

EARTH FROM SPACE



Unit 1

Demonstrating the View from Space

Introduction

Photographs of Earth taken from space show that our planet is a single system. When students observe Earth from this perspective, they can readily see oceans, clouds, and continents that are lit by sunlight, the energy that supports life on Earth. We do not know of any other planet that has water and an atmosphere like Earth's. (However, the components alone—solids, liquids, gases—without continuous changes in temperature, composition, and chemistry, might not support life as we know it.) To understand the way the Earth system works, students first must learn what these components are and then examine ways that they interact and change. To do this, they will build terrariums as models of Earth. Throughout these four units, students will learn how scientists study Earth's system to understand human-induced and natural changes.

Objectives

Students will be able to:

- Identify in photographs Earth's components from space: water (oceans, bays, rivers), land (continents), and air (atmosphere).
- Find the atmosphere in a photograph showing the limb (curved edge) of Earth.
- Identify the Sun as the source of energy and life on Earth.
- Recognize that different-colored components absorb and reflect sunlight differently.

Visuals

- NASA Lithograph: View of Earth
- NASA Lithograph: Water is a Force of Change
- NASA Lithograph: TOPEX/Poseidon. Photo of Earth limb from space showing Earth's atmosphere.

Vocabulary

Absorb	Heat	River
Atmosphere	Land	Soil
Cloud	Ocean	Sunlight
Continent	Oxygen	Surface
Earth	Reflect	Terrarium

Activities

Demonstrating the View from Space.

Films, videos, and photos: Show aerial and space views of Earth to help students understand that the air, land, and water seen in the photo are the same as those seen from the ground; they just are seen from a different perspective. Ask students who have flown in airplanes or climbed to the top of tall mountains to describe what they saw. Point to the U.S. in the photo of Earth from Space. If they are not familiar with the U.S. map, explain that large areas of land are visible from space and that it would take many hours to drive by car from one area to another. Use common local trips to help your students relate to distances.



Energy

The Sun's radiation is the source of energy for the Earth system. The heat and light allow plants and animals to thrive. The radiation also supplies the energy for many of the cycles among the atmosphere, oceans, and land. Air, land, and water absorb or reflect energy differently, affecting weather patterns, ocean currents, winds, and temperatures. Deserts and clouds reflect a great deal of energy, while ocean surfaces and forests reflect less. The warming of Earth's atmosphere moderates the temperatures around the globe making it inhabitable by living things.

Materials

White sand, black potting soil, and light grey gravel, three thermometers, three clear glass bowls. (Many heat-resistant, hard, fine-grained potting materials could work.) Be sure to use one white and one black for contrast in absorption of energy.

Observation

Demonstrating Absorption of Solar Energy.

To demonstrate the effects of solar energy on our planet, students must learn that components of the Earth system absorb sunlight differently. Place sand, gravel, and soil in each of the three glass bowls and insert one of the thermometers just below the surface of each material. Leave the containers in sunlight for several hours. White sand represents the clouds and snow; black soil, the land (forest, green grass); and grey, the ocean or dead grass. Ask the students to compare the temperatures to see how the differently colored materials absorb heat.

Extra Activity

Under which materials would you put ice if you wanted it to melt faster? Try it.

Lighter colors reflect more light (stay cooler); darker colors absorb more light (get warmer). Clean white surfaces, like snow, reflect about 90% of the light hitting them. City snow-removal crews could put dark soil on piles of snow when they want the snow to melt faster.

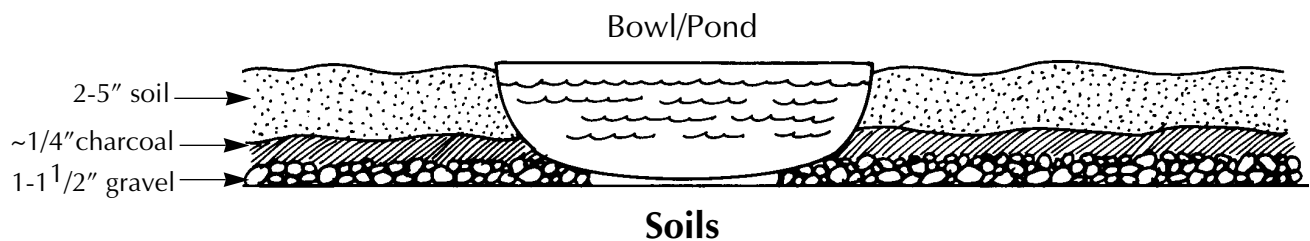
Creating an Earth System Model

Introduction

Students should build a small Earth environment to understand that the components fit together, and that they interact and change. Students may create a terrarium using animals and plants. Include a pond in the terrarium. The terrarium could show land, air, water, and energy. The easiest method to control the conditions during the experiments found in the next two lessons is to build one large group terrarium and several small ones (up to six). Some students may choose to pick a particular environment. One student team might work with sandy soil and cactuses, for example, and another might fill an aquarium with tadpoles and pond plants.

