

Grade Six: Plate Tectonics
Lesson 6.1: Densities Effect on Layers

Lesson Concept Density determines the order of layers of Earth materials.

Link Density determines the movement of materials in a liquid (magma) as well as sedimentary layers when deposited in water. Density is the basis for understanding Earth layers.

Time 120 – 135 minutes
Suggested Sessions (three 45 min. sessions)

Materials

Whole class

- Sedimentary bottle
- Poly Density Bottle (optional)
- 1 can of regular Coke
- 1 can of Diet Coke
- Clear tub of water
- 39g of sugar in a sandwich Ziploc bag
- 188mg of NutraSweet in a sandwich Ziploc bag
- Videos on California Streaming: Bill Nye “Buoyancy” and “Matter in Action: What is Matter?” -Density segment

Per Group (groups of 4)

- Sedimentary bottle (see resource page for directions)
- Cup A (water) and Cup B (alcohol)
- 2 ice cubes dyed blue
- 3 film canisters
- 25 pennies
- Tub of water
- Bath Towel

Individual

- Handout: Mystery Canister
- Science notebook

Pencil
Colored pencils
Glue stick

Resources

Sedimentary Bottle Directions

Advance

Preparation

1. Gather materials and run handout for Density Canister.
2. Measure out sugar and NutraSweet (option: use sugar packets)
3. Find videos online
4. Freeze blue ice cubes (night before)
5. Prepare sedimentary bottles for each group and one for the teacher. (see resource page for directions)

Procedure:

Session 1

Engage (10 minutes) Earth's layers can be observed and described.

1. Show pictures of the Grand Canyon or other resources. (Harcourt Science pg. 16) and ask students: How might these layers form? Chart student ideas.

Explore/Explain 1 (30 minutes) Ordering or layers depends on relative density of materials.

Teacher Note: Earth materials in water are deposited by relative density of the materials. Student groups need one bottle each and the teacher needs a demonstration bottle.

2. Distribute sediment bottles to each group of four students. Ask students to shake bottles and place on desks.
3. Ask students to observe and describe how earth material is deposited in the bottle. Chart observations on the chart developed in step 1.
4. Ask students to think/pair/share about how the sedimentary bottle could help explain the layers in the Grand Canyon rock.
5. Review chart developed in step 1 by asking students to identify ideas that could be explained by layering of materials. Identify ideas that cannot be explained by layering with a ? mark.

Teacher Note: Evidence for Layering material according to relative density can be explored through Option 1 or Option 2. Students can explain one material layers depending on relative density compared to another. Option 1 requires purchasing a poly density bottle from Educational Innovations. (steps 6 & 7) Option 2 is readily available with ice, water, and alcohol. (steps 8,9,10)

6. Option 1: Show the Poly Density bottle to students. Shake the bottle and ask students to draw the bottle, liquid, and beads.
7. Lead a discussion with students selecting from the following questions:
 - a. What's happening?
 - b. How many layers do you see?
 - c. Are you sure?
 - d. Does anyone have a different idea?
 - c. What is on the bottom, next, top?
 - e. How might the blue and white beads be different?
 - f. How might the liquids be different?
 - g. What is causing the layers?

Option 2: Water, alcohol and ice cubes. Use two clear cups for each table group. One cup contains water (cup A) and the other cup contains alcohol (cup B). Make sure to put the same amount of liquid in both cup A and cup B. Place one ice cube in each cup.

8. Place Cup A and Cup B on each table group. Have students observe and draw what is happening in both cup A and cup B.
9. Lead a discussion with students selecting from the following questions:
 - a. What's happening?
 - b. How is cup A different or the same as cup B?
 - c. How is the ice layering differently in cup A and cup B?
 - d. What is on the bottom? What is on the top?
 - e. Is the ice the same in both containers?
 - f. Is the liquid the same in both containers?
 - g. What could be the difference in the liquids?
 - h. What might be causing the ice to "layer" differently in cup A and Cup B.

Teacher Note: Use the verbal sentence frames: _____ is less dense than _____. Or _____ is more dense than _____. Or _____ is the same density as _____.

Session 2

Explore/Explain 2: (40 minutes) Materials layer depending on relative density.

