is Open to Revision in Light of New Evidence** • Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-2)	and environmental impacts.(HS-ETS1-1), *(secondary to HS-ESS3-2),(secondary HS-ESS3-4), (secondary to HS-LS2-7)* **ETS1.C: Optimizing the Design Solution** • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (HS-ETS1-2)	

Connections to other DCIs in this grade-band:

HS.PS1.A (HS-ESS2-5); **HS.PS1.B** (HS-ESS2-5), (HS-ESS3-3); **HS.PS3.B** (HS-ESS2-5), (HS-ESS3-2); **HS.PS3.D** (HS-ESS3-2); **HS.LS2.A** (HS-ESS3-2), (HS-ESS3-3); **HS.LS2.B** (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-6); **HS.LS2.C** (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6); **HS.LS4.D** (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6); **HS.ESS2.A** (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-6); **HS.ESS2.D** (HS-LS2-7), (HS-LS4); **HS.ESS2.E** (HS-ESS3-3), (HS-LS4-6); **HS.ESS3.A** (HS-LS4-6); **HS.ESS3.C** (HS-ESS2-5), (HS-LS4-6); **HS.ESS3.D** (HS-LS2-2), (HS-LS4-6)

Common Core State Standards Connections:
ELA/Literacy -

RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-7)

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-4), (HS-LS2-1), (HS-LS2-2)

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-LS2-7), (HS-ETS1-1), (HS-ETS1-3)

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-2), (HS-ESS3-4), (HS-LS2-7), (HS-ETS1-1), (HS-ETS1-3)

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-1), (HS-ETS1-3)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1), (HS-LS2-

1), (HS-LS2-2)

WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS4-6)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7), (HS-LS4-6), (HS-ESS2-5)

Mathematics -

MP.2 Reason abstractly and quantitatively. (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6), (HS-LS2-1), (HS-LS2-2), (HS-ETS1-1), (HS-ETS1-3)

MP.4 Model with mathematics. (HS-ESS3-3), (HS-ESS3-6), (HS-LS2-1), (HS-LS2-2), (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3)

HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-6), (HS-LS2-1), (HS-LS2-2), (HS-LS2-7)

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-6), (HS-LS2-1), (HS-LS2-2), (HS-LS2-7)

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-6), (HS-LS2-1), (HS-LS2-2), (HS-LS2-7), (HS-ESS2-5)

UHS Environmental Science CURRICULUM

CONTENT AREA: Environmental Science	Grade: HS	UNIT #: 2	UNIT NAME: Unit 2: Study of Resources

Sample Activities, Lessons, and Lab
Define and Explore the importance and methods of forestry and conserving tree resources (Environmental Science Txt Chapter 11)
Explore, Research, and Define the importance of Biodiversity resources and how humans can benefit from them and our impact (Env Sci Text Chapter 7)
Explore and define the methods of soil resources, how its studied, and how it can be conserved (Environmental Science Txt Section 12-1 and 12-2)
Correlate proper environmental methods for Agriculture and food production with soil resources (Environmental Science Txt Section 12-3 & 12-4)
Define and differentiate the process of mining and what mining regulations and impacts are (Environmental Science Txt Chapter 13)
Detail and explore the use and impact of Water Resources (Environmental Science Txt Chapter 14)
Examine examples and model the impact of humans on the atmosphere and what the results are from air pollution (Environmental Science Txt Chapter 15)
LAB: Pearson National Forest Lab allows students to research and design their own National Forest based on resources and policies of National Forests
LAB: Pearson Working Lumber Lab where students calculate how many boards for building can be gained from a tree based on width and height
LAB: Students can examine, record, and display local species from different taxonomic classes and make a Biodiversity Log using internet research
LAB: Pearson Soil Classification Lab where students identify soil samples to type with a dichotomous key and hands on testing
LAB: Pearson Planting Data Lab where students examine times and frost dates and plan a garden or crop based on a pre-determined sized area
LAB: Students research online the cost of food and the environmental impact of eating imported foods
LAB: Pearson Local Geology Lab where students research what minerals are found locally and then sample rocks found locally
LAB Water testing lab where students test for major pollutants that are present in water
LAB Students use index cards or petri dishes to sit out with Vaseline to sample particulate matter outside over a period of 24 hours

