

7TH GRADE • UNDERSTAND

Earth's Four Amazing Systems (And the Cool Jobs That Study Them!)



01 A river, rocks, sky, and plants show how Earth's four systems interact in one everyday landscape.

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01 A river, rocks, sky, and plants show how Earth's four systems interact in one everyday landscape.

Look Around You Right Now

Think about your walk to school this morning. Maybe you crossed a muddy creek, felt a cold wind, saw a squirrel scurry up a tree, or noticed a cracked sidewalk where a tree root pushed through nearby soil and rock. You witnessed parts of Earth's four major systems: the **geosphere**, **hydrosphere**, **atmosphere**, and **biosphere**. These systems constantly interact, shaping the ground beneath your feet and the environment around you.

Meet the Four Systems

The **geosphere** is the solid Earth. It includes rocks, minerals, soil, landforms, and Earth's interior. Mountains, canyons, and the soil in your backyard are all parts of the geosphere. The **hydrosphere** includes Earth's water in liquid, frozen, and vapor forms, including rivers, lakes, oceans, groundwater, glaciers, and water vapor. The **atmosphere** is the layer of gases surrounding Earth. It includes the air you breathe and the moving air you feel as wind. The **biosphere** includes

all living things, such as plants, animals, fungi, and microbes—including you.



02 This cross-section shows how solid ground, water, air, and living roots interact beneath the surface.

None of these systems acts alone. A river in the hydrosphere can erode rock in the geosphere. Wind in the atmosphere can carry seeds that become part of the biosphere. Tree roots in the biosphere can grow into cracks and help break apart rock in the geosphere. These connections are examples of **Earth systems interaction**.

Evidence of Surface Change

Scientists use evidence to explain how Earth's surface has changed. Rounded pebbles, layers of sand, and a widened creek bank may show that fast-moving water transported and deposited sediment during a flood. Smooth stones found high above a modern river could be evidence that water once flowed at a different level

or along a different path. Scientists compare observations with other evidence before deciding which explanation is best.

Surface changes can occur over very different time spans. Consider four explicitly hypothetical, labeled examples: **Example A** is a landslide lasting **30 seconds**; **Example B** is a flood lasting **2 hours**; **Example C** is river erosion forming a canyon over **1 million years**; and **Example D** is mountain building over **20 million years**. In these examples, A has the shortest duration, followed by B, C, and D. These durations are illustrative only. They are not universal rates for all landslides, floods, river erosion, or mountain building.



03 Earth scientists often collect rock and water samples outdoors to study how landscapes change over time.

Mountain building can occur where tectonic plates interact. A **tectonic plate** includes both Earth's crust and the rigid uppermost mantle beneath

it. Plate motion can deform rock and build mountains over long spans of geologic time.

Careers That Explore These Systems

People in several STEM careers study Earth's systems. The wage figures below are U.S. national median

annual wages for May 2025, not starting salaries. A **median** is the middle value in an ordered set; it is not necessarily the arithmetic mean. The projected changes cover the entire 2025–2035 decade, not one year.

Occupation	What they study/measure	Median annual wage, May 2025	Projected change, 2025–2035
Geoscientists	rocks, landforms and Earth processes	\$101,920	5%
Hydrologists	water movement and quality	\$96,600	1%
Atmospheric scientists, including meteorologists	weather and climate	\$99,070	3%
Environmental scientists and specialists	environmental conditions and health	\$82,220	6%
Geological and hydrologic technicians (combined group)	samples and measurements supporting scientists	\$57,150	2%

Among these five groups, environmental scientists and specialists have the highest projected percentage increase, followed by geoscientists, atmospheric scientists, geological and hydrologic technicians, and hydrologists. The technician wage shown is for the combined geological and hydrologic technician group.

Students can explore these careers through science museums, local parks, university outreach programs, weather offices, watershed groups, and conversations with STEM mentors.



04 Some Earth changes happen quickly, like floods, while others, like canyons, form over very long timescales.

Career data source: U.S. Bureau of Labor Statistics, Occupational Outlook Handbook, checked 2026-09-08: Geoscientists; Hydrologists; Atmospheric scientists, including meteorologists; Environmental scientists and specialists; Geological and hydrologic technicians.

Bringing It All Together

Earth's geosphere, hydrosphere, atmosphere, and biosphere continually interact. Scientists study present-day observations and evidence preserved in landscapes to explain both brief events and changes that unfold over geologic time. The next time you notice a river bend, a gust of wind, or a plant growing through pavement, consider which Earth systems are interacting and what evidence their interaction might leave behind.

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01 Lesson Objective

In this lesson, you will explain how Earth's geosphere, hydrosphere, atmosphere, and biosphere interact to change Earth's surface over both short and long time scales. You will also identify evidence scientists use to explain these changes and explore STEM careers connected to studying Earth's systems.

