

BPS Science Department Earth Science - Unit 8 - Earth's Water

Unit 8 - During this unit, students will plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. Students will 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. They will also evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. Students will create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. Students will also design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Driving Questions:

- How are the unique properties of water related to the roles it plays in Earth's systems?
- How does water cycle through different phases at Earth's surface?
- What are some major challenges in managing water resources?

NYSSLS Standards:

Lesson 8.1: In this lesson, students investigate the unique properties of water (SEP Planning and Carrying Out Investigations, CCC Matter and Energy, CCC Structure and Function). They develop an understanding of how these properties relate to processes (CCC Systems and System Models, SEP Developing and Using Models, DCI.ESS2.C The Roles of Water in Earth's Surface Processes) behind the evolution (CCC Stability and Change) of various Earth systems (DCI.ESS2.A Earth Materials and Systems) such as natural surface formations and weather systems (DCI.ESS2.D Weather and Climate).

- HS-ESS2-2 Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to Earth's systems.
 - 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)
- HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
 - 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)
- HS-ESS2-8 Evaluate data and communicate information to explain how the movement and interactions of air masses result in changes in weather conditions.
 - ESS2.D Weather and Climate
 - (NYSED) Concepts of density and heat energy can be used to explain observations of weather patterns. (HS-ESS2-8)

Lesson 8.2: In this lesson, students investigate the abundance of liquid water available on Earth's surface and construct explanations regarding the distribution of water resources and their impact on the development of human society. They examine and develop system models showing the water cycle (DCI.ESS2.C The Roles of Water in Earth's Surface Processes) and use these models to demonstrate that the water cycle is a closed system (CCC Systems and System Models). In addition, students will analyze and interpret data regarding stability and change in the water supply (SEP Analyzing and Interpreting Data, CCC Stability and Change). They use mathematical thinking to draw conclusions about economic, social, environmental, and geopolitical costs and risks as well as benefits. Finally, they will evaluate the sustainability of human resource management practices (DCI.ESS2.A Earth Materials and Systems) and propose sustainable solutions for ongoing human development (SEP Constructing Explanations and Designing Solutions).

- HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
 - 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)
- HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
 - ESS3.A Natural Resources
 - 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)

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- **HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.**
 - **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)
- **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.**
 - **ESS3.A Natural Resources**
 - Resource availability has guided the development of human society. (HS-ESS3-1)
- **HS-ESS2-2 Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to Earth's systems.**
 - **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)
- **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.**
 - **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)

Science & Engineering Practices ([link to SEP break-down](#)):

- Analyzing and Interpreting Data
- Planning and Carrying Out Investigations
- Constructing Explanations and Designing Solutions
- Developing and Using Models

Crosscutting Concepts ([link to guiding questions for CCC](#)):







- Stability and Change
- Structure and Function
- Energy and Matter
- Systems and System Models
- Energy and Matter

Opportunities for Student Collaboration p. 453H (Complete Collaboration Strategy Guide):


- **Self-Assessment** p. 454 ● **Group Activity** pp. 472, 475, 479, 481 ● **Group Discussion** pp. 458, 478 ● **Think, Pair, Share** p. 461, 463, 473 ● **Whole Class** pp. 465, 478 ●
 ● **Four Corners** p. 458 ● **Partner Activity** p. 481 ●

Time Frame	Lesson Framework	Instructional Sequence	Resources- HMH Dimensions- Earth & Space Science Textbook	Resources- HMH Dimensions Digital Component	Additional Resources
2/27/23-3/10/23	Unit 8: Earth's Water		<ul style="list-style-type: none"> ● Unit Opener (Pre-Assessment): Predict- What technologies are used to supply water to homes and businesses in your community? (pp.452-453) 	<ul style="list-style-type: none"> ● Unit Project: Harvesting Water through Biomimicry- Students learn about biomimicry, an approach to finding sustainable solutions to human problems through copying patterns and strategies found in nature. They investigate adaptations in living things that enable them to capture water vapor from the air and then work with a group to design and test a water-collection system based on these principles. They then use the results from these tests to suggest ways the design could be improved and implemented as a real-world solution to water shortages. 	