UHS Environmental Science CURRICULUM

CONTENT AREA: Environmental Science	Grade: HS	UNIT #: 3	UNIT NAME: Unit 3: Human Population & Impact

Unit 3 Human Population & Impact

- This unit will explain the unintended consequences of an ever growing human population and its impact on the environment. The student will compare over time the impact of human activity through; Human Population Growth, Environmental Policy & Economics, Land Use & Urbanization, Human Health & Toxicology, and waste produced by humans.
- The student will assess, explore, understand, address, and identify (using scientific, economic, and other data) the potential environmental impact of;
  - how human populations are changing and its relation to a nation's ecological footprint.
  - how land is being used and the growing urbanization trend seen worldwide.
  - the state of environmental health and toxicology of the natural resources humans use.
  - the forms of waste produced by humans, their potential hazards, and clean up.

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING PE
1	**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.** [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]	**HS-ESS3-1**
2	**Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.** [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] *[Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]*	**HS-ESS3-3**
3	**Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*** [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large	**HS-ESS3-4**

	changes to the atmosphere or ocean).]	
4	**Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.** [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] *[Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.*]	**HS-ESS3-6**
5	**Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.** [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] *[Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.]*	**HS-LS2-1**
6	**Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.** [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] *[Assessment Boundary: Assessment is limited to provided data.*]	**HS-LS2-2**
7	**Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*** [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]	**HS-LS2-7**
8	**Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.**	**HS-ETS1-1**
9	**Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.**	**HS-ETS1-2**

UHS Environmental Science CURRICULUM

CONTENT AREA: Environmental Science	Grade: HS	UNIT #: 3	UNIT NAME: Unit 3: Human Population & Impact

10	**Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.**	**HS-ETS1-3**

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Analyzing and Interpreting Data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-3), (HS-ESS3-4), (HS, ESS3-6)

Asking Questions and Defining Problems

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (HS-ETS1-1)

Using Mathematics and Computational Thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

Disciplinary Core Ideas

ESS2.D: Weather and Climate

- Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. *(secondary to HS-ESS3-6)*

ESS3.A: Natural Resources

- Resource availability has guided the development of human society. (HS-ESS3-1)
- All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS-ESS3-2)

LS2.A: Interdependent Relationships in Ecosystems

- Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given

Crosscutting Concepts

Scale, Proportion, and Quantity

- The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1)
- Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2)

Stability and Change (pp. 98-101)

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-7)
- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-3)
- Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4)

Cause and Effect (pp. 87-89)

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3-1)

Systems and System Models

- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3-6)

UHS Environmental Science CURRICULUM

CONTENT AREA: Environmental Science	Grade: HS	UNIT #: 3	UNIT NAME: Unit 3: Human Population & Impact

- Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-ESS3-3)
- Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1)
- Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2)
- Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific knowledge, principles, and theories.

- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1)
- Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)
- Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge,

ecosystem. (HS-LS2-1),(HS-LS2-2)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2)
- Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7)

LS4.D: Biodiversity and Humans

- Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). *(secondary to HS-LS2-7)*
- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.*(secondary to HS-LS2-7) (Note: This Disciplinary Core Idea is also addressed by HS-LS4-6.)*

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- Modern civilization depends on major technological systems. (HS-ESS3-1),(HS-ESS3-3)
- Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS-ESS3-4)
- New technologies can have deep impacts on society and the environment, including some that were not anticipated. (HS-ESS3-3), (HS-ETS1-1), (HS-ETS1-3)
- Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS3-3)

Connections to Nature of Science

Science is a Human Endeavor

- Science is a result of human endeavors, imagination, and creativity. (HS-ESS3-3)

Science Addresses Questions About the Natural and Material World

- Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. (HS-ESS3-3)
- Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human

student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-LS2-7)

- Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)
- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3)

Engaging in Argument from Evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-6)

Connections to Nature of Science

Scientific Knowledge is Open to Revision in Light of New Evidence

- Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-2)

ESS3.B: Natural Hazards

- Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1)

ESS3.C: Human Impacts on Earth Systems

- The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3)
- Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)

ETS1.A: Defining and Delimiting Engineering Problems

- Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1)
- Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)

ETS1.B: Developing Possible Solutions

- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.(HS-ETS1-3), *(secondary HS-ESS3-4), (secondary to HS-LS2-7)*

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the use of knowledge. (HS-ESS3-3)
- Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. (HS-ESS3-3)

