

Rock Cycle

PLANETARY THERMOSTAT

Even on a winter day, our Earth is a fairly warm, comfortable home for life. That's thanks in part to the carbon dioxide in our air. Although it accounts for only a tiny fraction of the atmosphere, it warms our planet by about 50 degrees Fahrenheit, and keeps Earth from turning into a ball of ice.

Carbon dioxide is called a greenhouse gas. Like the glass in a greenhouse, it traps heat, in the form of infrared energy. So sunlight can come in, but much of the heat can't get out.

In the distant past, the atmosphere contained much more carbon dioxide. But rain washed most of it out of the air. It combined with other chemicals to form carbonate rocks, such as limestone. Today, some carbon dioxide is pumped back into the air by volcanoes.

There's also carbon dioxide in the atmospheres of our two closest planetary neighbors, Venus and Mars.

Mars may have undergone the same process as Earth, with almost all of its carbon dioxide now locked up in rocks. The Martian atmosphere is thin, so Mars is cold and desolate, and temperatures normally stay well below zero.

On Venus, though, the carbon dioxide remained in the atmosphere. Today, Venus's atmosphere is 90 times thicker than Earth's, and it's made almost entirely of carbon dioxide, so the surface temperature is about 860 degrees Fahrenheit.

Only on Earth is the balance just right to provide a comfortable home for life.

This is the transcript of a StarDate radio episode that aired February 22, 2000. Script by Diamond Benningfield, ©1999.



This activity combines the concept of Earth's rock cycle with the characteristics of other planets in the solar system. After learning about Earth's rock cycle and the basic characteristics of objects in the solar system, students can consider how to extend this concept to other objects. The student's goal is to create a rock cycle for each selected solar system object.

PREPARATION

First, as a class, students should agree on a course of action based on their own driving questions. For instance:

- Which objects probably have some sort of rock cycle?
- What information about the object would relate to the rock cycle?
- What are the available resources of information?
- How should we as a class conduct our research and present our results?

After their investigation, students must communicate their results to their peers. This involves not just presentation, but also discussion about the supporting evidence for their rock cycle claims.

As an extension, students can investigate the case for Pluto and come up with their own conclusion — what is Pluto?

MATERIALS

- *StarDate: The Solar System* (or *Universo Guía del Sistema Solar*)
- Slide projector and slides (optional)
- Internet access, computer, and browser (optional)

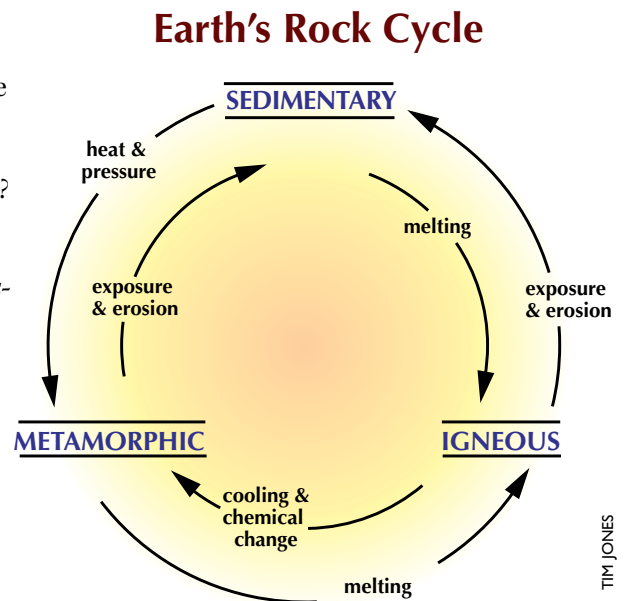
ACTIVITY

ENGAGE

Begin by reviewing the basics of Earth's rock cycle. Then pose a question about other members of our solar system (not just planets): do they have rock cycles, too? Record students' driving questions and discuss ways to go about answering those questions. You may wish to reserve Pluto as a special solar system member for later investigation (see the Extend section).

