DCPS
SCIENCE DEPT

Environmental Science Curriculum Guide

SCIENCE
THINGS

Contents

Guide to Reading the Science Curriculum Guide

Grade-Level Overview & Year-at-a-Glance

The DCPS Science Curriculum Guide begins with the **grade-level overview** and **year-at-a-glance** that names the NGSS disciplinary core ideas, the units of study, as well as the the topics and performance expectations to be covered each Term. The grouping of topics into units and sequence of those units generally matches the organization of content within STEMscopes, our core curricular resource for science. Because we are using STEMscopes structures, some of the units cross the boundary between terms. In some cases, the order of STEMscopes units has been adjusted based on feedback from DCPS teachers. In addition, each NGSS performance expectation listed is linked to a downloadable/printable PDF of the Evidence Statements from https://www.nextgenscience.org.

NGSS Evidence Statements

The **NGSS Evidence Statements** for all student performance expectations are an essential resource for planning science instruction. These statements provide additional detail on what students should know and be able to do, and include observable and measurable components that, when met, will satisfy the NGSS performance expectations.[1] These statements support teachers in unpacking the standards and determining what needs to be included in an instructional sequence. Evidence statements include the performance expectation in its entirety, including the **clarifying statements**, **assessment boundaries**, and **foundation boxes** which list the specific science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) that were combined to produce the performance expectation.

Unit Guides

Unit guides are included for each unit of study and include the following components:

- **Anchoring Phenomenon –** the phenomenon that students will make progress on throughout the unit as they experience and learn a variety of new science ideas.
- **Performance Expectations (PEs)** – a summary of the standards addressed in the unit; additional detailson the performance expectations are included in the evidence statements at the end of the document.
- **Big Ideas (Disciplinary Core Ideas)** – the big ideas come directly from the disciplinary core ideas associated with the unit's performance expectations.

[1] Taken from the Achieve Next Generation Science Standards website: http://www.nextgenscience.org/resources/evidence- statements.

- **Tier 1 Instructional Activities –** includes links to curricular resources from STEMscopes, EcoRise Sustainable Intelligence Program, and Project NEED resources. Specific guidance is provided on which components of the STEMscopes, EcoRise, or NEED lessons are recommended to address the PE and Big Idea for that topic. Tier 1 resources are arranged in accordance with the 5E model of instruction and therefore includes resources for:
    - Engage: Students are mentally engaged with an event, question, or challenge.
    - Explore: Students gather information through (often) hands-on experiences with scaffolded guidance.
    - Explain: Students communicate their understanding of scientific concepts by formulating generalizations, reflecting on plausibility of explanations, and/or analyzing and interpreting data.
    - Elaborate: Students apply what they have learned and extend their knowledge and skills to new situations.
    - Evaluate: Students assess their own knowledge and skills while teachers evaluate their progress.

      Please note: While Evaluate is listed as the last stage of the 5E model, evaluation should happen continuously throughout the lesson (e.g., exit tickets, journal writing, discussion questions, etc.).

    More information about the 5E model of instruction can be found in the Appendix of this curriculum guide.

    Accessing EcoRise materials:

    - Go to the website: https://www.ecorise.org/enroll/
    - Fill in your information.
    - Check your email for a Welcome Email and click on the unique link in your email.
    - Login using your email address as your username.
    - Check your email to set your password.

- **Tier 2 and 3 Supplemental Resources and Activities** – supplemental resources and activities are suggested from a variety of sources including Discovery Education Science Techbook (available for all students and teachers grades K-12), ExploreLearning Gizmos (available for all students and teachers grades 3-12), as well as other suggested resources – all to support Tier 2 and Tier 3 instruction. Resources to be used for acceleration are also included in this section.
- **Considerations for "Unit 0"** – It is common to begin the first week or two in any science class for introductory lessons and activities, often referred to as "Unit 0". In many schools, student schedules are in flux during the first few days or weeks of school, making it difficult to simply jump right into new course content. In addition to establishing classroom expectations and routines, students may need an introduction to the course which includes, but is not limited to, understanding the Nature of Science and revisiting the Science and Engineering Practices that they learned in previous years. Suggestions for Unit 0 resources can be found on the Science Canvas Portal.

Additional Resources to Support NGSS-aligned Planning and Classroom Implementation

The following is a list of resources to support planning and classroom implementation. This is not an exhaustive list and will be updated as needed.

1. 5E Instructional Practices document
2. Science Instruction Look-For Tool
3. NGSS site https://www.nextgenscience.org
4. EQuIP rubric and detailed guidance document
5. Task Annotation Project in Science (TAPS): https://www.nextgenscience.org/taps
6. STEM Teaching Tools: https://stemteachingtools.org/
7. Tools for Ambitious Science Teaching: https://ambitiousscienceteaching.org/
8. Teaching with Phenomena: https://www.ngssphenomena.com/teaching-with-phenomena

Environmental Science Overview & Year-at-a-Glance

In high school Environmental Science, students develop an understanding of their role in environmental management through hands-on activities based on topics such as ecosystems, biochemical cycles, and natural resources. Environmental Science students will be able to discuss and study a variety of concepts and examine problems from many different perspectives.