UHS Environmental Science CURRICULUM			
CONTENT AREA: Environmental Science	**Grade: HS**	**UNIT #: 3**	**UNIT NAME: Unit 3: Human Population & Impact**

	the priority of certain criteria over others (trade-offs) may be needed. (HS-ETS1-2)	

Connections to other DCIs in this grade-band:

HS.PS1.B (HS-ESS3-3); **HS.LS2.A** (HS-ESS3-3); **HS.LS2.B** (HS-ESS3-3), (HS-ESS3-6); **HS.LS2.C** (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6); **HS.LS4.D** (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6); **HS.ESS2.A** (HS-ESS3-3), (HS-ESS3-6); **HS.ESS2.D** (HS-LS2-7), (HS-LS4-6); **HS.ESS2.E** (HS-ESS3-3)

Common Core State Standards Connections:
ELA/Literacy -

RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-7)

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS3-1), (HS-ESS3-4), (HS-LS2-1), (HS-LS2-2)

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-LS2-7), (HS-ETS1-1), (HS-ETS1-3)

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-3), (HS-ESS3-4), (HS-LS2-7), (HS-ETS1-1), (HS-ETS1-3)

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-1), (HS-ETS1-3)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1), (HS-LS2-1), (HS-LS2-2)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7)

Mathematics -

UHS Environmental Science CURRICULUM

CONTENT AREA: Environmental Science	Grade: HS	UNIT #: 3	UNIT NAME: Unit 3: Human Population & Impact

MP.2	Reason abstractly and quantitatively. (HS-ESS3-1), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6), (HS-LS2-1), (HS-LS2-2), (HS-ETS1-1), (HS-ETS1-3)
MP.4	Model with mathematics. (HS-ESS3-3), (HS-ESS3-6) , (HS-LS2-1), (HS-LS2-2), (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3)
HSN.Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-6), (HS-LS2-1), (HS-LS2-2), (HS-LS2-7)
HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-6), (HS-LS2-1), (HS-LS2-2), (HS-LS2-7)
HSN.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1), (HS-ESS3-4),(HS-ESS3-6) , (HS-LS2-1), (HS-LS2-2) , (HS-LS2-7)

Sample Activities, Lessons, and Lab
Define and Research how Human Populations are structured and how they may be growing (Environmental Science Txt Chapter 8)
Explore and define what environmental health is (Environmental Science Txt Section 9-1)
Define and differentiate between toxicology and epidemiology (Environmental Science Txt Section 9-2 and 9-3)
Research and explore how natural disasters impact human health, environment, society, and economics (Environmental Science Txt Section 9-4)
Define and explore Land Use and Urbanization in the United States (Environmental Science Txt Section 10-1)
Research and model how sprawl is spreading through urbanized areas of the United States (Environmental Science Txt Section 10-2)
Examine, Research, and model how to build sustainable cities (Environmental Science Txt Section 10-3)
LAB: Pearson's Age, Sex Population Graph Lab of two different countries
LAB: Pearson's Census Lab where students examine the change in the community over the course of 10 years
LAB: Students will research and present how the Superfund program was created and what sites are within our county
LAB: Students will trace an outbreak of a disease and try to determine where it began and under what environmental conditions
LAB: Students will research what chemicals are present in their home and how toxic they are according to the online MSDS
LAB: Students will analyze a map of the city of UNION and determine how land is used and if Sprawl is present
LAB: Students will create and model a community from the ground up as a land planning community would.

Unit 4 Atmosphere & Climate Change & Energy

- This unit will explain the unintended consequences of an the effect of human technology and energy production, its by-products, and its impact on the environment. The student will compare over time the impact of human activity through; the Atmosphere and pollution, Climate Change, Non-Renewable Energy, Renewable Energy, and waste produced by humans.
- The student will assess, explore, understand, address, and identify (using scientific, economic, and other data) the potential environmental impact of:
  - How human technology has added and impacted the atmosphere and air with areas of high concentration.
  - Understand the impact that climate change has on our planet. Relate cause and effect of climate change and meteorological trends.
  - Display an understanding of non-renewable energy, its limits, conservation, and its impacts
  - Explore renewable energy, its future, limits, and its potential impacts.

