

Earth Science: Sphere Interactions

Objective: Understanding connections between spheres of the Earth as a Global system

Standards: 5a, 5b, 5c, and 5f

Earth

- Apollo 17 astronauts captured a snapshot of the Earth system on their way to the moon in 1972. Essentially everything that was a part of the system then is still a part of the system today—that's why it's considered a closed system. All of the matter (solid, liquid, and gas) and all of the processes that move energy and materials from one part of the planet to another make up the Earth system.

Looking at the image, what are the major parts of our planet that can interact as a system?



Earth's Four Spheres

- Four major parts of Earth work together as a complex system: rocks, water, air, and life.
- On a global scale, each part can be thought of as a sphere that when combined form our planet.
- The four parts are called the geosphere, hydrosphere, atmosphere, and biosphere.

Detailing the 4 spheres

- Lithosphere or Geosphere – Earth's core, mantle, and crust: continents, ocean floor, rocks, sand, dust, metal, brick, and asphalt
- Hydrosphere – Earth's oceans, lakes, rivers, groundwater, glaciers, polar ice caps, rain, and snow

Detailing the 4 spheres (continued...)

- Atmosphere: Earth's oxygen, nitrogen, water vapor, ozone, and wind
- Biosphere: Earth's living organisms such as plants, humans, animals, insects and microbes

Describe each of Earth's four spheres. List several examples of features in each sphere



Do you think clouds should be classified as part of the atmosphere, or part of the hydrosphere? Explain why.

Sphere Interactions

- The surface of the geosphere, where the rocky part of our planet is in contact with water, air, and/or life is generally where the spheres intersect and affect each other.
- The processes that move matter and energy from one sphere to another, we can call sphere interactions.

LOOK AT THE PICTURE BELOW, IDENTIFY THE SPHERES AND AT LEAST TWO SPHERE INTERACTIONS...



Example of Sphere Interactions



- Humans (biosphere) built a dam out of rock materials (geosphere).
- Water in the lake (hydrosphere) seeps into the cliff walls behind the dam, becoming groundwater (geosphere), or evaporating into the air (atmosphere).
- Humans (biosphere) harness energy from the water (hydrosphere) by having it spin turbines (geosphere, because the turbines come from metal ores in the ground) to produce electricity.

How are Earth's Spheres Interacting?

- What sphere interactions can you infer from this photograph?
- When you identify sphere interactions, think of one feature in the image at a time, decide which sphere it is a part of, then consider how it interacts with the other spheres.
- With a partner, describe interactions in this scene, tracing the movement of materials or energy through all four of Earth's spheres if possible.



Plants (biosphere) draw water (hydrosphere) and nutrients from the soil (geosphere) and release water vapor into the atmosphere. Humans (biosphere) use farm machinery (manufactured from geosphere materials) to plow the fields, and the atmosphere brings precipitation (hydrosphere) to water the plants. Energy from the sun is stored by plants (biosphere). When humans or animals (biosphere) eat the plants, they acquire the energy originally captured by the plants. Humans expend some of this energy arranging bricks and wood (geosphere and biosphere) into buildings.

In each image, look for evidence of materials and energy moving among the spheres.



- List the major features in the image and tell which sphere each one represents.
- Describe sphere interactions you can infer from the scene.
- Whenever possible, follow the results of an interaction through all four spheres.

Earth System Processes

- The interactions you've been describing are the processes of Earth system science. The current "balance" among these complex interactions makes it possible for life to flourish here. Because the spheres are all part of the same interconnected system, changes in any sphere ultimately affect the other spheres as well.
- What effect do you have on the Earth system? As a part of the biosphere, think of some ways that you change the atmosphere, hydrosphere, or geosphere.
- List some Earth sphere interactions that result from your own daily activities.