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<p>Lesson 8.1 Properties of Water</p> <p>In this lesson, you will use models to investigate the properties of water, the water cycle, and the role of water in Earth's surface processes, including weather.</p> <p>Vocabulary: solvent polar specific heat</p>	Engage	<ul style="list-style-type: none"> • *Phenomenon: Can You Explain It?- How does water contribute to the formation of potholes? (p.454) 		<p>ESRT:</p> <ul style="list-style-type: none"> • Specific Heats of Common Materials (p. 1)
	Explore/ Explain	<ul style="list-style-type: none"> • Exploration 1- The Strength of Water (pp.455-458) • Exploration 2- The Strength of Ice (pp. 459-461) • Exploration 3- Unique Properties of Water (pp.462-463) 	<ul style="list-style-type: none"> • Lesson 1- Properties of Water PPT (editable) • Exploration 1:  Hands-On Lab- Water Solubility- In this lab, students compare the solubility of different substances. • Exploration 2:  Hands-On Lab- Water Density- In this lab, students measure the temperature and density of water and analyze the effects of temperature and salinity on the density of water. 	
	Elaborate	<ul style="list-style-type: none"> • Continue Your Exploration- Guided Research: Hypersaline Environments (p. 464) 	<ul style="list-style-type: none"> • Continue Your Exploration: <ul style="list-style-type: none"> ○  Hands-On Lab- Water and Energy- In this lab, students measure the specific heat of water. ○ Ocean Surface Temperatures 	
	Evaluate	<ul style="list-style-type: none"> • Lesson Self Check (pp.465-467)- Can You Explain It- Revisit • Make Your Own Study Guide (p. 467) • Checkpoint Questions (pp.466-467) 	<ul style="list-style-type: none"> • Can You Explain It? Revisit • Checkpoint Questions • Make Your Own Study Guide • Unit 8- Lesson 1 Quiz 	
<p>Lesson 8.2 Water Resources</p> <p>In this lesson, you will construct explanations regarding the availability of water as a natural resource and the impact of humans on the water supply</p> <p>Vocabulary: groundwater aquifer watershed</p>	Engage	<ul style="list-style-type: none"> • Phenomenon: Can You Explain It?- How do individuals and communities monitor water resources? (p. 468) 		*At Home- Home Water News (p. 453H)
	Explore/ Explain	<ul style="list-style-type: none"> • Exploration 1- The Water Supply (pp. 469-472) • Exploration 2- Freshwater Resources (pp. 473-477) • Exploration 3- Water Use and Management (pp. 478-483) 	<ul style="list-style-type: none"> • Lesson 2- Water Resources PPT (editable) • Exploration 1:  Hands-On Lab- Water and CO₂- In this lab, students investigate the effects of temperature on the ability of dissolved gases to stay in a liquid. • Exploration 1:  Hands-On Lab- Porosity, Permeability, and Capillarity- In this lab, students will measure the porosity, permeability, and capillarity of several particle sizes. • Exploration 1:  Hands-On Lab- Quality of Water- In this lab, students examine important qualities of water and how the properties of water affect them. 	*In the Community- Local Water Issues (p. 453H)
	Elaborate	<ul style="list-style-type: none"> • Continue Your Exploration- Guided Research: Freshwater Reservoirs (p. 484) 	<ul style="list-style-type: none"> • Continue Your Exploration: <ul style="list-style-type: none"> ○ America's Groundwater ○ Model River Discharge ○ Who Pays for Pollution 	
	Evaluate	<ul style="list-style-type: none"> • Lesson Self Check (pp.485-487)- Can You Explain It- Revisit 	<ul style="list-style-type: none"> • Can You Explain It? Revisit • Checkpoint Questions 	

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		<ul style="list-style-type: none"> ● Make Your Own Study Guide (p. 487) ● Checkpoint Questions (pp. 486-487) 	<ul style="list-style-type: none"> ● Make Your Own Study Guide ● Unit 8- Lesson 2 Quiz 	
	Enrichment: Unit Connection Activities (Optional)	<ul style="list-style-type: none"> ● Biology- Water in Living Systems ● *Social Science- The Social Cost of Water ● *Engineering- Safe Drinking Water 		
	Unit Close	<ul style="list-style-type: none"> ● Synthesize the Unit (p.489) ● Driving Questions (revisit) ● Practice and Review Questions (pp.489-490) ● Unit Project Revisited (p.490) ● Unit Performance Task (p.491) 	<ul style="list-style-type: none"> ● Assessment Guide: <ul style="list-style-type: none"> ○ Unit Test A- provides an in-depth assessment of the Performance Expectations aligned to the unit. ○ Unit Test B can be used to assess students who need extra support 	 HMH Earth & Space Science Unit 8- Earth's Water (Editable item bank available under Public Assignments in Castle Learning)

Resources

<http://ngss.nsta.org/Classroom-Resources.aspx> - Searchable NYSSLS/NGSS aligned resources curated by NSTA

[BPS Earth Science Website](#)– BPS Earth Science curriculum resource hub

[BPS Science Department Recommended Virtual Labs](#) – Virtual lab resources with embedded links to virtual labs and student sheets. Must be logged into BPS google account through BPS Gmail account to access.

[BPS Science Department CER Student Writing Template](#) ([BPS Science Department CER Practice with a Graph](#))

[NYSED's Office of State Assessment webpage](#) - Access to Released Regents Earth Science Examinations

[Science Learning Standards \(HS\)](#) – NYSSLS High School Standards for Earth Science

[NYSED Bilingual Glossaries](#) – NYS Statewide Language Regional Bilingual Education Resource for NYSED approved bilingual glossaries.

