Earth’s Spheres and Systems

The atmosphere has five layers:
- the troposphere
- stratosphere
- mesosphere
- thermosphere
- exosphere

The geosphere is shaped by three processes:
1. plate tectonics
2. rock cycle
3. weathering, erosion, and deposition

The biosphere has five kingdoms of living things:
- bacteria
- protists
- fungi
- plants
- animals

The windward side of a mountain has more precipitation.

A dry rain shadow forms on the other side of the mountain.

There are four spheres that make up Earth:
- the atmosphere
- biosphere
- geosphere
- hydrosphere

The hydrosphere is controlled by the water cycle.

Fifth Grade • NGSS 5-ESS2-1

Jessica Boschen & Jill Elliott
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Science Stations Overview
This is a general overview of all science stations in each UNIT BUNDLE.

**Watch a Video**
At this station, students will watch a video relevant to the topic and answer questions. You have the option of using the included worksheet with the questions or using the task cards and having students respond in their science journals.

**Play a Game**
Students play a game and answer questions about the experience. You have the option of using the included worksheet with the questions or using the task cards and having students respond in their science journals.

**Investigate**
Students use materials to investigate the science topic by following directions and recording results. Students answer questions about the investigation.

**Draw a Diagram**
Students draw and label a diagram specific to certain requirements. Students then explain how their diagram meets the requirements.

**Read a Passage**
Students read a short passage about the topic and answer questions about the information in the passage. You have the option of using the included worksheet with the questions or using the task cards and having students respond in their science journals.

**Create a Model**
Students use materials to illustrate the science concept and answer questions. You have the option of using the included worksheet with the questions or using the task cards and having students respond in their science journals.

**Explore**
Students create a sample and manipulate it using the new science concepts they have learned. Students answer questions based on the effects.

**Sort**
Students sort cards into groups or put them in a specific order. Students record the sort and then describe their reasoning.
Next Generation Science Standards are written to be “Three Dimensional.” The following section explains how this set of science stations addresses the three dimensions of Performance Expectation, Disciplinary Core Idea, and Science and Engineering Practices/Crosscutting Concepts.

In Fifth Grade, students are expected to demonstrate understanding in the following area:

5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

[Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.]

[Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]

This correlates with the DCIs DCI 5-ESS2.A which states:

ESS2.A: Earth Materials and Systems

Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.

All stations in this set meet the DCI, helping students gain an understanding of the four Earth spheres that make up the Earth, its materials, and its processes.

Science and Engineering Practices

Developing and Using Models

Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

• Develop a model using an example to describe a scientific principle.

Crosscutting Concepts

Systems and System Models

• A system can be described in terms of its components and their interactions.
Specific to the Earth’s Spheres and Systems Unit BUNDLE:

As a Fifth Grade Performance Expectation, students are expected to “Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.” (5-ESS2-1). This correlates with the DCI 5-ESS2.A, which states, “Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.” All stations in this set meet the Performance Expectation and DCI, helping students gain an understanding of how Earth’s spheres interact with each other, with respect to the systems that take place within each sphere.

The Investigate, Diagram, and Model Stations meet the Science and Engineering Practice of “Developing and Using Models” as students create models to demonstrate how two or more of Earth’s spheres interact and affect each other.

The Investigate Station meets the Engineering Design Standard, 5-ETS1-1. Students investigate a problem caused by weathering and erosion and propose a solution, using engineering practices, to solve the problem.

The Read Station in “How People Affect the Earth” (5-ESS3-1) correlates with this Station Set. Students learn how humans have negatively impacted each of Earth’s four spheres, and what can be done to help solve the problems.

This station set covers a little bit of everything in life and earth science. There are many vocabulary words. Prioritize vocabulary words based on what you know about your students’ background knowledge. Vocabulary words related to the water cycle, rock cycle, and plate tectonics were covered in 2nd and 4th grade NGSS.
Earth’s Spheres and Systems Unit Bundle

**Materials Checklist**

The following checklist is for the FULL UNIT BUNDLE.

### Watch a Video
- Computer / Device
- Student Direction Card
- Response Sheet or Task Cards
- Science Journal (optional)

### Play a Game
- Student Direction Card
- Board Game
- Die
- 2 Game Pieces
- Answer Key
- Word Search or Crossword Puzzle

### Read a Passage
- Reading Passage
- Response Sheet or Task Cards
- Science Journal (optional)

### Create a Model
- Reading Passage (optional)
- Student Direction Card
- Model Worksheet
- Response Sheet or Task Cards
- Science Journal (optional)
- Device
- Materials for a three-dimensional model (clay, construction paper, glue, foam pieces, sediments, peat moss, etc.)

