Chem 106 / Dr. Rusay

Names (Lab Group): _____

Density & Buoyancy

Part I: PhET Simulation / Buoyancy & Density Ratio

https://phet.colorado.edu/sims/density-and-buoyancy/density_en.html

- Estimate the percentage of the wood, ice, and Styrofoam block that is under water while those blocks are floating. *Remember: the density of water is 1.00 kg/L.*

% Wood under water	*% Ice under water*	*% Styrofoam under water*
Density of Wood	***Density of Ice***	***Density of Styrofoam***

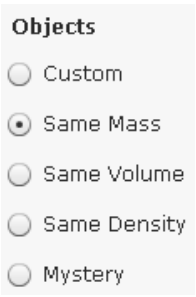
- Place the densities of the respective materials in the chart above. Compare these values to your estimations for the percentages.
- Create a formula to show what percent of a floating object would be submerged in **any** fluid using their respective densities.

% under = surface

Use the respective simulation for the scenario listed to the right of each box and complete the tables below.

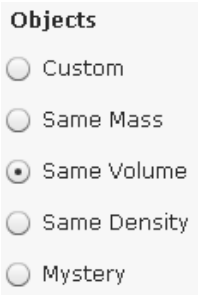
Same Mass

Block	***% submerged***	***Mass, kg***	***Volume, L***	***Density, kg/L***
Blue	*Sunk / 100%*	5.00 kg		
Yellow		5.00 kg	*Floats*	*Floats*
Green		5.00 kg		
Red		5.00 kg		



Same Volume

Block	***% submerged***	***Mass, kg***	***Volume, L***	***Density, kg/L***
Blue		6.00 kg		
Yellow		8.00 kg		
Green		4.00 kg	*Floats*	*Floats*
Red		2.00 kg	*Floats*	*Floats*



Same Density

Block	*% submerged*	*Mass, kg*	*Volume, L*	*Density, kg/L*
Blue		3.00 kg	*Floats*	*Floats*
Yellow		4.00 kg	*Floats*	*Floats*
Green		2.00 kg	*Floats*	*Floats*
Red		1.00 kg	*Floats*	*Floats*

Objects
- ○ Custom
- ○ Same Mass
- ○ Same Volume
- ◉ Same Density
- ○ Mystery

Mystery

Block	*% submerged*	*Mass, kg*	*Volume, L*	*Density, kg/L*
Yellow, A				
Blue, B			*Floats*	*Floats*
Green, C			*Floats*	*Floats*
Red, D			*Floats*	*Floats*
Purple, E				

Objects
- ○ Custom
- ○ Same Mass
- ○ Same Volume
- ○ Same Density
- ◉ Mystery

Questions

1. Increasing the size (mass and volume) of an object: *increases* / *decreases* / *doesn't change* (circle one) the object's density. This is referred to as an: *intensive (same regardless of amount) / extensive (depends on the amount)* (circle one) property.

2. An object with a density of 0.67 kg/L floats in water. Approximately (circle one) *1/3* , *1/2* , *2/3* of the object is **under** water.

3. An ice cube (ρ = 0.9168 g/cm^3) dropped into a glass of 100% ethanol (ρ = 0.789 g/mL) will *sink* or *float*?

4. Using the %-density ratio, determine the percentage of a white pine wooden cube, which is 10.0 cm on a side (ρ = 0.400 g/cm^3) would be submerged in water.

   _____

5. Using the %-density ratio, determine the percentage of a white pine wooden cube that is 20.0 cm on a side (ρ = 0.400 g/cm^3) that would be submerged in pure ethanol.

   _____

6. Gasoline has a density of 0.7 g/mL. If one gallon of gasoline is mixed with 1 gallon of water.

   a) the gasoline and water mix together
   b) the gasoline and water don't mix and the gasoline is on top of the water.
   c) the gasoline and water don't mix and the water is on top of the gasoline.

7. If one gallon of gasoline is mixed with 1 liter of water (about a quart).

   a) the gasoline and water mix together
   b) the gasoline and water don't mix and the gasoline is on top of the water.
   c) the gasoline and water don't mix and the water is on top of the gasoline.

8. Determine the density of an unknown metal that displaces 4.5 L of water and is found to have a mass of 25.4 kg.

_____

9. How much water will a 1.00 kg metal block displace with a density of 7.00 kg/L?

_____

10. How much water will a 1.00 kg **plastic** block (ρ= **0.60** kg/L) displace when **floating**?

_____

11. Develop a way to identify the 5 Mystery blocks based on what you have read and understood from the simulation and class presentations using the information in the simulation's Table and your method to identify the blocks.

    a. Complete the following table: identify the most likely material for each colored block with specific data to support your identification.

Block	***Material ID***	***Support Data***
Yellow, A		
Blue, B		
Green, C		
Red, D		
Purple, E		

    b. Write a very brief general procedure (directions) in paragraph form with a few full sentences (similar to a recipe) for your experimental method. Do not use first person pronouns, (I or We), nor second person pronouns, (You). *Turn in on a separate page either typed or hand written that is attached to this form*

12. Mass is an *extensive* property as is volume. Briefly explain your answers to question #1 using this accepted information.