Materials

Terrarium. Potting soil, gravel, activated charcoal, sand, clay, rocks, and small plants. Rectangular glass tank, watering can with a thermometer inside. Small glass bowl to sink in the soil as a pond. Small plastic toys loaned by the students. Optional occupants: salamanders, newts, turtles, insects, frogs, or fish. (Fish will die in a little bowl; each one requires at least one gallon of water, which needs to be changed regularly.) Laws govern the capture and handling of wildlife, so check with your state, city, or federal authorities. Several of these animals can be purchased from pet stores for as little as five dollars.



Vocabulary

Aquarium

System

Terrarium

Systems

A "system" is a group of elements that interact and function together as a whole. To help students understand the complexity of a "system," discuss other systems found in their immediate environment. School, neighborhoods, families, and local public transportation services all can be classified as systems. Second, to help students recognize the impact of change, ask students whether those systems ever malfunctioned. Was the bus late? Do large snowstorms sometimes close school? Tell them that to understand how the system works, they are going to construct their own model of an Earth system. Later, when all the components are in the terrariums, the students can conduct experiments to observe how the components interact with each other.

Activity

How to building the model Earth system, with several approaches to construction. Students should build an unsealed terrarium (open system) unless the teacher has experience with closed-system terrariums.

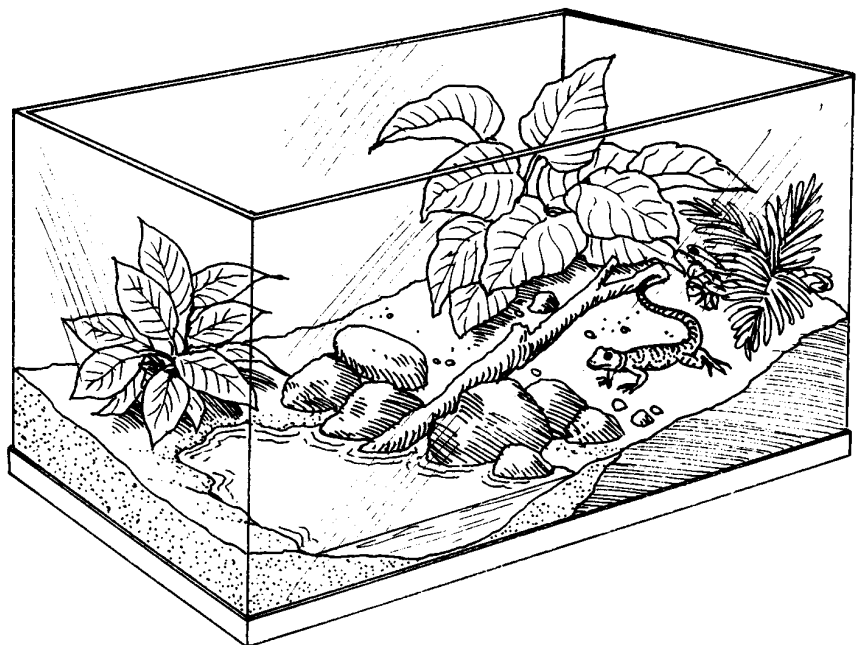
Observation

Terrariums or aquariums would work best in a class that has time to watch living things grow. A version built by the whole group might be better suited to K and Grade 1, while team or individually built versions would work well for Grades 2 or 3. To conduct the terrarium experiments found throughout the guide, classes will need at least six jar-size terrariums. **Do not use terrariums containing live animals in any of the experiments. Some of the experiments could harm the animals.**

Terrarium: Part 1, Setting up the Terrariums.

(A follow-up to this experiment will be conducted in subsequent lessons.)

Use one of the terrariums or separate containers. Set up an experiment monitoring plant growth and plant appearance in which frequency of watering, water temperature, exposure to fresh air, soil, and light at the start are as constant as possible. Select plants with different light or water requirements and establish if they thrive under these starting conditions. Select rapid-growing grasses or flowers and slow-growing cactuses, succulents, ferns, etc. Note their condition and growth on a chart (see model, page 10) or in notebooks. Later, students will experiment with the terrariums by altering one of the components, either exposure to light or frequency of watering, to see how changes affect the various types of plants. To teach the activity as a more controlled experiment, set up two identical containers for each plant variety. Allow a few days for them to stabilize, then use one as the control and one as the experimental mini-terrarium.



Terrarium Observation Chart

Type of Plant

Type of Plant				
Soil Type				
Room Temperature				
Frequency of Watering				
Hours of Light Exposure				