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING PE
1	**Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.** [Clarification Statement: Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.]	**HS-ESS2-2**
2	**Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.** [Clarification Statement: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth's three-dimensional structure obtained from seismic waves, records of the rate of change of Earth's magnetic field (as constraints on convection in the outer core), and identification of the composition of Earth's layers from high-pressure laboratory experiments.]	**HS-ESS2-3**
3	**Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.** [Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.] *[Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.]*	**HS-ESS2-4**
4	**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.** [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes,	**HS-ESS3-1**

	floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]	
5	**Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.** [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [*Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.*]	**HS-ESS3-3**
6	**Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. *** [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]	**HS-ESS3-4**
7	**Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.** [Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).] [*Assessment Boundary: Assessment is limited to one example of a climate change and its associated impacts.*]	**HS-ESS3-5**
8	**Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.** [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] *[Assessment Boundary: Assessment does* not *include running computational representations but is limited to using the published results of scientific computational models.]*	**HS-ESS3-6**
9	**Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*** [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]	**HS-LS2-7**
10	**Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.**	**HS-ETS1-1**

11	**Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.**	**HS-ETS1-2**
12	**Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.**	**HS-ETS1-3**

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Analyzing and Interpreting Data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS2-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-5), (HS, ESS3-6)

Asking Questions and Defining Problems

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (HS-ETS1-1)

Developing and Using Models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS2-3)
- Use a model to provide mechanistic accounts of phenomena. (HS-ESS2-4)

Using Mathematics and Computational Thinking

Disciplinary Core Ideas

ESS2.A: Earth Materials and Systems

- Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-2)
- The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (HS-ESS2-4)

ESS2.D: Weather and Climate

- Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2-6),(HS-ESS2-4)
- Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. *(secondary to HS-ESS3-6)*

ESS3.A: Natural Resources

- Resource availability has guided the development of human society. (HS-ESS3-1)
- All forms of energy production and other resource extraction have associated economic, social,

Crosscutting Concepts

Scale, Proportion, and Quantity

- The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1)
- Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2)

Stability and Change (pp. 98-101)

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-7)
- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-3), (HS-ESS3-5)
- Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS2-2), (HS-ESS3-4)

Cause and Effect (pp. 87-89)

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS2-4), (HS-ESS3-1)

Systems and System Models

- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3-6)

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-ESS3-3)
- Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1)
- Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2)
- Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific knowledge, principles, and theories.

- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1)
- Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and

environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS-ESS3-2)

LS2.A: Interdependent Relationships in Ecosystems

- Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HS-LS2-2)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2)
- Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7)

LS4.D: Biodiversity and Humans

- Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). *(secondary to HS-LS2-7)*
- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction,

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Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS2-3)

Influence of Science, Engineering, and Technology on Society and the Natural World

- Modern civilization depends on major technological systems. (HS-ESS3-1),(HS-ESS3-3)
- Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS-ESS3-4)
- New technologies can have deep impacts on society and the environment, including some that were not anticipated. (HS-ESS2-2), (HS-ESS3-3), (HS-ETS1-1), (HS-ETS1-3)
- Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS3-3)

Connections to Nature of Science

Science is a Human Endeavor

- Science is a result of human endeavors, imagination, and creativity. (HS-ESS3-3)

Science Addresses Questions About the Natural and Material World

- Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. (HS-ESS3-3)
- Science knowledge indicates what can happen

tradeoff considerations. (HS-ESS3-4)

- Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-LS2-7)
- Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)
- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3)

Engaging in Argument from Evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-6)

Connections to Nature of Science

Scientific Knowledge is Open to Revision in Light of New Evidence

- Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-2)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based on empirical evidence. (HS-ESS2-3)

pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.*(secondary to HS-LS2-7) (Note: This Disciplinary Core Idea is also addressed by HS-LS4-6.)*

ESS3.B: Natural Hazards

- Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1)

ESS3.C: Human Impacts on Earth Systems

- The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3)
- Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)

ESS3.D: Global Climate Change

- Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. (HS-ESS3-5)

ETS1.A: Defining and Delimiting Engineering Problems

- Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1)
- Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)

ETS1.B: Developing Possible Solutions

in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. (HS-ESS3-3)

- Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. (HS-ESS3-3)

