

Lesson Outline for Teaching

Lesson 3: The Theory of Plate Tectonics

A. The Plate Tectonics Theory

1. The theory of plate tectonics states that Earth's surface is divided into rigid plates of rock. Each plate moves over Earth's mantle and changes position with respect to other plates.
 - a. The word tectonic describes the forces that shape Earth's surface and rock structures that form as a result.
 - b. Of all Earth's tectonic plates, the Pacific Plate is the largest.
2. The cold, rigid rock layer on the outermost part of Earth is called the lithosphere. It consists of crust and the upper part of the mantle.
3. Below the lithosphere is the asthenosphere, which is so hot that it flows like plastic.
4. Plates of lithosphere move because they rest on the flowing asthenosphere.

B. Plate Boundaries

1. The place where two plates meet is called a(n) plate boundary.
2. When two plates move away from each other, a(n) divergent plate boundary forms.
 - a. In the ocean, mid-ocean ridges are located at divergent plate boundaries.
 - b. If divergent plate boundaries separate parts of a continent, rift valleys form.
3. When two plates slide by each other, a(n) transform plate boundary forms. This type of movement causes earthquakes.
4. When two plates collide, a(n) convergent plate boundary forms.
 - a. When plates collide, the plate that is denser slides under the less-dense plate in the process of subduction.
 - b. When an oceanic plate slides under a continental plate, a deep ocean trench forms. Near the trench, a line of volcanoes forms.
 - c. When two oceanic plates collide, a trench and a(n) island arc form.
 - d. When two continental plates collide, neither plate is subducted, and mountains form.

C. Evidence for Plate Tectonics

1. Scientists now use satellites to help measure how continents move.
2. The theory of plate tectonics explains why earthquakes and volcanoes occur in certain locations.

Lesson Outline continued

D. Plate Motion

1. Earth's mantle moves because warmer, less-dense materials rise, and cooler, denser materials sink.
 - a. Materials move based on differences in their temperatures and densities in the process of convection.
 - b. Inside Earth, radioactive elements provide some of the thermal energy that causes convection.
 - c. Convection currents form in the mantle when thermal energy transfers from the core to the mantle.
2. Three forces interact to cause tectonic plate motion.
 - a. Convection currents in the mantle produce a force that causes motion called basal drag.
 - b. Plates are pushed away from each other at mid-ocean ridges by the force of ridge push.
 - c. When a plate sinks below another plate, it pulls on the rest of the plate, exerting a force called slab pull.

E. A Theory in Progress

1. Plate tectonics is the unifying theory of geology.
2. Plate tectonics theory is still being revised as scientists learn more about how Earth's tectonic plates move.

Discussion Question

How could you use a pot of water on a stove to model the convection currents in Earth's mantle?

Like the core heating the lower mantle, the burner heats the water at the bottom of the pot. The heated water at the bottom of the pot becomes less dense and rises, as Earth's heated mantle does. As heated water rises, cooler water sinks because it is denser. This movement models the sinking of cooler, denser parts of the mantle.