Term (YL)	Term (4x4)	Unit	Topics (associated Performance Expectations)
1	1/3	Ecology and the Natural World	Earth's Biomes and the Flow of Energy Carbon and Earth's Processes Interactions of Organisms within Earth's Systems Human Dependence on Earth
2		Resources from Air, Water, and Land	Water Resources and Use Air Resources and Use Sustainable Eating Land Use
3	2/4	Earth's Resources and Energy	Earth's Processes Shape Our Resources Nuclear Power and Hydropower Wind and Solar Energy Coal, Oil, and Natural Gas Energy
4		Sustainability	Environmental Justice Atmosphere and Climate Change Waste Productions and Impact Environmental Sustainability

Note: Engineering, Technology, and Applications of Science (ETS) performance expectations should be addressed whenever possible in relation to the above topics.

Unit 1 Guide: Ecology and the Natural World

The following unit guide provides a breakdown of Tier 1 instructional activities that should be completed for each topic, each week. Supplemental resources and activities are also provided and can be used to provide additional support for students who need Tier 2 or 3 support (i.e., remediation and/or intervention).

<table>
<tr><td colspan="3">Unit Anchoring Phenomenon: What governs the types of plants and animals that can survive in a certain biome? Are patterns of biomes predictable throughout the earth's surface? Ex. Why can we find thriving acacia trees on several, if not all of earth's major continents?</td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Earth's Biomes and the Flow of Energy
HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
• Photosynthesis and cellular respiration provide most of the energy for life processes.
• Only a fraction of matter consumed at the lower level of a food web is transferred up, resulting in fewer organisms at higher levels. At each link in an ecosystem, elements are combined in different ways and matter and energy are conserved.
• Photosynthesis and cellular respiration are key components of the global carbon cycle.</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[2]</td></tr>
<tr><td>Week 1 (4x4)

Weeks 1-2 (Year-long)</td><td>Section Resource: Course Resource Folder in Science Canvas Portal and Science One Drive
Engage
• Law of Conservation of Mass: Complete the Engage, Explore and Explain sections for Part 1 of this activity. This may be completed in groups or as a demonstration with discussion.
Explore
• Explore 1: Complete the HHMI BioInteractive BiomeViewer activity with Student Worksheet in folder.</td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>Build a 3-D Model Biome</td><td>Students can take mathematical measurements of their designs at the beginning and end of module to help support their CER on energy and material cycling. Resource found in folder.</td></tr></table></td></tr>
</table>

[2] These suggested activities can be used, where indicated, for remediation and/or intervention. Resources to be used for acceleration are also included in this section.

<table>
<tr><td colspan="3">Unit Anchoring Phenomenon: What governs the types of plants and animals that can survive in a certain biome? Are patterns of biomes predictable throughout the earth's surface? Ex. Why can we find thriving acacia trees on several, if not all of earth's major continents?</td></tr>
<tr><td></td><td>• Explore 2: Complete the HHMI BioInteractive- Modeling Trophic Cascades activity with Educator Materials and Habitat and Organism Cards in folder.
• Explore 3: Complete the HHMI BioInteractive: Exploring Trophic Cascades Interactive.
Explain
• Complete the Design a Biome Profile Page activity in folder
• Bozeman Science: Ecosystem Ecology: This resource may be used to support students as they develop their explanations.
Elaborate
Complete the Biomagnification: Hidden Dangers in Food Webs activity in folder.
Evaluate
Complete the Measuring Biodiversity Performance Assessment in folder</td><td></td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Carbon and Earth’s Processes
HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
• Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen.
• Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate change.</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[3]</td></tr>
<tr><td>Week 2 (4x4)

Weeks 3-4 (Year-long)</td><td>Section Resource: STEMscopes scope HS Earth and Space Science: Carbon and Earth’s Processes
○ Course Resource Folder in Science Canvas Portal and Science One Drive

Engage- Accessing Prior Knowledge: The Flow of Carbon</td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>Bananas or bread?</td><td>Alternative explore or elaborate activity to reinforce the carbon cycle and evaluate the impact of climate change on the food that is produced.</td></tr></table></td></tr>
</table>

[3] These suggested activities can be used, where indicated, for remediation and/or intervention. Resources to be used for acceleration are also included in this section.

<table>
<tr><td colspan="4">Unit Anchoring Phenomenon: What governs the types of plants and animals that can survive in a certain biome? Are patterns of biomes predictable throughout the earth's surface? Ex. Why can we find thriving acacia trees on several, if not all of earth's major continents?</td></tr>
<tr><td></td><td colspan="2">Explore
• Explore 1: Scientific Investigation - Biogeochemical Terrarium
• Explore 2: Activity - Carbon Sinks and Carbon Bombs
Explain
• Picture Vocabulary and STEMscopedia should be introduced throughout each Explore activity to support students as they explain their understanding
Elaborate
• Math Connections- The Carbon Cycle: Carbon Stocks
Evaluate
• CER- Use data to explain why global CO2 levels have been altered</td><td>Teacher and Student resources found on linked website.

