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

**Student Exploration: Density Experiment: Slice and Dice**

**Vocabulary:** density, mass, matter, volume

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

1. What do you think would happen if you threw a block of polystyrene (Styrofoam™) into the water? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What would happen if you broke the Styrofoam up into lots of pieces, then threw the pieces into water? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What would happen if you threw a big rock into water? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. What would happen if you broke the rock into little pieces, then threw the pieces into water? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Gizmo Warm-up**

The *Density Experiment: Slice and Dice* Gizmo allows you to compare different-sized pieces of the same material.

1. Check that **Polystyrene** is selected. Drag the whole polystyrene piece into the water.

 Does it sink or float? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Click **Reset**, and then click **Slice** to cut the polystyrene into pieces. Drag each piece into the water and then back to the block.

What happens? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. How do you think the amount of a material affects its tendency to sink or float? \_\_\_\_\_\_\_\_\_\_

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

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| **Activity A:** **Slice and dice** | Get the Gizmo ready:* Click **Reset**. Check that **Polystyrene** is selected.
* A calculator is recommended for this activity.
 | 434SE2 |

**Introduction:** The **density** of a material is the amount of **mass** per unit of **volume**. Density is calculated by dividing an object’s mass by its volume.

**Question: How does density depend on the amount of material?**

1. Form hypothesis: How do you think cutting up a material will affect its density? \_\_\_\_\_\_\_\_\_\_

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

1. Collect data: Click **Slice**. Choose a piece of polystyrene and drag it onto the **Material investigation** tray. Record the mass and volume, then calculate the density by dividing the mass by the volume. Replace the piece, and then repeat for the remaining pieces.

|  |  |  |  |
| --- | --- | --- | --- |
| **Piece** | **Mass (g)** | **Volume (cm3)** | **Density (g/cm3)** |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 (if available) |  |  |  |

1. Analyze: What do you notice about the density of the polystyrene pieces? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

1. Predict: What do you think is the density of the whole block of polystyrene? \_\_\_\_\_\_\_\_\_\_\_\_\_
2. Test: Click **Reset**. Drag the whole (uncut) block of polystyrene onto the **Material investigation** tray. Record its mass and volume and calculate the density.

Mass: \_\_\_\_\_\_\_\_\_\_\_\_\_ Volume: \_\_\_\_\_\_\_\_\_\_\_\_\_ Density: \_\_\_\_\_\_\_\_\_\_\_\_\_

1. Apply: An archaeologist finds a golden figurine. How could she determine if the figurine is solid gold without cutting it? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

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| **Activity B:** **Sink or float?** | Get the Gizmo ready: * Click **Reset**.
 | 434SE3 |

**Question: The density of water is 1.0 g/mL, which is equivalent to 1 g/cm3. How does an object’s density affect whether it sinks or floats in water?**

1. Form hypothesis: How do you think an object’s density relates to whether it sinks or floats?

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

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1. Collect data: Measure the mass and volume of each known material, and calculate its density. Then drag each material into the water to see whether it sinks or floats.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Material** | **Mass** | **Volume** | **Density** | **Sinks or floats?** |
| Polystyrene |  |  |  |  |
| Aluminum |  |  |  |  |
| Wood |  |  |  |  |
| Slate |  |  |  |  |

1. Analyze: How does an object’s density determine if it will sink or float? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Apply: Find the density of Unknown A and Unknown B. Based on their densities, predict whether each will sink or float. Then, test your prediction using the Gizmo.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Material** | **Mass** | **Volume** | **Density** | **Sinks or floats? (prediction)** | **Sinks or floats? (actual)** |
| Unknown A |  |  |  |  |  |
| Unknown B |  |  |  |  |  |

1. Extend your thinking: Compare the three floating materials. How does the density of each material relate to how high it floats in the water? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

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