More to Learn

Density

You have read that the density of Earth’s crust varies from 2.7 g/cm³ to 3.0 g/cm³. The density of Earth’s mantle varies from 3.3 g/cm³ to 5.7 g/cm³. Because the mantle contains more metal than rock, it is denser than the crust. If you understand density, you will better understand how Earth’s mantle affects its crust and the plate movement. To help understand the relationship between Earth’s mantle and crust, you will investigate how a set of liquids with different densities interact.

Investigating Density

Predict

In this investigation, you will create a density column using four different liquids. It does not matter in what order you pour the liquids into the column. They will always settle the same way. The same one will always be on the bottom. You will begin by using what you already know about density to predict their order.

1. Collect a sample of each of the four liquids you will use to build your density column: dishwashing soap, baby oil, water, and glycerine.

2. Working by yourself, observe the liquids and use what you know about density to predict which liquids are more dense than others. Remember that density is a measure of how close together the particles of a substance are packed. In a denser substance, particles are packed more tightly. List the liquids from most dense to least dense. What characteristics do you think will affect where in the column each liquid will stack?

3. Still working by yourself, sketch the way you think the liquids will stack on the Predicted Order column of your Density Column page. Where do you think the liquid will end up in the column? Which liquid would be next? Why? Use colors and labels so that your diagram is clear to someone else.

Materials

- 10 mL dishwashing soap, baby oil, water, and glycerine
- 100-mL graduated cylinder
- 4 small cups
- medicine dropper
- Density Column page
- colored pencils

Wear goggles throughout this activity.

Some of the liquids being used are flammable. Keep all chemicals away from flames or other sources of ignition.

Some of the liquids being used are toxic. Do not taste them. Wash your hands immediately after the activity.

Be sure to clean up any spills immediately.
Conference
Before you actually place the liquids in the cylinder, share your prediction with your group. Describe why you think the liquids will stack according to your prediction. Listen carefully as your group members describe their ideas. Compare your predictions. Look for differences in how others ordered the liquids. Ask your group members why they made their predictions. Make a group prediction. Record the group prediction on your Density Column page.

Procedure
1. Use the medicine dropper to place each liquid in the graduated cylinder, starting with the bottom layer. Drop the liquids in the order your group predicted. Try to drip each liquid down the center without touching the sides of the graduated cylinder. It is all right if the liquids mix a little.

2. Observe your density column until the liquids have settled. They may move after you have layered them.

3. Next to your prediction sketch, draw the ordering of the liquids as you saw in your results. Use colors and labels to make sure you sketch an accurate density column showing how each of the liquids was layered.

Reflect
1. Compare your prediction sketch to the sketch of your results. How are they the same? How are they different?

2. You made a prediction based on some property of the liquid. How did that property help you determine the density of the different liquids? How accurate were your predictions? Why do you think there were errors in your prediction?

3. Which liquid in your density column has the greatest density? What makes you think this liquid is the most dense?

4. Which liquid is the least dense? What makes you think this liquid is the least dense?
5. The continental crust and the oceanic crust have different densities. The oceanic crust is the densest at approximately 3.0 g/cm³. The continental crust is approximately 2.8 g/cm³. The density of Earth’s mantle is approximately 3.3–5.7 g/cm³. Draw a density column for the continental crust, the oceanic crust, and the mantle.

6. How do you think density affects the relationship of Earth’s crust to its mantle?

Density and Earth’s Crust and Mantle
As you saw in your investigation, less-dense materials always rise above more-dense ones. In this Learning Set, you read that Earth’s plates float on top of the mantle. The plates float on top of Earth’s mantle for a reason. The material of the crust is less dense than mantle material. Understanding how and why Earth’s plates float on top of the mantle is important to answering the Big Question of this Unit.