Carbon Cycle Student Resources

Carbon Cycle PPT

Review activities including guided notes, video with questions, carbon cycling dice activity, and exit ticket to support students thinking about how and why carbon is constantly cycling through our environment. Resource found in folder.</td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="3">Interactions of Organisms within Earth's Systems
HS-ESS2-7. Construct and argument based on evidence about the simultaneous coevolution of the Earth’s systems and life on Earth.
• Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen.
• The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continua coevolution of Earth’s surface and the life that exists on it.</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td colspan="2">Tier 2 and 3 Supplemental Resources and Activities[4]</td></tr>
<tr><td>Week 3 (4x4)

Weeks 5-6 (Year-long)</td><td>Section Resource: STEMscopes scope HS Earth and Space Science: Interaction of Organisms and Earth’s Systems
○ Course Resource Folder in Science Canvas Portal and Science One Drive

Engage
• Accessing Prior Knowledge: Interactions Between Spheres
• Hook: Succession</td><td colspan="2"><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>Erosion Stations</td><td>Students build mini water sheds inside a foil pan or dissection tray. Using modeling clay and pipe cleaners, sand/soil/rocks/leaves from outside etc. Then “test” the erosion control by adding</td></tr></table></td></tr>
</table>

[4] These suggested activities can be used, where indicated, for remediation and/or intervention. Resources to be used for acceleration are also included in this section.

<table>
<tr><td colspan="3">Unit Anchoring Phenomenon: What governs the types of plants and animals that can survive in a certain biome? Are patterns of biomes predictable throughout the earth's surface? Ex. Why can we find thriving acacia trees on several, if not all of earth's major continents?</td></tr>
<tr><td></td><td>Explore
Explore 1: Activity- Making Calcium Carbonate from Carbon Dioxide
Explore 2: Activity- Origin of Atmospheric Oxygen
Explain
Picture Vocabulary and STEMscopedia should be introduced throughout each Explore activity to support students as they explain their understanding
Communicate Science- How can farming practices impact the future of our atmosphere?
Elaborate
Explore 4: Scientific Investigation - Reefs and Erosion
Explore 2: Activity- Resources, Sustainability, and Biodiversity (found in the ESS scope: Resources, Sustainability, and Biodiversity)
Evaluate
CER- Describes the relationship between Earth’s surface and living organisms.
OER questions</td><td><table><tr><td></td><td>water to the landscape which simulates annual rainfall. Observe and record results Additional resource found in course folder.</td></tr></table></td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Human Dependence on Earth
HS-ESS3-1. 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.
Resource availability has guided the development of human society
Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sized of human populations and have driven human migrations.</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[5]</td></tr>
</table>

[5] These suggested activities can be used, where indicated, for remediation and/or intervention. Resources to be used for acceleration are also included in this section.

<table>
<tr><td colspan="3">Unit Anchoring Phenomenon: What governs the types of plants and animals that can survive in a certain biome? Are patterns of biomes predictable throughout the earth's surface? Ex. Why can we find thriving acacia trees on several, if not all of earth's major continents?</td></tr>
<tr><td>Week 4
(4x4)

Weeks 7-8
(Year-long)</td><td>Section Resource: STEMscopes scope HS Earth and Space Science: Human Dependence on Earth
○ Course Resource Folder in Science Canvas Portal and Science One Drive

Engage
• Accessing Prior Knowledge: Human Activity and Natural Resources
• Hook: Water-Too much, too little
Explore
• Explore 1: Research- Human Settlements
• Explore 2: Activity- The Case of the Disappearing City
Explain
• Picture Vocabulary and STEMscopedia should be introduced throughout each Explore activity to support students as they explain their understanding.
• Connection Video- Natural Resources
Elaborate
• RCT 1: Impact of Deforestation on Arctic Ecosystems
• Math Connections: Human Dependance on Earth, Investigate the relationship between population growth and water availability.
Evaluate
• CER- describe how natural hazards have shaped the course of human history and migration.
• OER questions</td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>Carrying Capacity Student Activity and PPT</td><td>Use lessons on carrying capacity to discuss the interconnectedness of human dependence on resources. Also provides opportunities to interpret data.</td></tr><tr><td>Density dependent vs. Density independent variables that impact change</td><td>Use lesson to discuss the key differences between density dependent and density independent variables that have shaped populations over time.</td></tr><tr><td>Ocean Acidification lab</td><td>This activity may be used as an alternative for a Tier 1 explore activity or as a remediation activity.</td></tr></table></td></tr>
<tr><td>Week 5
(4x4)

Week 9
(Year-long)</td><td colspan="2">Teacher created Summative Assessment and re-teach opportunities.</td></tr>
</table>

Unit 2 Guide: Resources from Air, Water, and Land

The following unit guide provides a breakdown of Tier 1 instructional activities that should be completed for each topic, each week. Supplemental resources and activities are also provided and can be used to provide additional support for students who need Tiers 2 or 3 support (i.e., remediation and/or intervention).