### Investigate
- Reading Passage (optional)
- Student Direction Card
- Investigate Worksheet
- Response Sheet or Task Cards
- Science Journal (optional)

### Explore
- Reading Passage (optional)
- Student Direction Card
- Explore Worksheet
- Response Sheet or Task Cards
- Science Journal (optional)

### Draw a Diagram
- Reading Passage (optional)
- Student Direction Card
- Diagram Worksheet
- Response Sheet or Task Cards
- Science Journal (optional)
- Devices
- Materials for creating diagrams (see Teacher Instructions for ideas)

### Sort
- Reading Passage (optional)
- Student Direction Card
- Larger Sort Cards or Worksheet
- Scissors
- Glue
- Response Sheet or Task Cards
- Science Journal (optional)
The atmosphere has five layers: the troposphere, stratosphere, mesosphere, thermosphere, and exosphere.

The geosphere is shaped by three processes: (1) plate tectonics; (2) rock cycle; (3) weathering, erosion, and deposition.

The biosphere has five kingdoms of living things: bacteria, protists, fungi, plants, and animals.

The windward side of a mountain has more precipitation. A dry rain shadow forms on the other side of the mountain.

There are four spheres that make up Earth: the atmosphere, biosphere, geosphere, and hydrosphere.

The hydrosphere is controlled by the water cycle.
VOCABULARY CARDS

**Unit Bundle Only**

- **geosphere**: part of the Earth that contains all the minerals and rocks, found on the surface of the Earth and extends to Earth’s core.
- **prevailing winds**: winds that move steadily from a particular direction.
- **drought**: unusually long period of dry weather that leads to a water shortage.
- **ecosystem**: community of living things and nonliving things in an environment.
- **ice wedging**: when water freezes in rock cracks and breaks the rock.
- **producer**: organism that makes its own food.
- **hydrosphere**: part of the Earth that contains all the solid, liquid, and gaseous water; found under the surface of the geosphere and extends into the atmosphere.
- **igneous rocks**: form when magma cools and hardens.
- **metamorphic rock**: rock that has been changed by heat and pressure.
- **evaporation**: when a liquid changes to a gas.
- **magma**: melted rock under the Earth’s surface.
- **stratosphere**: second layer of the atmosphere; contains the ozone layer.
- **kingdom**: category of living things; the five kingdoms are protists (including algae), bacteria, plants, animals, and fungi.
- **thermosphere**: fourth layer of the atmosphere; where satellites orbit the Earth.
ecosystem: all the living things and nonliving things in an environment

evaporation: when a liquid changes to a gas

photosynthesis: the process through which energy from the sun is used to convert carbon dioxide and water into sugar and oxygen

geosphere: part of the Earth that contains all the minerals and rocks; found on the surface of the Earth and extends to Earth's core

permafrost: thick layer of soil that remains permanently frozen

metamorphic rock: rock that has been changed by heat and pressure

mesoscale: third layer of the atmosphere; where meteors burn up and particular air mass movement occurs

prevailing winds: dry winds that blow from a particular direction and water shortages
Watch a Video

1. What are the four spheres of Earth?
The four spheres on Earth are the geosphere, biosphere, hydrosphere, and atmosphere.

2. What does "geo" mean?
"Geo" means "having to do with the Earth."

3. What is the geosphere made of?
The geosphere is made of all the rocks and minerals on Earth and the landforms that they make up.

4. Name at least one type of landform.
One type of landform is canyon.

5. What does "bio" mean?
"Bio" means "life."

6. What is the biosphere made of?
The biosphere is made of all the biomes on Earth; alternatively, students may say that the biosphere is made of all the living things on Earth.
Watch a Video

#2 Watch a Video
What makes up the hydrosphere?
- All the gases on the planet
- Rocks, minerals, and landforms
- All the water on Earth
- Living things and their biomes

#3 Watch a Video
Which of these does not contain Earth's water?
- Glaciers
- Snow
- Rivers
- Rocks

#4 Watch a Video
What makes up the atmosphere?
- All the gases on the planet
- Rocks, minerals, and landforms
- All the water on Earth
- Living things and their biomes

