Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Student Exploration:** **Density via Comparison**

**Vocabulary:** density, mass, volume

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)

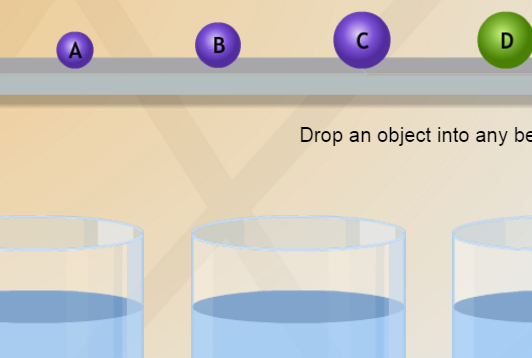
The image at right shows a man floating in the Dead Sea, an extremely salty lake that lies between Israel and Jordan.

1. Why do you think the man is floating so high in the water? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What might happen if this man tried to read the newspaper while floating in a normal pool?

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**Gizmo Warm-up**

Whether an object floats or sinks in a fluid depends on the **density**—or **mass** per unit of **volume**—of the object as well as the density of the fluid. The *Density via Comparison* Gizmo allows you to compare objects by placing them in fluids of differing densities.

1. Place object **A** into **Beaker 2**, which contains a liquid with a density of 1 g/mL, equal to the density of water.
2. What happens? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Is object **A** more or less dense than water? Explain how you know. \_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Now drop object **B** into **Beaker 2**. Describe what happens and explain what that tells you about the density of object **B**. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| **Activity:**  **Estimating density** | Get the Gizmo ready:   * Double-click on the shelf to return all objects to the shelf. | 396SE2 |

**Question: How do you estimate the density of an object without measuring its mass or volume?**

1. Observe: Drag object **A** into **Beaker 1**. If it sinks, move it into beakers **2**, **3**, and so on until it floats.
   * 1. What is the highest-density fluid in which object **A** sinks? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
     2. What is the lowest-density fluid in which object **A** floats? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
     3. Based on the previous two answers, what can you say about the density of object **A**? (Note: The density of a solid is measured in g/cm3, which are equivalent to g/mL.)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Gather data: Drag each object into all of the beakers. Write “floats” or “sinks” in each space in the table below. In the last column, estimate the density of each object.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Object** | **Beaker 1 (0.5 g/mL)** | **Beaker 2 (1 g/mL)** | **Beaker 3 (1.5 g/mL)** | **Beaker 4 (2.5 g/mL)** | **Estimated density** |
| B |  |  |  |  |  |
| C |  |  |  |  |  |
| D |  |  |  |  |  |
| E |  |  |  |  |  |
| F |  |  |  |  |  |

1. Analyze: Drag objects **B** and **E** into **Beaker 2**. Which object is denser? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain how you know: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Challenge yourself: Describe how you know which object is denser in each situation.
   * 1. Objects **A** and **B** are placed in **Beaker 1**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + 1. Objects **A** and **B** are placed in **Beaker 4**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_