Name: _____ Date: _____

Student Exploration: Density

Vocabulary: density, mass, matter, volume

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

1. List three objects that you think would sink in water, and three objects you think would float.

   Sink: _____

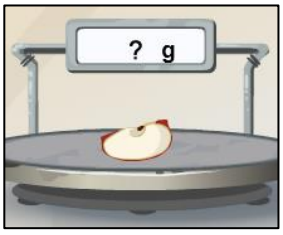
   Float: _____

2. Why do you think some things float and some things sink? _____

   _____

   _____

Gizmo Warm-up



1. In the Gizmo, drag the **apple** onto the **Scale**. The scale measures **mass**. Mass is the amount of **matter**, or "stuff," in an object.

   What is the apple's mass? _____ (Note: "g" stands for grams.)

2. An object's **volume** is the amount of space it takes up. The volume of an object can be measuring by using a **graduated cylinder**. Observe the graduated cylinder and the blue text showing the volume of water inside the cylinder.

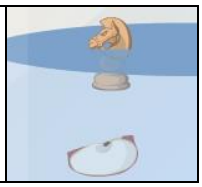
   A. What is the starting volume of water in the graduated cylinder? _____

   B. Place the apple into the cylinder. What is the volume in the cylinder now? _____

      The water rises in the cylinder because it is displaced, or pushed upward, by the apple. The amount of displaced water is equal to the volume of the apple.

   C. What is the volume of the apple? _____ (Use the **Object volume** to check.)

   Note: Milliliters (mL) are used for liquid volumes, while cubic centimeters (cm^3) are used for solids. One mL is the same volume as one cm^3. The apple's volume is measured in cm^3.

Activity A: **Sink or float?**	Get the Gizmo ready: • Replace all objects on the shelf. • Be sure the liquid in the beaker is **Water**.	

Question: How do mass and volume affect sinking and floating?

1. Predict: Which objects do you think will float in water? Which do you think will sink? Record your predictions below in the first column of the table.

Object	Prediction (sink or float?)	Mass (g)	Volume (cm^3)	Result (sink or float?)
Ping pong ball				
Golf ball				
Apple				
Chess piece				
Penny				
Rock				

2. Experiment: Use the Gizmo to find the mass and volume of each object and whether it floats or sinks. Record your results in the table.

3. Analyze results: Look at the data in your table.

   A. Can you use mass alone to predict whether an object will sink or float? Explain.

   _____

   B. Can you use volume alone to predict whether an object will sink or float? Explain.

   _____

4. Draw conclusion: Can you use mass *and* volume to predict whether an object will sink or float in water? Explain your thinking.

   _____

   _____

5. Apply: Measure the mass and volume of the toy soldier: Mass _____ Volume _____

   Will it float or sink? _____ Use the Gizmo to test your prediction.

Activity B: **Calculating density**	Get the Gizmo ready: • Replace the objects on the shelves. • Be sure the liquid in the beaker is **Water**.	

Question: How does density tell you whether an object will sink or float?

1. Calculate: **Density** is the amount of mass contained in a given volume. To find the density of an object, divide its mass by its volume. Density is recorded in units of grams per cubic centimeter (g/cm^3).

   What is the density of an object with a mass of 100 g and a volume of 50 cm^3? _____

2. Record data: In the Gizmo, find mass and volume of the objects listed below. Then calculate each object's density and record it. Finally, test whether each one sinks or floats in water.

Object	Density (g/cm^3)	Sink or Float?
Chess piece		
Rock		
Toy soldier		
Apple		

3. Draw conclusion: The density of water is 1.0 g/mL, or 1.0 g/cm^3. Look at the data in your table. How can you use the density of an object to predict whether it will sink or float?

   _____

   _____

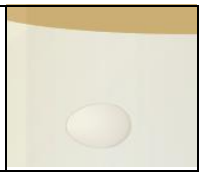
4. Apply: In the Gizmo, either **Crown 1** or **Crown 2** is solid gold (but not both). Find the density of the gold nugget and of each crown. (Hint: You will probably need a calculator to do this.)

   A. Density of the gold nugget: _____

   B. Density of Crown 1: _____

   C. Density of Crown 2: _____

   D. Which crown is pure gold? _____

Activity C: **Egg-speriment**	Get the Gizmo ready: • Replace all the objects on the shelf.	

Question: How does an object behave in different liquids?

1. Observe: Use the Gizmo to explore whether the **egg** sinks or floats in different liquids. Record what you find in the table below.

Liquid	Water	Oil	Gasoline	Seawater	Corn Syrup
Sink or Float?					

2. Draw conclusion: Which liquids are denser than the egg? Which are less dense? Explain your reasoning.

_____

_____

_____

_____

3. Extend your thinking: Observe the egg in each liquid again.

   A. In which liquid does the egg float the highest? _____

   B. In which liquid does the egg sink the fastest? _____

   C. Which liquid do you think is the densest? Least dense? Explain. _____

   _____

   _____

4. Challenge yourself: Using the objects in the Gizmo to help you, list the liquids from densest to least dense. Discuss your answer with your teacher and classmates. (Hint: Compare where objects float within each liquid.)

_____

_____