#5 Watch a Video
What does "atmos" mean?
- Life
- Water
- Earth
- Air

#6 Watch a Video
What happens in the troposphere?
- Satellites
- Solar radiation
- Weather
- All of the above

#7 Watch a Video
Which of these layers is above the troposphere?
- Stratosphere
- Mesosphere
- Thermosphere
- All of the above

Watch a Video
Use your device to watch Four Spheres Part 2
PLAY A GAME
Play a Cross Word Game

1. The process through which energy from the sun is used to convert carbon dioxide and water into sugar and oxygen
2. An animal that eats only plants
3. Trait or behavior that helps an organism survive and reproduce
4. Living thing that contains the life things
5. Organism that can only be seen with a microscope
6. Organism that makes its own food
7. A large group of tiny droplets of water or ice crystals that float in the air
8. When a gas changes to a liquid (verb condense)
9. A type of weathering in which water fills rock cracks, freezes, expands, and breaks apart the rock
10. A large open area of ground
11. Rocks that were formed by heat and pressure
12. Rocks that were formed by cooling and hardening
13. Rocks that were formed by the laying down of sediments by wind, water, or ice
14. Rocks that were formed by the theory that the Earth's crust is made of plates that are in constant motion
15. Rocks that were formed by the erosion of other rocks
16. Rocks that were formed by the weathering of other rocks
17. Rocks that were formed by the condensation of water vapor
18. Rocks that were formed by the erosion of other rocks
19. Rocks that were formed by the cooling of magma
20. Rocks that were formed by the precipitation of minerals from water

Play a Cross Word Game

1. Water Cycle
2. Rocks, Weathering
3. Play a Cross Word Game

ACROSS
1. Runoff
2. AQUIFER
3. Cloud
4. Condensation
5. Unusually long period of dry weather that leads to a water shortage
6. Part of the Earth that contains the solid, liquid, and gases
7. Water, found under the surface of the geosphere and extends into the atmosphere
8. Side of the mountain the prevailing winds come to
9. A large group of tiny droplets of water or ice crystals that float in the air
10. When a gas changes to a liquid (verb condense)
11. Rocks that were formed by the cooling of magma
12. Rocks that were formed by the erosion of other rocks
13. Rocks that were formed by the weathering of other rocks
14. Rocks that were formed by the precipitation of minerals from water
15. Rocks that were formed by the cooling of magma
16. Rocks that were formed by the erosion of other rocks
17. Rocks that were formed by the precipitation of minerals from water
18. Rocks that were formed by the cooling of magma
19. Rocks that were formed by the erosion of other rocks
20. Rocks that were formed by the precipitation of minerals from water

DOWN
1. Rocks that were formed by the cooling of magma
2. Rocks that were formed by the erosion of other rocks
3. Rocks that were formed by the precipitation of minerals from water
4. Rocks that were formed by the cooling of magma
5. Rocks that were formed by the erosion of other rocks
6. Rocks that were formed by the precipitation of minerals from water
7. Rocks that were formed by the cooling of magma
8. Rocks that were formed by the erosion of other rocks
9. Rocks that were formed by the precipitation of minerals from water
10. Rocks that were formed by the cooling of magma
11. Rocks that were formed by the erosion of other rocks
12. Rocks that were formed by the precipitation of minerals from water
13. Rocks that were formed by the cooling of magma
14. Rocks that were formed by the erosion of other rocks
15. Rocks that were formed by the precipitation of minerals from water
16. Rocks that were formed by the cooling of magma
17. Rocks that were formed by the erosion of other rocks
18. Rocks that were formed by the precipitation of minerals from water
19. Rocks that were formed by the cooling of magma
20. Rocks that were formed by the erosion of other rocks

Play a Game
Investigate Ocean Action

Have you ever wondered why the coast has so many different kinds of features? Some places have wide-open beaches, while others have jagged cliffs, caves, and tunnels. What causes all these differences? Weathering, erosion, and deposition work together to create a variety of coastlines.

Our world can be divided into four parts. We talk about these four parts as "four spheres" that make up Earth. The first of these is called the geosphere. This sphere contains all the Earth's minerals and rocks. It is found on the surface of the Earth and extends all the way to Earth's core.

The atmosphere is the part of the Earth that contains all the air and other gases that surround the Earth. It is found on the surface of the Earth and extends all the way to space. The atmosphere contains the oxygen we need to breathe, as well as the carbon dioxide needed by plants and other organisms for photosynthesis. It also is where all the weather patterns take place.

