7-7 Density Mystery

SkillCheck
- Measuring
- Classifying
- Explaining systems
- Evaluating information

In this investigation, you can make and use accurate measurements to determine density and predict layering.

Question

What are the densities of various fluids and solids?

Materials

- various fluids, such as water, vegetable oil, corn syrup, molasses, dish detergent
- various granular solids, such as sand, sugar, flour, aquarium rocks
- various solid objects, such as an eraser, pencil sharpener, block
- large graduated cylinder
- overflow can
- water
- 250 mL beaker
- clear plastic disposable drinking cups
- electronic scale or triple beam balance
- medicine dropper
- ruler
- calculator

Safety

- Handle balances with care and use them as instructed by your teacher.
- Avoid spilling fluids and solids on the balances.
- Do not pour materials down the drain. Dispose of them as instructed by your teacher.
- Use only fluids that are foods or mild dish detergents. Do not use any fluids that have any type of danger symbol on their labels.

Science Skills

Go to Science Skill 7 for help with measuring mass and volume. Go to Science Skill 5 for help with drawing a graph.

Procedure

Part 1 Calculating Density

1. Copy the data table below to use in recording your experimental data.

Material	Mass of Graduated Cylinder (g)	Mass of Graduated Cylinder and Material (g)	Mass of Material (g)	Volume (mL or cm^3)	Density (g/mL or g/cm^3)
	50,40				

2. Use measurement A, B, or C to determine the mass and volume of each material.

Measurement A: Use for fluids and granular solids.

(a) Place the empty graduated cylinder on the scale. Record its mass.

(b) Fill the graduated cylinder to the 25 mL mark. Use the medicine dropper if necessary. Record the volume of the fluid or granular solid as 25 mL.

(c) Place the filled graduated cylinder on the scale and record the mass of the fluid or granular solid and cylinder.

(d) Subtract the mass of the empty graduated cylinder from the mass of the filled graduated cylinder. This is the mass of the fluid or granular solid. Record the mass in your table.

Measurement B: Use for solids that are cubic or rectangular.

(a) Place the solid on the scale. Record its mass.

(b) Use the ruler to measure the length, width, and height of the solid in centimetres.

(c) Multiply the length, width, and height values together. This is the volume of the solid. Record the volume in your table.

Measurement C: Use for irregularly shaped solids.

(a) Place the solid on the scale. Record its mass.

(b) Position the beaker to catch water from the overflow can. Fill the overflow can with water. Empty the beaker of any water that has overflowed and place it back into position to catch water.

(c) Push the solid into the water of the overflow can so that it is just underwater. Pour the beaker overflow water into the graduated cylinder. The reading on the cylinder is the volume of the solid. Record the volume in your table.

3. Divide the mass of each material by its volume. This is the density of the fluid or solid. Record this density in your table.

Part 2 Comparing the Materials

4. Examine the densities of the materials in the data table. Create a bar graph that compares all the densities.

5. Examine your bar graph. Predict how these fluids would layer if you put them into the same clear plastic cup. Make a sketch that illustrates how you think the fluids would layer.

6. Carefully pour each fluid you tested into a clear plastic cup in the order you predicted in step 2. Start with the fluid at the bottom. Use only enough fluid to create a layer approximately 1 cm deep. Tilt the cup as you pour to allow the fluids to layer and avoid splashing.

Analyze

1. (a) What parts of this density experiment could have caused experimental error?

(b) How might you do the experiment differently to reduce that error?

2. Compare your density results and layering test to the predictions you made. If you were wrong on any prediction, offer an explanation why.

Conclude and Apply

1. (a) Write a short paragraph that describes how you can determine the density of a fluid or solid. Include an evaluation of two different density-determining techniques.

(b) Is one technique better than the other? Why?