• Science disciplines share common rules of evidence used to evaluate explanations about natural systems. (HS-ESS2-3) • Science includes the process of coordinating patterns of evidence with current theory. (HS-ESS2-3) • Science arguments are strengthened by multiple lines of evidence supporting a single explanation. (HS-ESS2-4) - ***Connections to Nature of Science*** **Scientific Investigations Use a Variety of Methods** • Science investigations use diverse methods and do not always use the same set of procedures to obtain data. (HS-ESS3-5) • New technologies advance scientific knowledge. (HS-ESS3-5) **Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based on empirical evidence. (HS-ESS3-5) • Science arguments are strengthened by multiple lines of evidence supporting a single explanation. (HS-ESS3-5)	• When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.(HS-ETS1-3), *(secondary HS-ESS3-4), (secondary to HS-LS2-7)* **ETS1.C: Optimizing the Design Solution** • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (HS-ETS1-2)	

Connections to other DCIs in this grade-band:

HS.PS1.B (HS-ESS3-3); **HS.PS2.B** (HS-ESS2-1), (HS-ESS2-3);); **HS.PS3.A** (HS-ESS2-4); **HS.PS3.B** (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS3-B); **HS.PS3.D** (HS-ESS2-3), (HS-ESS3-B); **HS.PS4.B** (HS-ESS2-2); **HS.LS1.C** (HS-ESS3-5); **HS.LS2.A** (HS-ESS3-3); **HS.LS2.B** (HS-ESS2-2), (HS-ESS3-3), (HS-ESS3-6); **HS.LS2.C** (HS-ESS2-2), (HS-ESS2-4), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6); **HS.LS4.D** (HS-ESS2-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6); **HS.ESS1.C** (HS-ESS2-4); **HS.ESS2.A** (HS-ESS3-3), (HS-ESS3-6); **HS.ESS2.D** (HS-ESS3-5), (HS-LS2-7), (HS-LS4); **HS.ESS2.E** (HS-ESS3-3); **HS.ESS3.C** (HS-ESS2-2), (HS-ESS2-4); **HS.ESS3.D** (HS-ESS2-2), (HS-ESS2-4)

Common Core State Standards Connections:
ELA/Literacy -

RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-7)

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS2-2), (HS-ESS2-3), (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5)

RST.11-12.2	Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS2-2), (HS-ESS3-5)
RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-LS2-7), (HS-ESS3-5), (HS-ETS1-1), (HS-ETS1-3)
RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-3), (HS-ESS3-4), (HS-LS2-7), (HS-ETS1-1), (HS-ETS1-3)
RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-1), (HS-ETS1-3)
WHST.9-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1)
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7)
SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-ESS2-3),(HS-ESS2-4)
Mathematics -	
MP.2	Reason abstractly and quantitatively. (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS3-1), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6), (HS-ETS1-1), (HS-ETS1-3)
MP.4	Model with mathematics. (HS-ESS2-3), (HS-ESS2-4), (HS-ESS3-3), (HS-ESS3-6) , (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3)
HSN.Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6), (HS-LS2-7)
HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS2-3), (HS-ESS2-4), (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6), (HS-LS2-7)
HSN.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6), (HS-LS2-7)

Sample Activities, Lessons, and Lab
Discuss and Identify the effects and processes that cause the greenhouse effect. (Environmental Science Txt Chapter 16)
Identify the factors of the environment that show the effects of climate change: weather patterns, agriculture, sea levels (Environmental Science Txt Chp. 16)
Define and illustrate examples of CFCs along with other greenhouse gases and discuss possible solutions and alternatives to such substances.