The biosphere is the part of the Earth that contains all the living things on Earth. This includes plants, fungi, algae, as well as animals, birds, and microorganisms. Living things that can only be seen with a microscope. Organisms live in most parts of the geosphere and the hydrosphere.

The geosphere contains soil, which helps plants to grow. It is also where all the land features are, like mountains, volcanoes, caves, and deserts. The sandy ground is called soil.

Investigate Ocean Action

1. What are the four spheres that make up Earth? The four spheres that make up Earth are the geosphere, hydrosphere, atmosphere, and biosphere.

2. What is the geosphere? The geosphere contains all the Earth's minerals and rocks. It is found on the surface of the Earth and extends all the way to Earth's core.

3. Describe Earth's atmosphere. The atmosphere is the part of the Earth that contains all the air and other gases that surround the Earth. It is found on the surface of the Earth and extends all the way to space.

4. What is one way that the atmosphere helps to keep us alive? Water, wind, and other organisms need to breathe. They need air to survive.

5. What is the hydrosphere? The hydrosphere is the part of the Earth that contains all the water.

6. What is the biosphere? The biosphere is the part of the Earth that contains all the living things on Earth.

7. Describe two ways water causes weathering. Water causes weathering when it mixes with minerals in the rocks and breaks them apart. Water also causes weathering when it freezes in rock cracks during the winter. When water freezes in rock cracks, it expands and breaks them apart.

8. What is a way the biosphere affects the geosphere during weathering? The biosphere affects the geosphere during weathering when plants and animals erode rock cracks, dissolving minerals, and also wind and rain help to wear away the rocks. These processes are carried away by erosion and placed somewhere else by deposition. Sediments created by deposition along coastlines include beaches, sandbars, and...
Investigate: Ocean Action

Student Instructions

Today, you will investigate possible solutions to coastal weathering, erosion, and deposition problems.

1. Using the materials provided to you, re-create this situation. Draw your re-creation and label your diagram.

Dune Town, USA, has a major erosion and deposition problem. The sand on their beaches is continuously moving around, creating sand dunes. These sand dunes, whose homes are along the beach, often find sand dunes being pushed their houses. These houses are in danger of being buried under dunes.

Island Town, USA, has a major weathering, erosion, and deposition problem. This town now on a barrier island, which is an island formed along the coast, made almost entirely of sand. Recent storms have caused faster weathering and eroding of this island. A strong tide rushed in and cut the island in half. Help!

Beach Town, USA, has a major weathering and erosion problem. The sand on its beaches is being taken away by the ocean current. The beaches have grown smaller. With narrower beaches, the town is in danger of losing its homes.

2. Using the materials provided to you, design a solution to help prevent the problems described above. Draw your solution and label your diagram.
Ecosystems and the Hydrosphere

Living things can be found everywhere on Earth. From extreme environments where only a few organisms can survive to places where lots of plants and animals live, living things have made their homes throughout the world.

There are eight major ecosystems in the world. An ecosystem is all the living things and nonliving things in an environment. Living things in an ecosystem include plants and animals, fungi and algae, and even microorganisms, organisms that we can only see with a microscope. The nonliving parts in an ecosystem include the amount of light and water that is available, the temperature and weather, and the soil and rocks found in the area. All living and nonliving things in an ecosystem affect each other. If one part of an ecosystem changes, other parts might change as well.

The Earth is made up of four parts called spheres. One sphere is the atmosphere, which contains all the air and other gases that surround the Earth. The biosphere is the part of the Earth that is home to all living things. The geosphere contains all the minerals and rocks found from Earth's surface down to the core. Finally, the hydrosphere is the part of the Earth that contains all solid, liquid, and gaseous water. Each ecosystem on Earth is affected by all four spheres of Earth.

Diagram

1. What is an organism? An organism is a living thing.
2. What is an ecosystem? An ecosystem is all the living things in an environment.
3. What are two of the nonliving things that make up an ecosystem? Two nonliving things that make up an ecosystem are light, water, temperature, weather, soil, and sunlight.
4. What is a microorganism? A microorganism is an organism that can only be seen with a microscope.
5. What are the four spheres that make up Earth? The four spheres that make up Earth are the atmosphere, biosphere, geosphere, and hydrosphere.
6. Describe the biosphere. The biosphere is the part of the Earth with all of the living things.
7. Describe the atmosphere. The atmosphere includes the air and other gases that surround the Earth.
8. What is the geosphere? The geosphere contains all the minerals and rocks found from Earth's surface and down to the core.
9. What is the hydrosphere? The hydrosphere is the part of the Earth that contains all the solid, liquid, and gaseous water.
10. Name three of the main ecosystems found on Earth. Desert, grassland, chaparral, temperate forest, tropical rainforest, taiga, tundra, and ocean.
11. What is an adaptation? It is a trait or behavior that helps an organism survive and
Ecosystem Activity:

