Name: _____ Date: _____

CHEMISTRY

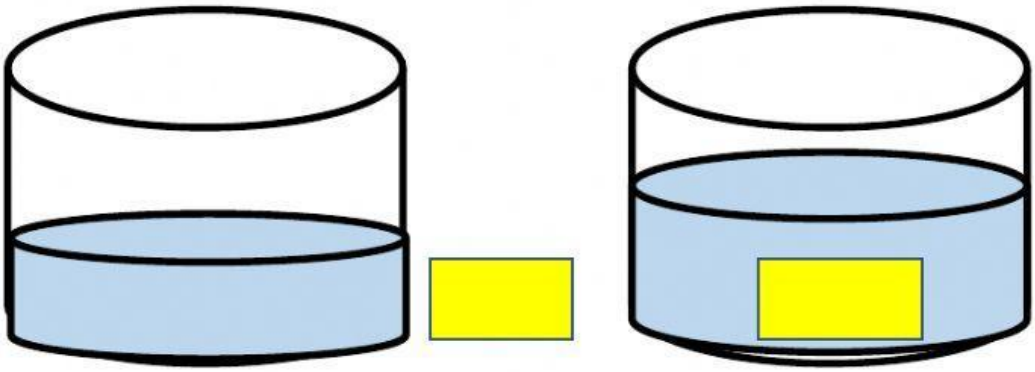
PBS Density by Displacement Simulation

Density is the compactness of matter. Density describes **the quantity of matter (mass) per unit of volume (3-dimensional space).** Density is calculated as the mass of the matter divided by volume.

$$\rho = \frac{m}{V}$$

The symbol for density is Greek letter rho (ρ). The units for mass are in grams (g) and the units for volume is cubic centimeter (cm^3). It should be noted that 1 cm^3 is equal to 1 ml of volume. 1 cm^3 = 1 ml. The units for density are g/cm^3.

Density is calculated at mass divided by volume. You will determine density of solid materials. The volume will be determined by the displacement method. In the displacement method, the object is totally submerged within the liquid. The level or volume of the liquid inside of the container will increase because the new volume after the object is added will include the object's volume.



Volume of liquid without the submerged solid object = 200 ml (200 cm^3).

Volume of liquid with the submerged solid object = 265 ml (265 cm^3). The new volume is the volume of the liquid and volume of the object together.

The volume of the solid object is determined as the difference between the combined volume (liquid + solid) and the original volume of the liquid.

Volume object = 265 cm^3 – 200 cm^3 = 65 cm^3.

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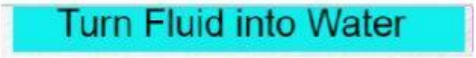
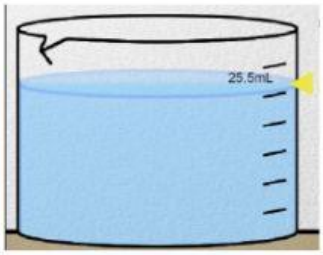
Instructions

1. Go to the website for the activity:
https://contrib.pbslearningmedia.org/WGBH/arct15/SimBucket/Simulations/densitylab/content/index.html

2. A beaker of blue liquid will appear. In the upper center of the page, press the button **"Turn Fluid into Water"**. The density will turn to 1.0 g/cm^3. Keep that density, do not change it. Remove the red block from the liquid with the cursor. Sit it next to the digital balance.



3. The initial volume of the water is 25.5 ml (25.5 cm^3). That is the volume of the water only. This is the initial volume for water for all samples in this experiment.



4. An item list of 8 substances is in the lower right corner under scale. When a substance is clicked, a block will appear.

5. Click on Gold. A gold brick will appear. With the cursor, drag the gold brick onto the digital scale. Record the mass of the gold brick. Write the mass into the table.

6. With the cursor, drag the gold brick into the beaker of water. Make sure that the entire gold brick is submerged into the water. The volume of the water inside the beaker will increase. This is the final volume. Record the final volume in the table.

7. Press the "Reset" button in the top right corner of the page. Repeat steps 2, 3 & 4 for Lead, Foam, Ice, Iron, Wood, Rubber, and ???????.

Note: If an object floats and does not sink to the bottom of the beaker, you must use the cursor arrow to hold the object below the surface of the liquid to get the correct displaced volume.

LIVEWORKSHEETS

The displaced volume is the volume of the submerged object.
Displaced volume = Final volume – Initial volume

The density is the mass of the object divided by the displaced volume. Report density to the 2nd number after the decimal. Use a zero to the left of the decimal for values less than 1.00. Examples: 2.35, 0.75, 1.90

Table

Object	Mass (g)	Initial volume (cm^3)	Final volume (cm^3)	Displaced volume (cm^3)	Density (g/cm^3)
Gold					
Lead					
Foam					
Ice					
Iron					
Wood					
Rubber					
Mystery ??????					

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