Standard: NGSS MS-ESS2-2; TEKS 6.10A; TEKS 6.4C

Bloom's Level: Understand

Bloom's Goal: Students will explain, in their own words, how Earth's four systems interact and how geoscience processes shape the surface at different speeds and scales.

Explanation: This objective targets the Understand level because students must interpret and summarize how the four Earth systems interact and use evidence, rather than simply recalling definitions or applying new data to solve a problem.

Standard

NGSS MS-ESS2-2 (primary) — Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.; TEKS 6.10A (primary) — Differentiate between the biosphere, hydrosphere, atmosphere, and geosphere and identify components of each system.; TEKS 6.4C (supporting) — Research and explore resources and STEM mentors to investigate STEM careers.

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02 Vocabulary



01 A river, rocks, sky, and plants show how Earth's four systems interact in one everyday landscape.

Define the terms in your own words.

Atmosphere Explain in your own words:

Biosphere Explain in your own words:

Earth systems interaction Explain in your own words:

Erosion Explain in your own words:

Geoscientists Explain in your own words:

Geosphere Explain in your own words:

Hydrosphere Explain in your own words:

Landslide Explain in your own words:

Sediment Explain in your own words:

Tectonic plates Explain in your own words:

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03 Multiple Choice

Read each question carefully and choose the best answer: a, b, c, or d.



04 Some Earth changes happen quickly, like floods, while others, like canyons, form over very long timescales.

1. Which Earth system includes solid rock, soil, Earth's interior, and landforms such as mountains and canyons?

- A.** Geosphere
- B.** Hydrosphere
- C.** Atmosphere
- D.** Biosphere

2. A student feels a cold wind and notices frost on the grass, a flowing stream, and a bird building a nest in a tree. Which THREE Earth systems are explicitly shown by the wind, water, and living things?

- A.** Geosphere, hydrosphere, atmosphere
- B.** Hydrosphere, atmosphere, biosphere
- C.** Geosphere, atmosphere, biosphere
- D.** Geosphere, hydrosphere, biosphere

3. Tree roots slowly breaking apart rock and soil near a sidewalk is an example of interaction between which two systems?

- A.** Atmosphere and hydrosphere
 - B.** Biosphere and geosphere
 - C.** Hydrosphere and biosphere
 - D.** Geosphere and atmosphere
-

4. Which of the following is part of the hydrosphere?

- A.** The wind that blows through the trees
 - B.** The soil in a garden
 - C.** The ice at Earth's poles
 - D.** A squirrel climbing a tree
-

5. According to the article, what evidence might suggest that fast-moving water once carried sediment during a flood?

- A.** A layer of undisturbed dry soil
- B.** Rounded pebbles, sand layers, and a widened creek bank
- C.** A perfectly flat, unchanged riverbed
- D.** A lack of any rocks near the river

6. For the article's four explicitly hypothetical examples, which order lists their illustrative durations from shortest to longest?

- A.** Mountain building over 20 million years, river erosion over 1 million years, a 2-hour flood, a 30-second landslide
 - B.** A 30-second landslide, a 2-hour flood, river erosion over 1 million years, mountain building over 20 million years
 - C.** A 2-hour flood, a 30-second landslide, mountain building over 20 million years, river erosion over 1 million years
 - D.** River erosion over 1 million years, a 30-second landslide, a 2-hour flood, mountain building over 20 million years
-

7. Which statement correctly compares the specifically labeled 30-second landslide and 20-million-year mountain-building examples?

- A.** The hypothetical mountain-building example involves tectonic plate motion over 20 million years, while the hypothetical landslide lasts 30 seconds
 - B.** Mountains are made of a different material than hills
 - C.** All landslides happen underwater
 - D.** Mountain building does not involve the geosphere
-

8. A scientist who studies water movement and water quality in rivers and lakes is called a(n):

- A.** Meteorologist
- B.** Hydrologist
- C.** Geoscientist
- D.** Atmospheric scientist

9. Which occupation focuses mainly on studying weather and climate?

- A.** Environmental scientist
 - B.** Geological technician
 - C.** Atmospheric scientist, including meteorologists
 - D.** Hydrologic technician
-

10. According to the article, what is one way students can explore Earth and environmental science careers?

- A.** By avoiding outdoor activities
- B.** By visiting science museums, parks, and talking with STEM mentors
- C.** By only reading about careers in other countries
- D.** By waiting until college to learn about any science careers

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04 True / False

Read each statement about Earth's four systems, geoscience processes, and related careers. Decide whether the statement is True (T) or False (F).