1. Your teacher will assign you an ecosystem.
2. Using the information in the reading section AND the informat you gather from your own research (using online sources and sources from books), complete the “Ecosystem Research” sheet.
3. Your teacher will give you a piece of paper describing changes happen to your ecosystem. Using what you learned from your research, answer the questions on the “Activity Sheet.”
4. Make a diagram showing what your ecosystem will look like after of the changes. Label the parts of the hydrosphere and biosphere your diagram. Show the adaptations the organisms have done to survive these changes.

Diagram Ecosystems and the Hydrosphere

Name of Ecosystem: Ocean

Describe this ecosystem:
The Ocean is the largest ecosystem covering about 70% of the Earth's surface. It is made up of large connected bodies of saltwater and the various plants and animals that live in them.

Describe what the hydrosphere (the liquid and gaseous water) is like in this ecosystem:
The ocean is primarily composed of liquid water with salt and other minerals. The ocean also contains large amounts of solid fresh water that is locked in polar ice caps.

Describe what the biosphere (the living things) is like in this ecosystem:
The ocean has plants, large and small. These plants generate about 70% of the Earth's oxygen. Animals also live in the ocean. Mammals, vertebrates, invertebrates, and birds all live in and rely on the ocean.

How do the biosphere and the hydrosphere interact? What adaptations do living things have for dealing with not enough or too much water?
Read: Earth's Spheres

1. Read Earth's Spheres
Which is NOT one of the four spheres of Earth?
- a) Ionosphere
- b) Atmosphere
- c) Hydrosphere
- d) Geosphere

2. Read Earth's Spheres
Which statement is TRUE about the atmosphere?
- a) It is the farthest layer from Earth
- b) No life exists there
- c) It has the air we breathe
- d) The top of it is 6,000 miles from Earth

3. Read Earth's Spheres
Why is the ozone layer important?
- a) It has the air we need to breathe
- b) It is where most of the weather happens
- c) It is where commercial jet airplanes fly
- d) It absorbs much of the harmful radiation from the sun

4. Read Earth's Spheres
Which of these is NOT one of the three types of rocks?
- a) Igneous
- b) Protoplast
- c) Metamorphic
- d) Sedimentary

5. Read Earth's Spheres
Where is liquid water found on the surface of the Earth?
- a) Oceans
- b) Glaciers
- c) Aquifers
- d) All of the above

6. Read Earth's Spheres
How does water affect rocks?
- a) If causes weathering of rocks
- b) It causes erosion of rocks
- c) Both a and b
- d) Neither a nor b

READ: EARTH’S SPHERES
There are four layers of Earth. They include the hydrosphere (all the water and those water cycles), atmosphere (all the gases in the air), biosphere (all the living things on Earth), and the geosphere (all the minerals and rock found on Earth). These layers interact with each other, creating different landscapes on the Earth. Each layer is affected by climate, which in turn affects them.

1. The four spheres of Earth are the __________, __________, __________, and __________.
2. All the __________ are found on Earth's surface and down to the core. More are found in the __________.
3. All the __________ are found on the surface of the Earth. A __________ is a natural feature on the surface of the Earth.
4. Wind and water cause __________ to erode, changing them.
5. As the __________ changes, the shape of the surface of the __________ changes. Landform is an area of land that is more than 1,000 feet high. Mountain is a landform that is high on the __________. Plateau is a landform that is high on the __________. Hill is a landform that is high on the __________.

Mountains, hills, plateaus, and plains are specific ways. Even so, they are found. We see how the geosphere affects the biosphere, adapted to live in environments where they are found. And landforms with more soil are home because there are more nutrients.

Landforms and the Biosphere

There are four layers of Earth. They include the hydrosphere (all the water and those water cycles), atmosphere (all the gases in the air), biosphere (all the living things on Earth), and the geosphere (all the minerals and rock found on Earth). These layers interact with each other, creating different landscapes on the Earth. Each layer is affected by climate, which in turn affects them.