<table>
<tr><td colspan="3">Unit Anchoring Phenomenon: Can we ever run out of water? How to landlocked states or countries grapple with this concern?</td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Water Resources and Use
HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth’s surface can create feedbacks that cause changes to other Earth systems.
HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
HS-ESS3-1. 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.
Key areas of concern related to our sustainable use of Earth's water resources
How personal habits matter in terms of a larger ecology
The difference between physical and economic water scarcity
How different populations around the world depend on, value, and interact with water
The impact water-conservation designs had on local, regional, and global communities</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[1]</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Week 1 (4x4)

Weeks 1-2 (Year-long)</td><td>Section Resource: EcoRise Module: The Power of Water (EcoRise Canvas Course)
Course Resource Folder in Science Canvas Portal and Science One Drive
Engage
101 Fundamentals: Water, Introduction video
Explore
101 Fundamentals: Water, Presentation and Discussion
Global Water Innovations
Do it Yourself Drinking Water</td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>It is possible to run out of water?</td><td>Use these NSTA resources for engaging activities and explorations to supplements students’ understanding of the hydrologic cycle. Resource found on NSTA website.</td></tr></table></td></tr>
</table>

<table>
<tr><td></td><td>Explain
Use presentations to support students as they explain their understanding
Elaborate
RCT 2: Assessing Optimal Rainwater Collection Systems
Inspired by Nature
HS Lesson 1: Water Resources and Water Footprints
Evaluate- Teacher created assessment</td><td></td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Air Resources and Use
HS-ESS3-4. Evaluate of refine a technological solution that reduces impacts of human activities on natural systems.
Defining air and air pollution
Factors influence indoor and outdoor air quality, and how it is measured
Ways that air pollution challenges can be addressed locally and globally
Daily actions that impact air quality?</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[1]</td></tr>
<tr><td>Week 2 (4x4)

Weeks 3-4 (Year-long)</td><td>Section Resource: EcoRise Modules: A Breath of Fresh Air and Air Eco-Audit (EcoRise Canvas Course)
Course Resource Folder in Science Canvas Portal and Science One Drive
Engage
101 Fundamentals: Air
Explore
Picturing Pollution
Explain- Use presentations to support students as they explain their understanding
Elaborate- A Living Wall
School Air Eco-Audit: Exploring
School Air Eco-Audit: Analyzing
Evaluate- Teacher created assessment</td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>Is there a link between meteorological activity and air pollution in urbanized and coastal areas?</td><td>Use this resource for a CER or more lengthy research project for students to explore a relevant issue around air resources. Link to Science.gov website.</td></tr><tr><td>Air Particulates Lab and PPT</td><td>Lab activity using simple materials and power point resource.</td></tr></table></td></tr>
</table>

<table>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Sustainable Eating
HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
HS-ESS3-1. 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.
HS-ESS3-3. Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.
• What exactly is food, and what are some of the different reasons we value it?
• What are some common farming practices, and how sustainable are they?
• What are some possible solutions to food-related challenges?
• What is the value of a farmers' market?
• How can we use human ingenuity and innovation to design solutions to lessen the impacts of food production and consumption?</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[2]</td></tr>
<tr><td>Week 3 (4x4)

Weeks 5-6 (Year-long)</td><td>Section Resource: EcoRise Modules: Sustainable Eating and Food Eco- Audit (EcoRise Canvas Course)
○ Course Resource Folder in Science Canvas Portal and Science One Drive

Engage
• 101 Fundamentals: Food
Explore
• Farm Fresh Food
• Animal Farms
Explain- Use presentations to support students as they explain their understanding
Elaborate-
• School Food Eco-Audit: Exploring
• School Food Eco-Audit: Analyzing
Evaluate- Teacher created assessment</td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>Socratic Seminar: An exercise in Team Building and Communication</td><td>There are several ways to frame "sustainable food" or "sustainable eating." We can look at it from a business perspective, a nutritional or dietary need. Divide students up into 3 teams (or 6 teams and two teams cover the same angle) and help them conduct a Socratic Seminar based on their team's unique lens. Have the class vote at the end as to which team's talking points or arguments were the most effective. Link to website resource.</td></tr></table></td></tr>
</table>

<table>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Land Use
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
Characteristics of a great public space
What is placemaking, and how can it enhance a community?
The value and role of culture in public spaces
Integrating aspects of our culture into public spaces on our campus
Planning to improve a public space on campus</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[1]</td></tr>
<tr><td>Week 4
(4x4)