10. Ask students to think about a swimming pool. Brainstorm with a partner three things that sink in a pool and three things that float. Chart responses on a class chart with two headings: More dense than water/ Less dense than water
11. Explain today includes another experience exploring how materials layer. Show students a can of regular Coke and a can of Diet Coke. Pass around the cans of soda so students can carefully look for what is the same or different on the soda cans.
12. Ask students to share their observations and chart.
13. Have students predict what will happen when the can of Coke and can of Diet Coke are placed in the tub of water. Will both cans of soda be more dense than water or less dense than water?
14. Place both cans of soda in the bottom of a tank of water visible from all parts of the class. Make sure that there is no air bubble inside the cans. Turn cans on their side to get rid of the air bubble. Ask students to observe what is happening?

Teacher note: If students ask to verify that both cans are still sealed ...ask a student to come up and check. Make sure they notice the volume of each material is the same.

15. Remove the cans from the water and replace the cans on opposite sides at the bottom of the tank. Ask students which can of soda is more dense than water and which can is less dense than water.
16. Ask students to observe what is happening and draw a picture of the cans and the water.
17. Ask students to infer what might be happening. Chart ideas.
18. Show students what 39g of sugar looks like. Put the sugar in a small beaker or cup while holding it next to the can so they can see how much space it would take up in the can.
19. Next, show students approximately 188 mg of NutraSweet in a small container and show how much space it would take up in the can.
20. Ask students to think, pair, share what the sugar or NutraSweet in the cans of soda might be doing to the mass of each type of soda.
21. Ask students to label Coke drawing using the words More Dense than Water and Less Dense than Water. Make sure that they make comparisons between cans and water.
22. Ask students to add Diet Coke and Coke to the swimming pool list in step.10
23. Optional: Ask students to infer and draw a "visual model" of how the molecules in the Diet Coke, Water, and coke might be "packed" with greater density or less

density in each liquid. Indicate that dense regular Coke has molecules closer together than water, and Diet Coke has molecules further apart or less dense than water. Ask students to compare drawings to one other group.

VIDEOS: Option 1 (20 minutes): Watch Bill Nye “Buoyancy Video.” It has a lot of great information on buoyancy but doesn’t directly relate to how layers on Earth layer. Option 2 (2 minutes): Matter in Action: What is Matter? Density segment. (Note: stop when Summing Up is on the screen). You can find these videos on the SBCEO Portal in California Streaming.

Session 3

Extend (45 minutes) Density determines the order of layers in materials.

1. Ask students to think about the Diet Coke and the regular Coke. The Diet Coke was less dense than water and the regular Coke was more dense than water. Ask students to Think Pair Share about what would happen to a “can” that was the same density as water? Chart ideas.
2. Distribute materials to each table group. (3 film canisters, a pile of pennies, bath towel, and a tub of water). Have students lay the towel on the table and place the tub of water on top of the towel. Explain the challenge is to figure out how to get one canister to float, one to suspend in the middle of the tub and one canister to sink
3. Explain to students that the time allowed is 10 minutes to make the canisters of different densities. Use a different number of pennies in each canister to change the density. Test the density of each container compared to water by submerging the canister in water.
4. Ask students to work with a partner group to explain how they met the challenge. Encourage students to use the words “more dense” than water “less dense” than water and equal to the density of water to explain the canisters.
5. Distribute the handout and ask students to complete the worksheet by completing the table and answering the questions. Students fill out the table and answer the questions on the handout for all 3 canisters with their table group.

Evaluate (10 minutes) Density determines the order of layers of materials.

6. Display the picture of the Grand Canyon again.
7. Ask students to write a response to the following question on an exit card: How does density relate to the layers of rocks in the Grand Canyon or to the layers of Earth? What is your evidence?

Handout for Mystery Canisters

Density of water: 1.0 g/ml

	# of pennies	How does the density of each container compare to the density of the water? (more, less, or equal)	Did this float, sink, or suspend?
Canister #1			
Canister #2			
Canister #3			

Based on each density, predict the location of each item in a tub of water. Choose from float, sink, or suspend.

A. 0.2 g/ml _____

B. 1.0 g/ml _____

C. 2.3 g/ml _____

D. 0.5 g/ml _____

E. 0.99 g/ml _____

F. 1.9 g/ml _____

Sedimentary Bottle Directions

1. Use a plastic bottle (1 liter or smaller) and sediments from your community to create a sediment bottle. Don't fill the bottle more than halfway full with sediments.
2. Add water to fill up the bottle to within one inch of the cap. Screw on the cap tightly!
3. Shake and observe!