(Environmental Science Txt Chapter 16)
Discuss what the term energy means and brainstorm reasons we need energy to live in today's world. Explain how major sources of energy are dwindling. Discuss and demonstrate how energy conservation is important. (Environmental Science Text Chapters 17 & 18)
Explain how fossil fuels are used to produce electricity. -Distinguish among types of coal and how much energy. -Describe how oil is extracted in different parts of the world and how it's used. -List and describe how many products are made from oil in a ppt -Describe and explain the characteristics of natural gas. (Environmental Science Txt Chapters 17)
Explain and predict the future of fossil fuels. -Explain the impact of fossil fuels to the environment and to people. This will be done historically and predictably. -Analyze data to determine predictions about when our fossil fuels will run out. -Explain the politics and economics of dependence of foreign countries for fossil fuels. (Environmental Science Chapter 17)
Discuss how nuclear energy works. -Model and explain how nuclear power plants generate energy. -Identify possible safety concerns regarding nuclear energy. (Environmental Science Chapter 17)
Explain the benefits and current status of renewable energy resources with presentations and models. -List alternative sources of biomass and explain how it is used (Environmental Science Chapter 18) -Describe and model how geothermal energy is used -Display and describe how hydropower is used and utilized. -Display, model, and explain how solar energy is used to heat buildings and generate electricity -Display, model, and explain how wind energy is used to produce electricity. (Environmental Science Chapter 18)
Display, model, and explain how hydrogen energy is used to produce electricity in fuel cells. (Environmental Science Chapter 18)
Compare and contrast alternative energy sources, with emphasis on cost, renewability, and location. (Environmental Science Chapter 18)
Evaluate the pros and cons of solar, wind, geothermal, and hydro power. (Environmental Science Chapter 18)
LAB: Pearson's Fossil Fuel Lab allows students to research, graph, and analyze fossil fuel use in the United States
LAB: Students will enumerate, define, and show examples of Fossil fuels and will model how it is obtained and refined
LAB: Students will research and present how Fossil Fuel Incidents impact the environment from Fracking, Oil Drilling, and Transport/Refinery accidents
LAB: Students will design, model, and build their own Solar oven
LAB: Students will research and process harvested algae to produce their own biofuel
LAB: Students will design, model, and build their own wind turbine.
LAB: Students will utilize NREL online to create their own feasible hybrid, stand-alone, or renewable power system.

The following standards are threaded throughout all units of the NJSLS-Science:

21st Century Life and Career Standards: Career Awareness, ELD Standards, and Technology Standards.

WIDA ELD Standards: Teaching with Standards | WIDA

WIDA has established language development standards for English and Spanish. These standards represent the language students need to be successful in early childhood programs and Grades K-12.

The first standard, **Social and Instructional Language,** reflects the ways in which students interact socially to build community and establish working relationships with peers and teachers in ways that support learning.

The remaining four standards present ways multilingual learners can communicate information, ideas and concepts necessary for academic success in **Language Arts, Math, Science** and **Social Studies**.

Specifically in Science Standard 4- Language of Science- English Language learners communicate information, ideas and concepts necessary for academic success in the content area of science.

New Jersey Student Learning Standards

Standard 9

21st Century Life and Careers

In today's global economy, students need to be lifelong learners who have the knowledge and skills to adapt to an evolving workplace and world. To address these demands, Standard 9, 21st Century Life and Careers, which includes the 12 Career Ready Practices, establishes clear guidelines for what students need to know and be able to do in order to be successful in their future careers and to achieve financial independence.

Mission: *21st century life and career skills enable students to make informed decisions that prepare them to engage as active citizens in a dynamic global society and to successfully meet the challenges and opportunities of the 21st century global workplace.*

Vision: To integrate 21st Century life and career skills across the K-12 curriculum and to foster a population that:

- Continually self-reflects and seeks to improve the essential life and career practices that lead to success.
- Uses effective communication and collaboration skills and resources to interact with a global society.
- Is financially literate and financially responsible at home and in the broader community.
- Is knowledgeable about careers and can plan, execute, and alter career goals in response to changing societal and economic conditions.
- Seeks to attain skill and content mastery to achieve success in a chosen career path.

Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

CRP1. Act as a responsible and contributing citizen and employee.

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2. Apply appropriate academic and technical skills.

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

CRP3. Attend to personal health and financial well-being.

Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial wellbeing, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

CRP4. Communicate clearly and effectively and with reason.

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP5. Consider the environmental, social and economic impacts of decisions.

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP6. Demonstrate creativity and innovation.

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP7. Employ valid and reliable research strategies.

Career-ready individuals are discerning in accepting and using new information to make decisions, changes. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the

problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP9. Model integrity, ethical leadership and effective management.

Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRP10. Plan education and career paths aligned to personal goals.

Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

CRP11. Use technology to enhance productivity.

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

CRP12. Work productively in teams while using cultural global competence.

Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

2014 New Jersey Core Curriculum Content Standards - Technology

Content Area		**Technology**	
Standard		**8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**	
Strand		**A. Technology Operations and Concepts:** *Students demonstrate a sound understanding of technology concepts, systems and operations.*	
Grade Level bands	**Content Statement Students will:**	**Indicator**	**Indicator**
P	Understand and use technology systems.	8.1.P.A.1	Use an input device to select an item and navigate the screen
		8.1.P.A.2	Navigate the basic functions of a browser.
	Select and use applications effectively and productively.	8.1.P.A.3	Use digital devices to create stories with pictures, numbers, letters and words.
		8.1.P.A.4	Use basic technology terms in the proper context in conversation with peers and teachers (e.g., camera, tablet, Internet, mouse, keyboard, and printer).
		8.1.P.A.5	Demonstrate the ability to access and use resources on a computing device.
K-2	Understand and use technology systems.	8.1.2.A.1	Identify the basic features of a digital device and explain its purpose.
	Select and use applications effectively and productively.	8.1.2.A.2	Create a document using a word processing application.
		8.1.2.A.3	Compare the common uses of at least two different digital applications and identify the advantages and disadvantages of using each.
		8.1.2.A.4	Demonstrate developmentally appropriate navigation skills in virtual environments (i.e. games, museums).
		8.1.2.A.5	Enter information into a spreadsheet and sort the information.
		8.1.2.A.6	Identify the structure and components of a database.
		8.1.2.A.7	Enter information into a database or spreadsheet and filter the information.
3-5	Understand and use technology systems.	8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
	Select and use applications effectively and productively.	8.1.5.A.2	Format a document using a word processing application to enhance text and include graphics, symbols and/ or pictures.

		8.1.5.A.3	Use a graphic organizer to organize information about problem or issue.
		8.1.5.A.4	Graph data using a spreadsheet, analyze and produce a report that explains the analysis of the data.
		8.1.5.A.5	Create and use a database to answer basic questions.
		8.1.5.A.6	Export data from a database into a spreadsheet; analyze and produce a report that explains the analysis of the data.
6-8	Understand and use technology systems.	8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
	Select and use applications effectively and productively.	8.1.8.A.2	Create a document (e.g. newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.
		8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
		8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results
		8.1.8.A.5	Create a database query, sort and create a report and describe the process, and explain the report results.
9-12	Understand and use technology systems.	8.1.12.A.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
	Select and use applications effectively and productively.	8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
		8.1.12.A.3	Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
		8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
		8.1.12.A.5	Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.

Content Area	**Technology**
Standard	**8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**
Strand	**B. Creativity and Innovation:** *Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.*

Grade Level bands	Content Statement Students will:	Indicator	Indicator
P	Apply existing knowledge to generate new ideas, products, or processes. Create original works as a means of personal or group expression.	8.1.P.B.1	Create a story about a picture taken by the student on a digital camera or mobile device.
K-2		8.1.2.B.1	Illustrate and communicate original ideas and stories using multiple digital tools and resources.
3-5		8.1.5.B.1	Collaborative to produce a digital story about a significant local event or issue based on first-person interviews.
6-8		8.1.8.B.1	Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).
9-12		8.1.12.B.2	Apply previous content knowledge by creating and piloting a digital learning game or tutorial.
Content Area	**Technology**		
Standard	**8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**		
Strand	**C. Communication and Collaboration:** *Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.*		
Grade Level bands	**Content Statement**	**Indicator**	**Indicator**
P	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media. Communicate information and ideas to multiple audiences using a variety of media and formats. Develop cultural understanding and global awareness by engaging with learners of other cultures. Contribute to project teams to produce original works or solve problems.	8.1.P.C.1	Collaborate with peers by participating in interactive digital games or activities.
K-2		8.1.2.C.1	Engage in a variety of developmentally appropriate learning activities with students in other classes, schools, or countries using various media formats such as online collaborative tools, and social media.
3-5		8.1.5.C.1	Engage in online discussions with learners of other cultures to investigate a worldwide issue from multiple perspectives and sources, evaluate findings and present possible solutions, using digital tools and online resources for all steps.
6-8		8.1.8.C.1	Collaborate to develop and publish work that provides perspectives on a global problem for discussions with learners from other countries.
9-12		8.1.12.C.1	Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback

			through social media or in an online community.
Content Area	**Technology**		
Standard	**8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**		
Strand	**D. Digital Citizenship:** *Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.*		
Grade Level bands	**Content Statement**	**Indicator**	**Indicator**
K-2	Advocate and practice safe, legal, and responsible use of information and technology.	8.1.2.D.1	Develop an understanding of ownership of print and nonprint information.
3-5	Advocate and practice safe, legal, and responsible use of information and technology.	8.1.5.D.1	Understand the need for and use of copyrights.
		8.1.5.D.2	Analyze the resource citations in online materials for proper use.
	Demonstrate personal responsibility for lifelong learning.	8.1.5.D.3	Demonstrate an understanding of the need to practice cyber safety, cyber security, and cyber ethics when using technologies and social media.
	Exhibit leadership for digital citizenship.	8.1.5.D.4	Understand digital citizenship and demonstrate an understanding of the personal consequences of inappropriate use of technology and social media.
6-8	Advocate and practice safe, legal, and responsible use of information and technology.	8.1.8.D.1	Understand and model appropriate online behaviors related to cyber safety, cyber bullying, cyber security, and cyber ethics including appropriate use of social media.
	Demonstrate personal responsibility for lifelong learning.	8.1.8.D.2	Demonstrate the application of appropriate citations to digital content.
		8.1.8.D.3	Demonstrate an understanding of fair use and Creative Commons to intellectual property.
	Exhibit leadership for digital citizenship.	8.1.8.D.4	Assess the credibility and accuracy of digital content.
		8.1.8.D.5	Understand appropriate uses for social media and the negative consequences of misuse.
9-12	Advocate and practice safe, legal, and responsible use of information and	8.1.12.D.1	Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.

	technology.		
	Demonstrate personal responsibility for lifelong learning.	8.1.12.D.2	Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on dissemination of personal information.
		8.1.12.D.3	Compare and contrast policies on filtering and censorship both locally and globally.
	Exhibit leadership for digital citizenship.	8.1.12.D.4	Research and understand the positive and negative impact of one's digital footprint.
		8.1.12.D.5	Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.
Content Area	**Technology**		
Standard	**8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**		
Strand	**E: Research and Information Fluency:** *Students apply digital tools to gather, evaluate, and use information.*		
Grade Level bands	**Content Statement** **Students will:**	**Indicator**	**Indicator**
P	Plan strategies to guide inquiry.	8.1.P.E.1	Use the Internet to explore and investigate questions with a teacher's support.
K-2	Plan strategies to guide inquiry Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media. Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.	8.1.2.E.1	Use digital tools and online resources to explore a problem or issue.
3-5	Plan strategies to guide inquiry. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.	8.1.5.E.1	Use digital tools to research and evaluate the accuracy of, relevance to, and appropriateness of using print and non-print electronic information sources to complete a variety of tasks.

	Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.		
6-8	Plan strategies to guide inquiry. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media. Evaluate and select information sources and digital tools based on the appropriateness for specific tasks. Process data and report results.	8.1.8.E.1	Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.
9-12	Plan strategies to guide inquiry. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media. Evaluate and select information sources and digital tools based on the appropriateness for specific tasks. Process data and report results.	8.1.12.E.1	Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.
		8.1.12.E.2	Research and evaluate the impact on society of the unethical use of digital tools and present your research to peers.

Content Area	**Technology**		
Standard	**8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**		
Strand	**F: Critical thinking, problem solving, and decision making:** *Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.*		
Grade Level bands	**Content Statement** **Students will:**	**Indicator**	**Indicator**

K-2	Identify and define authentic problems and significant questions for investigation. Plan and manage activities to develop a solution or complete a project. Collect and analyze data to identify solutions and/or make informed decisions. Use multiple processes and diverse perspectives to explore alternative solutions.	8.1.2.F.1	Use geographic mapping tools to plan and solve problems.
3-5	Identify and define authentic problems and significant questions for investigation. Plan and manage activities to develop a solution or complete a project. Collect and analyze data to identify solutions and/or make informed decisions. Use multiple processes and diverse perspectives to explore alternative solutions	8.1.5.F.1	Apply digital tools to collect, organize, and analyze data that support a scientific finding.
6-8	Identify and define authentic problems and significant questions for investigation. Plan and manage activities to develop a solution or complete a project. Collect and analyze data to identify solutions and/or make informed decisions.	8.1.8.F.1	Explore a local issue, by using digital tools to collect and analyze data to identify a solution and make an informed decision.

	Use multiple processes and diverse perspectives to explore alternative solutions.		
9-12	Identify and define authentic problems and significant questions for investigation. Plan and manage activities to develop a solution or complete a project. Collect and analyze data to identify solutions and/or make informed decisions. Use multiple processes and diverse perspectives to explore alternative solutions.	8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.