Weeks 7-8
(Year-long)</td><td>Section Resource: EcoRise Modules: Powerful Public Spaces (EcoRise Canvas Course)
Course Resource Folder in Science Canvas Portal and Science One Drive
Engage
101 Fundamentals: Public Spaces
Explore
Planning Smart Spaces
A Place for Culture
Explain- Use presentations to support students as they explain their understanding
Elaborate
From Plans to Reality
School Public Spaces: Exploring
School Food Eco-Audit: Analyzing
Evaluate-
Teacher created assessment</td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>Cookie Mining activity (Blueberry muffins and Sand tubs with small jewels or glass gems can also be used depending on time and class fund)
Cookie Mining Student Sheet</td><td>Hands on, experiential activity with minimal cost and set up for the teacher. Driving Question: How do we quantify land use and its various uses or human based applications? Links to teacher instructions and activity on website and student worksheet in folder.</td></tr></table></td></tr>
<tr><td>Week 5
(4x4)

Week 9
(Year-long)</td><td colspan="2">Teacher created Summative Assessment and re-teach opportunities.</td></tr>
</table>

Unit 3 Guide: Earth's Resources and Energy

The following unit guide provides a breakdown of Tier 1 instructional activities that should be completed for each topic, each week. Supplemental resources and activities are also provided and can be used to provide additional support for students who need Tier 2 or 3 support (i.e., remediation and/or intervention).

<table>
<tr><td colspan="3">Unit Anchoring Phenomenon: Is it worth it to pursue a carbon neutral society? Why should we strive to minimize or at least mitigate the impact we have on the earth? We cannot compare the various forms of energy in an "apples to apples" fashion, can you develop a way to quantify the pros and cons of each power source humans have to choose from for their homes and businesses?</td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Earth Processes Shape our Resources
HS-ESS1-5. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.
HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.
• Continental rocks, which can be older than 4 billion years, are generally much older that the rocks of the ocean floor, which are less than 200 million years old.
• Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[1]</td></tr>
<tr><td>Week 1 (4x4)

Weeks 1-2 (Year-long)</td><td>Section Resource: STEMscopes scope HS Earth and Space Science: Scope-Plate Tectonics and Scope- Earth's Formations
○ Course Resource Folder in Science Canvas Portal and Science One Drive

Engage
• Accessing Prior Knowledge: Plate Tectonics
• Accessing Prior Knowledge: Earth's Formations
Explore
• Plate Tectonics: Explore 2- Edible Plate Boundaries
• Earth's Formations: Explore 1- Landforms at Plate Boundaries
• Earth's Formations: Explore 2- Mass Wasting</td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>Discovery Education video: Plate Tectonics</td><td>Explains the theory of plate tectonics and the different types of plate movements. Link to Discovery Education website.</td></tr><tr><td>Discovery Education video: Real world science – Earth's Land Formations</td><td>Investigates land formations that can be found on the earth's surface. Discusses the continents and how they were once joined together to form a large land mass called Pangea, and the current land formations which can be found in high lands, lowlands, flat lands, and near the oceans. Link to Discovery Education website.</td></tr></table></td></tr>
</table>

<table>
<tr><td></td><td>Explain
Picture Vocabulary and STEMscopedia should be introduced throughout each Explore activity to support students as they explain their understanding
Connection Video- Earth’s Surface (Earth’s Formations Scope)
Elaborate
Earth’s Formations: Explore 3- Constructive and Destructive Force of Water
Evaluate
CER: explain how the given model would be used to explain how features are created on the sea floor.</td><td></td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Nuclear Power and Hydropower
HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
Nuclear power despite being a top generator of electricity has its limits to use, is very regulated, and is subject to public concern related to safe use.
Hydropower is a highly efficient source for electric power in the U.S.
Conventional hydropower involves the use of a dam or generation facility in a river or stream. The future of hydropower includes low-impact hydropower technologies, conduits, pumped storage, and marine hydrokinetic technologies (oceans).</td></tr>
<tr><td>Week 2 (4x4)

Weeks 3-4 (Year-long)</td><td>Section Resource: NEED Project Resources: Energy of Moving Water, Exploring Hydroelectricity, and Exploring Nuclear Energy Teacher and Student Guides. All resources found in course folder.
Course Resource Folder in Science Canvas Portal and Science One Drive
Engage
Introduction Energy, Electricity and Water (Select activities from Activity 1: Introduction to the Unit found in Energy of Moving Water, TG p.7 and Energy of Moving Water SG, p.29-31)
Explore
Nuclear Energy
Radioactivity: Stable and Unstable Isotopes (Exploring Nuclear Energy p. 8, 52-53)
Radioactive Dose Chart (Exploring Nuclear Energy p. 8, 54)</td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>Nothing Fishy Happening Here
(Hydroelectricity TG p.16-17)
(Hydroelectricity SG p.54-56)</td><td>Use this resource to extend students’ understanding of ecological impacts that dams have on fish populations and other species.</td></tr><tr><td>Candy Chemistry
(Exploring Nuclear Energy, pg.9)
SG include:
Radioactive Decay
(Exploring Nuclear Energy p.9, 55)
Avg. Atomic Mass
(Exploring Nuclear Energy, p.56)
Examining Nuclear Energy</td><td>Use this resource to help students understand ideas around how there may be multiple isotopes of the same element, how atoms decay, and how to draw a decay curve.</td></tr></table></td></tr>
</table>

