Grade 5 Science, Unit 4

Water on the Earth

Overview

Unit abstract

In this unit of study, students describe and graph data to provide evidence about the distribution of water on Earth. The crosscutting concepts of scale, proportion, and quantity and systems and systems models are called out as organizing concepts for these disciplinary core ideas. In the fifth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in using mathematics and computational thinking and in obtaining, evaluating, and communicating information. They are expected to use these practices to demonstrate understanding of the core ideas.

Essential question

- How much water can be found at different places on Earth?

Bristol–Warren, Central Falls, Cranston, Tiverton, and Woonsocket, with process support from The Charles A. Dana Center at the University of Texas at Austin

Written Curriculum

Next Generation Science Standards

5. Earth's Systems

Students who demonstrate understanding can:

5-ESS2-2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.]

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	Disciplinary Core Ideas	Crosscutting Concepts
Using Mathematics and Computational Thinking Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. ▪ Describe and graph quantities such as area and volume to address scientific questions. (5-ESS2-2)	**ESS2.C: The Roles of Water in Earth's Surface Processes** ▪ Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5-ESS2-2)	**Scale, Proportion, and Quantity** ▪ Standard units are used to measure and describe physical quantities such as weight, and volume. (5-ESS2-2)

Connections to other DCIs in fifth grade: N/A

Articulation of DCIs across grade-levels: **2.ESS2.C** (5-ESS2-2); **MS.ESS2.C** (5-ESS2-2); **MS.ESS3.A** (5-ESS2-2)

Common Core State Standards Connections:

ELA/Literacy –

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. *(5-ESS2-2)*

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (*5-ESS2-2)*

SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. *(5-ESS2-2)*

Mathematics –

MP.2 Reason abstractly and quantitatively. (5-ESS2-2)

MP.4 Model with mathematics. (5-ESS2-2)

5. Earth's Systems

Students who demonstrate understanding can:

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

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	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. ▪ Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (5-ESS3-1)	**ESS3.C: Human Impacts on Earth Systems** ▪ Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)	**Systems and System Models** ▪ A system can be described in terms of its components and their interactions. (5-ESS3-1) --- ***Connections to Nature of Science*** **Science Addresses Questions About the Natural and Material World** ▪ Science findings are limited to questions that can be answered with empirical evidence. (5-ESS3-1)

Connections to other DCIs in fifth grade: N/A

Articulation of DCIs across grade-levels: **MS.ESS3.A** (5-ESS3-1); **MS.ESS3.C** (5-ESS3-1); **MS.ESS3.D** (5-ESS3-1)

Common Core State Standards Connections:

ELA/Literacy –

RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. *(5-ESS3-1)*

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS3-1)

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS3-1)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-ESS3-1)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. *(5-ESS3-1)*

Mathematics –

MP.2 Reason abstractly and quantitatively. *(5-ESS3-1)*

MP.4 Model with mathematics. *(5-ESS3-1)*

Clarifying the standards

Prior learning

The following disciplinary core ideas are prior learning for the concepts in this unit of study.

By the end of Grade 2, students know that:

- Water is found in oceans, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.

Progression of current learning

Driving question 1
Where is water found on the Earth? What percentage of the Earth's water is fresh water?

Concepts	Practices
• Standard units are used to measure and describe physical quantities such as weight and volume. • Nearly all of Earth's available water is in the ocean. • Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.	• Describe physical quantities, such as weight and volume, in standard units. • Describe and graph quantities such as area and volume to address scientific questions. • Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. (Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.).

Driving question 2
How do individual communities use science ideas to protect Earth's resources and environment?

Concepts	Practices
• A system can be described in terms of its components and their interactions. • Science findings are limited to questions that can be answered with empirical evidence. • Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. • Individuals and communities are doing things to help protect Earth's resources and environments.	• Describe a system in terms of its components and interactions. • Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. • Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Integration of content, practices, and crosscutting concepts

During this unit of study, students need to understand that Earth is a system made up of subsystems, all of which have multiple components that interact. Throughout this unit, students will consider scale and proportion when examining the amount of water on the Earth, and they will consider the impact that humans have on one of Earth's most valuable resources.