03 Earth scientists often collect rock and water samples outdoors to study how landscapes change over time.

1. The geosphere includes rocks, minerals, soil, landforms, and Earth's interior.

☐ True ☐ False

2. The hydrosphere only includes liquid water, such as rivers and lakes, and does not include ice or water vapor.

☐ True ☐ False

3. The atmosphere is the layer of gases surrounding Earth, including the air we breathe.

☐ True ☐ False

4. The biosphere covers all living things, including plants, animals, fungi, and microbes.

☐ True ☐ False

5. According to the article, Earth's four systems act completely separately and rarely affect one another.

☐ True ☐ False

6. Rounded pebbles and layers of sand along a creek bank can be evidence that fast-moving water carried sediment during a flood.

☐ True ☐ False

7. In the article's explicitly hypothetical examples, the 30-second landslide has a shorter duration than the 2-hour flood.

☐ True ☐ False

8. In the article's explicitly hypothetical examples, mountain building over 20 million years has the longest duration of the four labeled examples.

☐ True ☐ False

9. Hydrologists are scientists who mainly study water movement and quality.

☐ True ☐ False

10. The article states that students cannot learn about Earth science careers except by attending a four-year university.

☐ True ☐ False

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05 Short Answer



02 This cross-section shows how solid ground, water, air, and living roots interact beneath the surface.

Read each question carefully and answer in complete sentences using what you learned in the lesson.

1. Name Earth's four major systems and briefly describe what each one includes.

2. Explain what is meant by 'Earth systems interaction' and give one example from the lesson.

3. Using the May 2025 median annual wages in the career table, calculate how much greater the atmospheric scientists' median wage of \$99,070 is than the hydrologists' median wage of \$96,600. Show your subtraction and include a dollar sign in your result.

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06 Case Study

Read the scenario carefully, then answer the questions that follow using what you learned about Earth's four systems and geoscience processes.



03 Earth scientists often collect rock and water samples outdoors to study how landscapes change over time.

Scenario: After three days of heavy rain, a hiking trail near Maria's neighborhood looked completely different. During a 2-hour flood, a small creek that used to be only 30 cm (11.8 in) wide grew into a rushing stream about 2 m (6.6 ft) wide, carrying mud, rounded pebbles, and small branches downstream. Maria noticed that the creek bank had crumbled in places, exposing layers of soil and rock that had been hidden before the storm. Nearby, tall grasses and wildflowers were bent flat by strong wind and rain, while the roots of an old oak tree had cracked part of the paved trail over several years. Maria's older cousin, who is studying to become a hydrologist, explained that scientists use clues such as rounded pebbles and reshaped creek banks as evidence of how moving water changes land. Her cousin also shared four illustrative examples from the lesson: a landslide lasting 30 seconds, a flood lasting 2 hours, river erosion forming a canyon over 1 million years, and mountain building over 20 million years. These hypothetical durations are examples, not universal rates for the processes. Maria wondered if she might want a career like her cousin's someday, studying how water and land interact.

1. Identify at least three of Earth's four systems described in this scenario and give one example of each from the story.

2. Using evidence from the scenario, explain how the 2-hour flood changed the creek and how scientists could tell water was the cause.

3. Compare the illustrative durations of the labeled 30-second landslide and 2-hour flood. Which example has the shorter duration, and why should these durations not be treated as universal rates?

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07 Discussion Questions

Discuss each question with your group and be ready to share your reasoning with the class.



01 A river, rocks, sky, and plants show how Earth's four systems interact in one everyday landscape.

1. Explain why scientists say Earth's four systems are always 'teaming up' rather than acting alone. Use an example from the article to support your explanation.

2. Consider the lesson's four hypothetical examples: a 30-second landslide, a 2-hour flood, river erosion forming a canyon over 1 million years, and mountain building over 20 million years. How might the duration of each example affect the evidence scientists observe?