	• Hydropower ○ Virtual Tours (Exploring Hydroelectricity TG, p. 20) ○ Force of Water Explorations (Energy of Moving Water TG, p.11, Energy of Moving Water SG, p. 47-51) **Explain** • Secondary Energy Infobook should be used to support students as they explain their understanding **Elaborate** • Nuclear Power Plant Simulation Summary (Exploring Nuclear Energy, p. 14, 63) • Hot topics in Hydropower (Exploring Hydroelectricity TG, p. 18, 51-52) **Evaluate** • Nuclear Energy Assessment (Exploring Nuclear Energy, p. 24, 70-72) Hydropower Pre/Post Assessment (Exploring Hydroelectricity TG, p. 18 and 53)	(Exploring Nuclear Energy p.57)	
PE(s) and Big Ideas for this section	**Wind and Solar Energy** HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. • Wind energy is harnessed using a turbine generator to capture the energy in the moving air, and is cost competitive, despite its intermittency • Solar energy, or can be harnessed using thermal energy conversion, or more commonly through solar panels.		
Week(s)	**Tier 1 Instructional Activities**	**Tier 2 and 3 Supplemental Resources and Activities[2]**	
Week 3 (4x4) Weeks 5-6 (Year-long)	**Section Resource:** NEED Project Resources: Exploring Wind Energy, Exploring Offshore Wind Energy, and Exploring Photovoltaics Teacher and Student Guides. All resources found in course folders. ○ Course Resource Folder in Science Canvas Portal and Science One Drive **Engage** • Introduction to Wind (Exploring Wind Energy TG, p. 7, Exploring Wind Energy SG p. 2-8) • Introduction to Solar Energy (Exploring Photovoltaics TG, p. 6- reference pages and activities in both the Teacher and Student guide) **Explore** • Wind Energy	**Resources**	**Rationale for use**
		Baseload Balance Activity	Most students don't give electric power much thought until the power goes out. Electricity plays a giant role in our day-to-day lives. This activity demonstrates how electricity supply is transmitted on the electric grid to consumers. It also encourages students to explore the differences between baseload and peak demand power, and how power companies maintain supply to ensure customers have power as they need it. Resource found in Exploring Wind Energy Teacher Guide.
		Solar Space Heating (Solar Oven)	Students may be familiar with this activity. Use it to reinforce ideas about how radiant

	○ Measuring Wind Speed (Exploring Wind Energy TG, p. 8, Exploring Wind Energy SG, p. 8) ○ Wind Can Do Work (Exploring Wind Energy TG, p. 9, Exploring Wind Energy SG, p. 24) ○ Wind Can Generate Electricity (Exploring Offshore Wind Energy TG, p. 12, Exploring Offshore Wind Energy SG, p.30-32) • Solar Energy ○ PV Ping Pong Simulation (Exploring Photovoltaics TG, p. 18-19) **Explain** • Secondary Energy Infobook should be used to support students as they explain their understanding. **Elaborate** • RCT 3: Wind and Solar Energy • Siting and Permitting a Wind Farm (Exploring Wind Energy TG, p. 17, 22 44-47) **Evaluate** • Offshore Wind Assessment (Exploring Offshore Wind energy TG, p.22, 26) • Solar Review Questions (Exploring Photovoltaics TG, p. 9 and 11, Exploring Photovoltaics SG, p. 18)	energy can transform into thermal energy, passive and active solar technology applications and why they are beneficial. Resource found in Exploring Photovoltaics Teacher Guide.
PE(s) and Big Ideas for this section	**Coal, Oil and Natural Gas Energy** HS- ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and change in climate have influenced human activity. HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources. • Mineral and fossil resources are extracted through different processes depending on the resource. Each of these processes impacts the natural environment. Reducing impacts on the environment and reclaiming the used land must be incorporated for responsible practices. • We use energy in the US for electricity generation, industry, commercial and residential buildings, and transportation. Each energy source has its advantages and disadvantages, and all have impacts and ties to our economy, policy, societal goals, and sustainability practices.	
Week(s)	**Tier 1 Instructional Activities**	**Tier 2 and 3 Supplemental Resources and Activities[2]**
Week 4 (4x4)	**Section Resource:** NEED Project Resources: Great Energy Debate, Exploring Oil and Gas, and Exploring Coal. All resources found in course folders.	