To begin the progression of learning in this unit, students conduct research, using informational texts and online resources, to determine the distribution of fresh water and salt water among Earth's oceans, rivers, lakes, glaciers, groundwater, and polar ice caps. Students organize their data into graphs or charts, showing the allocation of fresh water and salt water on Earth. (Amounts should be described in terms of volume, as well as in percentages.) After comparing and analyzing data, students should be able to conclude the following:

- Nearly all of Earth's available water is in the ocean.
- Fresh water makes up less than 3% of the total amount of water on the Earth.
- Most fresh water is found in glaciers or underground.
- Only a tiny fraction of the fresh water on Earth is in streams, lakes, wetlands, and the atmosphere.

Next, students conduct research in order to determine ways in which individuals and communities help to protect the Earth's resources and environments. Using books and other reliable media resources, as well as first-hand observations in the local community, students gather information about the ways in which humans affect the environment. They should look for examples of human activities in agriculture, industry, and in their everyday lives, and should describe, both orally and in writing, the ways in which these activities affect the land, oceans, streams, groundwater, air, and other organisms (both plants and animals). Students will need the opportunity to share their findings with the class, and then should conduct further research to find ways in which individual communities use science ideas to protect the Earth's resources and environments.

Working in pairs or small groups, students should gather relevant information from both observations and reliable resources to prepare a presentation that explains one way in which a community is minimizing the effects of human activities on Earth's resources and environment. The presentation should include both writing and speaking components, as well as a list of sources that were used to provide information. As a result of conducting research and creating a presentation, students should come to understand that the ecosystem is a system that includes both living and nonliving components that interact with one another. These interactions cause changes to the system and its components. Humans are just one of many components in an ecosystem, yet our activities affect all parts of the ecosystem, many times in adverse ways.

Integration of engineering

Although engineering design is not explicitly called out in this unit, students could incorporate engineering design as they research the effect of human activities on Earth's resources and environments. The engineering design process can be used to:

- Through research and observation, define a problem in the local environment that is caused by a specific human activity.
- Identify possible constraints on design solutions, and determine possible criteria that can be used to compare the success of solutions.
- Use research to identify solutions that communities are using to minimize the effects on the environment, and then compare these solutions based on how well each meets the criteria and constraints of the problem.

Integration of English language arts and mathematics

English language arts

In order to integrate the CCSS for English language arts standards into this unit, students use print and digital sources to gather information and data that describe the amount of fresh water and salt water on the Earth and where it is found. As students gather information, they should organize the information into graphs, analyze and interpret the information to answer questions, and summarize the information in order to describe the amounts and percentages of fresh water and salt water on the Earth and to provide evidence about the distribution of water in oceans, lakes, streams, and reservoirs. Students also use several print and digital resources to find examples of:

- The effects of human activities in agriculture, industry, and everyday life on Earth's resources and environments, and
- Ways in which communities are using science ideas to protect Earth's resources and environments.

Students summarize and paraphrase the information and use it when creating presentations that describe ways in which communities are using science ideas to protect Earth's resources and environments. The presentation should include both oral and written components, and a list of sources should be included with the presentation.

Mathematics

The CCSS for mathematics are integrated into this unit as students model with mathematics by using tables, charts, and/or graphs to organize data and information they collect. This includes the amount of fresh and salt water on Earth, the locations of both fresh and salt water on Earth, how human activities affect Earth's resources, and ways in which communities protect the Earth's resources and environments. Students also reason abstractly and quantitatively when analyzing these data to use as evidence to support their thinking.

Future learning

The following disciplinary core ideas are future learning for the concepts in this unit of study.

By the end of middle school, students know that:

- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.
- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.
- Global movements of water and its changes in form are propelled by sunlight and gravity.
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.
- Water's movements—both on land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.
- Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.
- Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth, unless the activities and technologies involved are engineered otherwise.
- Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding human behavior and applying that knowledge wisely in decisions and activities.

Number of Instructional Days

Recommended number of instructional days: 15 (1 day = approximately 45–60 minutes)

Note—The recommended number of days is an estimate based on the information available at this time. Teachers are strongly encouraged to review the entire unit of study carefully and collaboratively to determine whether adjustments to this estimate need to be made.