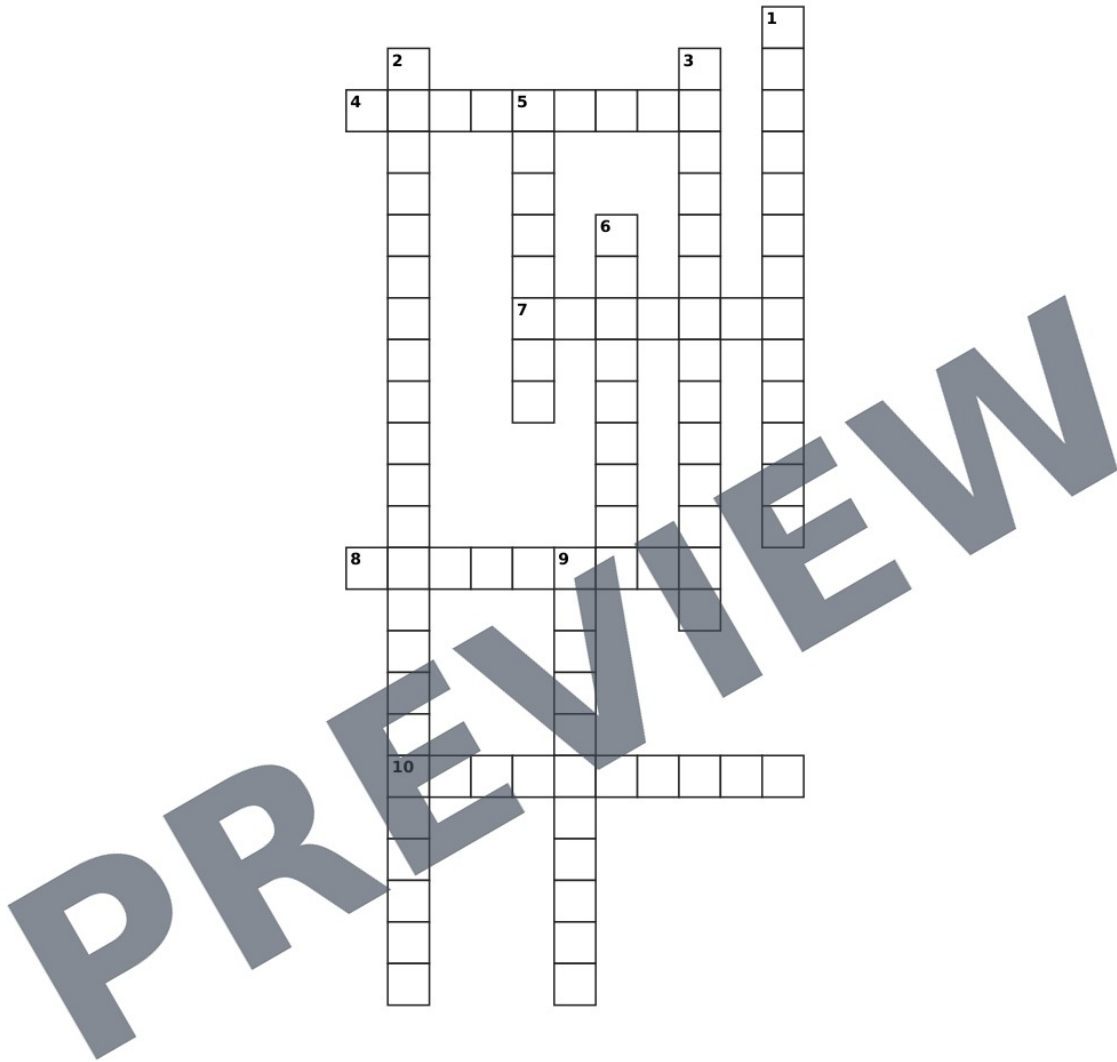
3. A hiker finds rounded pebbles and layers of sand high above a modern river. How might a geoscientist explain this evidence?

4. Choose one example from your own life, such as a walk to school, and explain how it shows the geosphere, hydrosphere, atmosphere, and biosphere interacting.

5. Why might it be helpful for someone studying to become a hydrologist or meteorologist to also understand the other three Earth systems, not just their own specialty?

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Crossword



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Crossword

ACROSS

4. A _____ is the downslope movement of rock, soil, or debris caused by gravity.
7. _____ is the movement of weathered rock, soil, or sediment from one place to another by water, wind, ice, or gravity.
8. The _____ includes all living things on Earth, including plants, animals, fungi, and microbes.
10. The _____ is the layer of gases surrounding Earth that includes the air we breathe and the moving air we feel as wind.

DOWN

1. _____ are scientists who study rocks, landforms, Earth's structure, and Earth processes.
2. _____ occurs when the geosphere, hydrosphere, atmosphere, and biosphere affect one another.
3. _____ are large, moving slabs made of Earth's crust and the rigid uppermost mantle.
5. _____ consists of pieces of rock, minerals, or once-living material that can be transported and deposited by water, wind, ice, or gravity.
6. The _____ is the solid Earth, including rocks, minerals, soil, landforms, and Earth's interior.
9. The _____ includes Earth's water in liquid, frozen, and vapor forms, such as rivers, lakes, oceans, groundwater, glaciers, and water vapor.

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Word Search

S T Y R D T T E E O R I E E S S P I E S C D E
 P T Y J S T E A O L I T T E S E L A H R C T P
 S N S D S L E R E S O H I I L N T S P T R T S
 E D I P R E T T O C T S O R S E E H E Y R E N
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 D H S D A E T O B H L O R D R A L T A R D O I
 L M N E S I O N S B T M I E R O A E E H S E P

FIND THESE WORDS

Earth systems

interaction

Atmosphere

Sediment

Tectonic plates

Biosphere

Erosion

Geoscientists

Geosphere

Hydrosphere

Landslide