<table>
<tr>
<td>Weeks 7-8
(Year-long)</td>
<td>
Course Resource Folder in Science Canvas Portal and Science One Drive
Engage

Formation of Petroleum and Natural Gas (Exploring Oil and Gas, p.9 and 67)
Resource extraction process and impact videos: https://www.energy4me.org/learn-about-energy/technology/hydraulic-fracturing-technology/

Explore

Core Sampling (Exploring Oil and Gas, p. 15 and 79)
Getting the Oil Out (Exploring Oil and Gas, p.17 and 81)
Using Density to Extract Petroleum (Exploring Oil and Gas, p. 23 and 93)
Comparing the Types of Coal (Exploring Coal, p. 8 and 56)
The Properties of Coal (Exploring Coal, p. 9 and 57-58)

Explain

Secondary Energy Infobook should be used to support students as they explain their understanding

Elaborate

Great Energy Debate: Student teams learn about all the energy sources, then are assigned to represent one specific energy source. Working cooperatively, students develop arguments on the merits of their source over the others.

Evaluate

Complete Evaluation Activities (Exploring Coal, p.28 and Exploring Oil and Gas, p. 32)

</td>
<td>
<table>
<tr><th>Resources</th><th>Rationale for use</th></tr>
<tr><td>Socratic Seminar: An exercise in team building and communication</td><td>Energy Wars! Allow your students to continue to sharpen their communication skills, debate skills, and teamwork as they work in teams of 3-4 to participate in another Socratic Seminar with a focus on details of the energy sector: uranium, hydropower, solar power, wind, coal, oil, etc. Website resource linked.</td></tr>
<tr><td>Mining Challenge (Exploring Coal, p.12, 65-67)</td><td>Students will be able to describe the process and challenges of mining.</td></tr>
<tr><td>Understanding Density (Exploring Oil and Gas, p. 22 and 92)</td><td>Students will review density concepts by comparing the densities of different items and defining density and describing its importance as a physical property.</td></tr>
</table>
</td>
</tr>
<tr>
<td>Week 5
(4x4)

Week 9
(Year-long)</td>
<td colspan="2">Teacher created Summative Assessment and re-teach opportunities.</td>
</tr>
</table>

Unit 4 Guide: Environmental Justice and Sustainability

The following unit guide provides a breakdown of Tier 1 instructional activities that should be completed for each topic, each week. Supplemental resources and activities are also provided and can be used to provide additional support for students who need Tier 2 or 3 support (i.e., remediation and/or intervention).

<table>
<tr><td colspan="3">Unit Anchoring Phenomenon: Highway construction of the 50s and 60s and the subsequent environmental impact, zoning rules and government level planning have shown landscape level consequences for those most vulnerable.</td></tr>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Environmental Justice
• Analyze and reflect on how, due to systemic social and environmental inequalities, resources are not always distributed equally.
• Describe the importance of perspective, empathy, and compassion in understanding the needs of and conditions impacting others.
• Explore key events and leaders related to the EJ movement to build shared understanding.</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[1]</td></tr>
<tr><td>Week 1
(4x4)

Weeks 1-2
(Year-long)</td><td>Section Resource: EcoRise Modules: Introduction to Environmental Justice (Ecorise Canvas Course)
○ Course Resource Folder in Science Canvas Portal and Science One Drive
Engage-
• Session 1: Limited Resources Game
Explore
• Session 2: Defining Environmental Justice
• Session 3: Exploring Environmental Justice
Explain
• Use presentations to support students as they explain their understanding
Elaborate
• RCT 4: Access to National Parks
• Session 4: Advocating for Environmental Justice
Evaluate
• Teacher created assessment</td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>Why EJ is so critical</td><td>Let students explore local issues that fall within the parameters of true environmental justice. Link to website resource.</td></tr><tr><td>Reinforce Media Literacy</td><td>The media is saturated with differing viewpoints and vantage points. Ask students what they think drives these many and diverse opinions.</td></tr><tr><td>Introducing the concept of Bias</td><td>Select from PBS Learning activities in Interactive lesson: Who, me?
Biased: Understanding Implicit Bias
Resources from STEM Teaching Tools website</td></tr></table></td></tr>
</table>

<table>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Atmosphere and Climate Change
HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth’s systems result in changes in climate.
HS ESS3-5. Analyze geoscience data and the results from global climate models to make evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
• There is a strong relationship between energy consumption and climate change. Mitigating the effects of climate change will require addressing the energy sources and technologies we use to meet our needs.</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[2]</td></tr>
<tr><td>Week 2
(4x4)

Weeks 3-4
(Year-long)</td><td>Section Resource: STEMscopes scope HS Earth and Space Science: Energy and Climate Scope and Impact of Climate Change Scope
NEED Project Resources: Exploring Climate Science. All resources found in course folders.
• Course Resource Folder in Science Canvas Portal and Science One Drive