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Mountains, hills, plateaus, and plains are specific ways. Even so, they are found. We see how the geosphere affects the biosphere, adapted to live in environments where they are found. And landforms with more soil are home because there are more nutrients.

Landforms and the Biosphere
Landforms and the Biosphere

Activity Model: Biosphere

Student Instructions

Today, you will model how landforms affect the types of organisms that live there.

Landform Activity:

1. Your teacher will assign you a landform.

2. Using the information in the reading section AND the information you gather from your own research (using online sources and/or sources from books), complete the "Landform Research" sheet.

3. Your teacher will give you a piece of paper describing changes that happen to your landform. Using what you learned from your research, answer the questions on the "Activity Sheet."

4. Make a three-dimensional model showing what your landform will look like after the changes. Also, include the changes to the organisms that you will find there. Label the parts of the geosphere and biosphere on your diagram. Show the organisms' adaptations that have developed in order to survive these changes.

Activity Sheets:

Plain Landform:
Change: This plain is in its third year of drought. There has not been enough rain and many plants are beginning to die. Winds are blowing the soil away, exposing the rocks and bringing them to the surface.

Mountain Landform:
Change: A volcanic eruption took place, blowing off the mountain top. The volcano is now half the size that it was. The peak is at an elevation of just over 1,000 feet. The sides of the mountain are covered in ash and sedimentary rocks. Layers can be seen in the sheer sides of the plateau.

Plateau Landform:
Change: A river system has cut several canyons through this plateau. Now it is not one continuous plateau. It has been broken up into many pieces.

MODEL: BIOSPHERE

[Continued...]

Name of Landform: Plateau

Describe this landform:
An area of land that is elevated and flat. Plateau appear to be sharply raised above the surrounding area on at least one side.

Describe what the geosphere (the rocks, soil, and sediment) is like in this ecosystem:
Plateau are often comprised of coarse soil, gysum, and sedimentary rocks. Layers can be seen in the sheer sides of the plateau.

Describe what the biosphere (the living things) is like in this ecosystem:

How do the biosphere and the geosphere interact? What adaptations do living things have for dealing with the types of soil, sediments, and rocks that are present?
The Earth is made of many different parts that all work together. Living things affect the areas in which they live. Rain, snow, and wind affect living things and the surrounding landscape. Rivers and oceans shape rocks and affect the organisms that are able to live there. All these things are part of the four spheres of Earth.

The atmosphere is the part of the Earth with all the air and other gases that surround the Earth. It contains oxygen that animals need to breathe and carbon dioxide that plants need for photosynthesis. The biosphere includes all living things on Earth: plants, animals, fungi, algae, and organisms too small to be seen without a microscope. All make up Earth’s biosphere.

The geosphere contains all the minerals and rocks that make up all the rocks and mountains.

The hydrosphere is where the water is found. Water covers 70% of Earth’s surface. It exists in all these places: solid form, water is snow, hail, sleet, glaciers, icebergs, permafrost, and also contains ice. 17% of all Earth exists in solid form. But of Earth’s freshwater, more than 60% is solid, which exists mainly in glaciers and ice caps.

The atmosphere is the universe’s air. It is made up of many gases that we breathe: oxygen and carbon dioxide. 98.5% of all liquid water on Earth is ocean water. That means that water on Earth is freshwater. Freshwater is to live, but most of it on Earth is underground. Only 0.001% of water is in a gaseous state.

Water on Earth, or the hydrosphere, is controlled by the water cycle. Water mixes with the air. Water vapor continues to heat up, and as it does so, it rises in the air. Eventually, it meets higher in the atmosphere, and it cools. Clouds form when the water vapor condenses. It becomes either liquid water or ice crystals and forms a cloud. When the cloud becomes too heavy, it will be too heavy to hold onto all the water or ice and it will release it. Precipitation will be in the form of rain unless it is too cold. Then it will be snow or sleet. If there is a mixture of temperatures in the atmosphere, there will be hail or freezing rain.

When clouds form, they do not stay in one place. The wind blows them along. If they are blown to warmer places where water is evaporating, they will continue to lose water.

The clouds do not lose all of their water in these mountains. As they move eastward, pushed by the prevailing winds, they move back over California’s Central Valley. The air is warmer, and water from the surface evaporates. It returns to the sky and adds its moisture to the clouds.