English Language Learners (ELL) Enhancements To access hyperlinked material, you must be logged into your BPS Google Drive	Listening <ul style="list-style-type: none"> ● Cross- Linguistic Practices: Gives students opportunities to make connections between what they hear and their home language (For example, allow students to listen to a passage and identify cognates.) ● Build background knowledge ● Activating Prior Knowledge ● Activating prior knowledge means both eliciting from students what they already know and building initial knowledge that they need in order to access upcoming content ● Visuals - GIFs, pictures- will assist students in understanding what they 	Speaking <ul style="list-style-type: none"> ● Sentence Frames - to begin a sentence - such as <i>Evolution is...</i> or <i>I think that evolution is...</i> ● Academic Conversation Starters: Have a visual of a list of academic sentence starters that students can refer to in a discussion such as <i>I expect ___ to happen.</i> or <i>My data shows that...</i> This aids students in having more science focused dialogue. ● Choral Reading - Build fluency, self-confidence and motivation with reading/speaking 	Reading <ul style="list-style-type: none"> ● Supplementary Text to reinforce concepts. If necessary, use lower Lexile levels to ensure comprehension. ● Visual Aids - Pictures or models to support vocabulary words/ concepts ● Video to review introduce a topic - use closed captioning so students can read along and listen to content ● 4 Square / Frayer models to help students gain a deeper understanding of vocabulary. ● Highlighting important text to assist students in answering questions after the reading. 	Writing <ul style="list-style-type: none"> ● Sentence Frames - to begin a sentence- such as <i>Biodiversity is...</i> or <i>An example of competition is....</i> ● Cloze passages with word banks ● Word banks ● Graphic Organizers to help break down the writing process and organize thoughts ● Standards-based sentence stems ● Performance Level Descriptors- this document provides teachers with a description of what output 	Instructional Accommodations (depending on the student's needs) <ul style="list-style-type: none"> ● Extended time for tests in class, projects and assignments ● Directions read. Broken down as necessary ● Model how to complete the activity in the lesson ● Oral simplification of directions or questions ● Translated version of test when available. Student may have both version English and native language version ● Use of approved bilingual glossaries from NYS in each subject
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	<p>are listening to. Visual thinking strategies set the lens for learning.</p> <ul style="list-style-type: none"> Video to review/ introduce a topic – use closed captioning so students see the words and pronunciations while they listen to the content. Word stretching / Vowel stretching allows student to listen closely to the pronunciation words Performance Level Descriptors - this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of listening Scroll for grades 9-12. 	<ul style="list-style-type: none"> Create movement to go with the word. Movement can be a motivating factor and kinesthetic tool for conceptualizing the rhythm and flow of fluent reading while triggering brain function for optimal learning Performance Level Descriptors - this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of speaking. Scroll for grades 9-12 	<ul style="list-style-type: none"> Chunking-Break reading of text into chunks or paragraphs Vocabulary Morphology- segmenting words into affixes (prefixes/suffixes) and roots/base words. Understanding that words connected by meaning/origin can be connected by spelling can be critical to expanding a student's vocabulary. Performance Level Descriptors- this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of reading. Scroll for grades 9-12. 	<p>they can expect from students based on earned NYSESLAT levels in the modality of writing. Scroll for grades 9-12.</p>	
<p>Special Education Modifications</p> <p>Special Education students must have accommodations as per Individual Educational Plan (IEP)</p>	<p><u>Instructional</u></p> <ul style="list-style-type: none"> Pre-teach vocabulary Use picture vocabulary Scaffold Depth of Knowledge questions Provide copy of notes/notes in “cloze” form Use of Think, Pair, and Share strategy to help process information Scaffold written assignments with the use of graphic organizers Allow for multiple ways to respond (verbal, written, response board) Provide model of performance task Modify informational text to fit the needs of the students Provide a digital or paper interactive notebook Present complex tasks in multiple ways Provide mnemonic strategies for Living Environment concepts 	<p><u>Technology:</u></p> <ul style="list-style-type: none"> Audio reading of text Text to type functions Videos to clarify/visualize Living Environment concepts Record class lecture/discussions and make accessible to student Nearpod- interactive presentations of notes Playposit - show a video clip about the topic and add your own questions for them to answer as they watch Allow students to type answers in chat on Teams <p><u>Other:</u></p> <ul style="list-style-type: none"> Arrange seating for maximum engagement and minimum distraction Accessible lab space (counter level) 	<p><u>In Class Assessments</u></p> <ul style="list-style-type: none"> Provide review packet or review sheet of concepts covered on the test Practice similar questions prior to the test Provide multiple options for projects Give a timeline of when things are due and remind them of the process often. Use of timer in class Break all complex tasks into chunks 		
<p>BPS Science K-12 Schoology Folder:</p> <p>9-12 Resources Earth Science Resources Curriculum Materials</p>	<p><u>SUTW Strategies</u></p> <ul style="list-style-type: none"> Informal Outline Color-Coding – Informative/Explanatory Text Two-column notes I-V-F Topic Sentence progressing to Four Step Summary Paragraph CUPS – Capitalization, Usage, Punctuation, Spelling Transitions 				
<p>Culturally and Linguistically Responsive Teaching</p>	<p>Materials, resources, and/or discussions address diverse cultural backgrounds and real-world applications</p> <ul style="list-style-type: none"> Artifacts (posters, charts, etc.) in the science classroom are representative of the cultures of the student population All students are given an opportunity to engage in science discourse Teacher demonstrates high expectations for all students 				

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**(CLRT) in the
Science
Classroom**

CLRT resources which align to Science content are denoted with a *