EXPLORE

Divide students into small groups of four to six. Each group should investigate a different planet, depending on the result of the class brainstorm. *StarDate: The Solar System* will help students gather information about planetary features that provide clues to the planet's rock cycle. If students have trouble, help them consider Earth's rock cycle and how it relates to



Earth's features. Air and water erode rocks into sediments. Earth's mantle heats buried rocks to make metamorphic rocks. Continents collide and raise mountains for water and air to erode.

EXPLAIN

The planets closest to the Sun (Mercury, Venus, Earth, and Mars) are rocky; they will most likely show evidence of a rock cycle. The gas giants (Jupiter, Saturn, Uranus, and Neptune) won't. But these gas giants have rocky moons that can be investigated. For each solar system object, information about its surface features, agents of erosion, and geologic structure under the crust will provide the major clues necessary to construct a possible rock cycle. Check your school's library for available resources. A wealth of information about the planets resides on StarDate Online. One effective way to organize the research is to break the class into research groups, with each focusing on one planet or moon.

EXTEND

Break the students into another set of groups with each member being an expert on a different planet. These groups discuss some of the following questions:

- What is Pluto? Is it a planet?
- What about the gas giants — Jupiter, Saturn, Uranus, and Neptune? Instead of rock cycles, might they have gas cycles?
- Consider what might happen if you could change the conditions on your object, such as adding liquid water to Mars or changing Earth's atmosphere. Would these changes affect the rock cycles on these bodies?

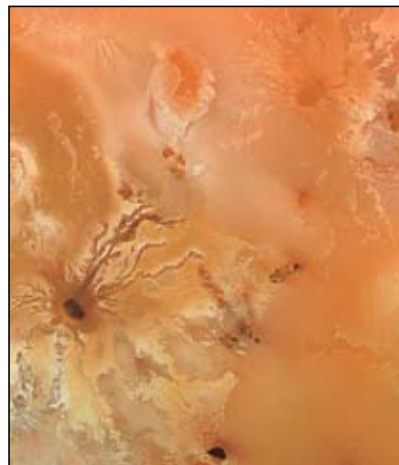
EVALUATE

After their investigation, each group presents its object's rock cycle to the class. During their presentation, students should point to particular features of their planet as evidence that supports different phases of their hypothetical rock cycle. This could be a presentation involving posters or computer graphics. Or it could be something else a bit more interactive, such as a poem or song.

NATIONAL SCIENCE EDUCATION STANDARDS

- Content Standard in 5-8 Science as Inquiry (Abilities necessary to do scientific inquiry, Understanding about scientific inquiry)
- Content Standard in 5-8 Earth and Space Science (Earth in the solar system, Structure of Earth system)

Rain, wind, rivers, and ocean tides erode surface rocks, washing material into the oceans to begin the rock cycle anew (below). Volcanoes on Io (lower left), Earth (bottom), and other bodies deposit new rocks on the surface.



NOAA



NASA (2)

Rock Cycle

Subjects: Our Solar System

Grade Levels: 6-8

After learning about Earth's rock cycle and the basic characteristics of objects in the solar system, students can consider how to extend this concept to other worlds beyond Earth.

Texas Essential Knowledge and Skills

Science:

§112.18-20 grade 6-8 (b)-4(A) use appropriate tools to collect, record, and analyze information, including journals/notebooks, beakers, Petri dishes, meter sticks, graduated cylinders, hot plates, test tubes, triple beam balances, microscopes, thermometers, calculators, computers, timing devices, and other equipment as needed to teach the curriculum.

§112.18 grade 6 (b)-9(A) investigate methods of thermal energy transfer, including conduction, convection, and radiation.

§112.18 grade 6 (b)-9(B) verify through investigations that thermal energy moves in a predictable pattern from warmer to cooler until all the substances attain the same temperature such as an ice cube melting.

§112.18 grade 6 (b)-10(A) build a model to illustrate the structural layers of Earth, including the inner core, outer core, mantle, crust, asthenosphere, and lithosphere.

§112.18 grade 6 (b)-10(B) classify rocks as metamorphic, igneous, or sedimentary by the processes of their formation.

§112.18 grade 6(b)-11(A) describe the physical properties, locations, and movements of the Sun, planets, Galilean moons, meteors, asteroids, and comets.

§112.18 grade 6 (b)-11(B) understand that gravity is the force that governs the motion of our solar system.