As the prevailing winds move the clouds eastward, they come into contact with the Sierra Nevada Mountain Range. This is a much higher mountain range than the Coast Mountain Range. Therefore, the air and clouds become very cold, and most of the water falls from the clouds. In spring, summer, and autumn, this precipitation is in the form of rain. In the winter, it will be snow.

A view of California’s Central Valley with the snow-capped Sierra Nevada Mountains in the background.
EXPLORE: MOUNTAINS AND RAIN

In this activity, you are going to explore how the geosphere affects the hydrosphere.

Instructions:

1. Look at the Interstate 90 Data Table. The table shows the elevation (how many feet above sea level) of towns along I-90. It also shows the average amount of precipitation that falls in a year in these cities.

2. Plot your data in the graphs:
   a. In the Precipitation Graph, plot the annual precipitation for the cities based on their distance from Seattle.
   b. In the Elevation Graph, plot the elevation of each of the cities based on their distance from Seattle.

3. Answer the Questions on the Activity Sheet.
Sort: Four Spheres

The water cycle shows how water changes forms on Earth. It also moves between the ground and the air. The sun provides energy warming up liquid water on Earth's surface. Water evaporates to a gas called water vapor. As water vapor warms, water vapor rises in the air, the colder it gets, gaseous state. It turns back into liquid water through condensation. When enough water vapor condenses, the cloud fills up with water and releases the water or ice. This is known as snow or hail.

The biosphere is the third sphere. It is home to all life on Earth. The biosphere includes forests, oceans, and other living things.

The atmosphere is the fourth sphere. It is the layer of air that surrounds the Earth. The atmosphere is made up of gases, such as nitrogen and oxygen.

Deep inside the Earth, magma bubbles up. It might cool and harden below ground, becoming rock. It might also come out as lava onto the surface of the Earth and cool and harden there, becoming rock. Either way, rock that is formed when magma or lava cools and hardens is called igneous rock. The hardened rock can become very hot and experience high pressure. This will cause the minerals in the rock to rearrange, forming metamorphic rock.

Over time, wind, water, and other forces on Earth grind away at rocks. This is called erosion. Eroded rocks can then be carried away by water, wind, or other forces. Over time, sedimentary rocks are formed.

Earth is made of many parts that all work together. The picture on the right shows all parts of the Earth working together. We'll learn about those parts in this lesson and see how each affects the other.

Hydrosphere
Geosphere
Atmosphere

Sort
Four Spheres of Earth

1. The _______ atmosphere _______ is the part of the Earth that contains air and other gases that surround the Earth.

2. The _______ troposphere _______ has oxygen and carbon dioxide for living things.

3. The _______ ozone layer _______ absorbs most of the harmful radiation from the sun.

4. A kingdom is a category of _______ living things _______.
   - Bacteria
   - Fungi

5. _______ sedimentary _______ rocks are formed from layers of sediment.

6. The _______ hydrosphere _______ is made up of water on Earth.
   - solid, liquid, and gaseous water
   - evaporate
   - precipitation

Sort: FOUR SPHERES
Sort: Four Spheres

**Activity**

### Biosphere & Geosphere
- Shellfish that live on rocks can dig deep holes in them.
- Many animals call rivers and oceans their homes.
- The sun provides energy for plants, animals, and oceans to survive.
- Water in rock cracks expands when it freezes. Over time, the cracks widen until the rock breaks.

### Biosphere & Hydrosphere
- All animals need water to live.
- If an area floods, many plants and animals cannot live there.
- Water lilies clean the water they live in.
- Water absorbs solar energy at night. This heat helps the plants grow.

### Geosphere & Hydrosphere
- A canyon is formed when rivers weather and erode the rocky surface over many years.
- Water in rock cracks expands when it freezes. Over time, the cracks widen until the rock breaks.
- Weathering breaks rocks into smaller pieces. Over time, the rocks grow smaller and smaller.

### Atmosphere, Biosphere, & Hydrosphere
- A source of air pollution comes from cows releasing methane into the air.
- In places where there is more water vapor in the air, temperatures are higher.
- Water lilies clean the water they live in.
- Heat causes rocks to expand. If rocks are exposed to high heat over a long period of time, they begin to crumble.

### Atmosphere, Biosphere, & Geosphere
- Denser soil absorbs more water during the day. This helps the plants grow.
- Weathering breaks rocks into smaller pieces. Over time, the rocks grow smaller and smaller.
- Plants release oxygen into the air.
- Solar energy is abundant throughout the day. It is used by plants to grow.
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