Engage- Impact of Climate Change: Accessing Prior Knowledge- Human v. Natural Climate Change Factors
Explore
• Explore 1: Wobbly Earth (Energy and Climate Scope)
• Explore 1: What Does the Climate say? (Impact of Climate Change Scope)
• Explore 2: Tuva- Climate Change Data Analysis (Impact of Climate Change Scope)
Explain- Picture Vocabulary and STEMscopedia should be introduced throughout each Explore activity to support students as they explain their understanding
Elaborate
• Greenhouse Gas Demonstration (Exploring Climate Science, p. 7)
• Properties of CO2 (Exploring Climate Science, p. 8 and 40)
• Greenhouse in a Beaker (Exploring Climate Science, p.10 and 41-42)
Evaluate- Climate Web Activity (Exploring Climate Science, p.19 and 64-69)</td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>Carbon Cycle Simulation (Exploring Climate Science, p. 15, 24-38, 47-61)</td><td>Use this resource to assist students with describing the basic ways that carbon cycles throughout the Earth’s systems, and compare how carbon cycled prior to and after the Industrial Revolution.</td></tr><tr><td>Electrical Devices and Their Impacts (Exploring Climate Science, p. 20)</td><td>Students will describe the energy requirements of using certain electrical appliances and calculate the cost of using electrical appliances.</td></tr></table></td></tr>
</table>

<table>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Waste Production and Impact
HS- ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and change in climate have influenced human activity.
• Americans produce over 4lbs of waste per day, per person. Waste management is a large challenge for towns, cities, and nations, as land space becomes scarcer, and environmental regulations are increased.</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[2]</td></tr>
<tr><td>Week 3 (4x4)

Weeks 5-6 (Year-long)</td><td>Section Resource: EcoRise Module: The Weight of Waste (Ecorise Canvas Course) and NEED Project Resources: Museum of Solid Waste. All resources found in course folders.
○ Course Resource Folder in Science Canvas Portal and Science One Drive

Engage
• 101 Fundamentals: Waste (The Weight of Waste)
Explore
• The Story of Electronics (The Weight of Waste)
• Plastic Bottle Planter (The Weight of Waste)
• Upcycling Competition (The Weight of Waste)
Explain
• Use presentations to support students as they explain their understanding
Elaborate
• Museum of Solid Waste & Energy (NEED: Museum of Solid Waste)
Evaluate
• Teacher created assessment</td><td><table><tr><th>Resources</th><th>Rationale for use</th></tr><tr><td>No Impact Man</td><td>After viewing the film, (in whole or a few clips, up to your discretion) Challenge the students to pick a daily practice that could be viewed as “Unsustainable” and make a podcast or short PSA about it. Posters and videos can both count as their PSA.</td></tr><tr><td>EcoRise Audit Activities (EcoRise Canvas Course)
School Waste Eco-Audit: Exploring
School Waste Eco-Audit: Analyzing</td><td>Use these resources with students who are uncertain about the impact of waste in their immediate environment. Resources found in EcoRise Canvas Course</td></tr></table></td></tr>
</table>

<table>
<tr><td>PE(s) and Big Ideas for this section</td><td colspan="2">Environmental Solutions
HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
• Scientists and engineers can make major contributions by developing technologies that produce less pollution and wasted and that preclude ecosystem degradation.</td></tr>
<tr><td>Week(s)</td><td>Tier 1 Instructional Activities</td><td>Tier 2 and 3 Supplemental Resources and Activities[2]</td></tr>
<tr><td>Week 4
(4x4)

Weeks 7-8
(Year-long)</td><td>Section Resource: STEMscopes scope HS Earth and Space Science: Environmental Solutions
○ Course Resource Folder in Science Canvas Portal and Science One Drive

Engage
• Accessing Prior Knowledge: How Has the Human Use of Natural Resources Changed Earth?
Explore
• Explore 1- Inquiry Investigation: The Quest for Clean Water
• Explore 2- Engineering Solution: Building Blocks
Explain
• Picture Vocabulary and STEMscopedia should be introduced throughout each Explore activity to support students as they explain their understanding
• Connection Video- Reducing Human Impact
Elaborate
• Reading Science- Urban Heat Islands
Evaluate
• CER: provide a scientific explanation that justifies the recycling of aluminum.</td><td><table><tr><th>Resources</th><th>Rationale for Use</th></tr><tr><td>Understanding Human Impact on the Sesan Dam</td><td>Students will analyze and interpret data in a local drainage basin to predict how changes caused by human activity influence the hydrology of the basin and the amount of water for use in the ecosystem. Link to Discovery Science Techbook.</td></tr><tr><td>STEM in Action</td><td>Applying relationships between human activity and Earth’s systems. Link to Discovery Science Techbook.</td></tr></table></td></tr>
<tr><td>Week 5
(4x4)
Week 9
(Year-long)</td><td colspan="2">Summative Assessment and re-teach opportunities.</td></tr>
</table>

Central Services Science Team Contacts

For more information or support around the DCPS science curriculum, aligned resources, and NGSS implementation, please contact us:

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