During Class Invention

Name(s) with Lab section in Group

Density

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1. When a marble is dropped into a beaker of water, it sinks to the bottom. Which is the best explanation?

a. The surface area of the marble is not large enough to be held up by the surface tension of the water.
b. The mass of the marble is greater than that of the water.
c. The marble weighs more than the equivalent volume of the water.
d. The force from dropping the marble breaks the surface tension of the water.
e. The marble has greater mass and volume than the water.

Justify your choice. For the choices you did not pick, explain what is wrong with the statement.

2. Consider the following compounds and their densities.

Substance	Density (g/mL)	Substance	Density (g/mL)
Isopropyl alcohol	0.785	Toluene	0.866
n-butyl alcohol	0.810	Ethylene glycol	1.114

100 mL of each liquid is placed in its own graduate cylinder.

a) The label on each graduate cylinder got lost. How would you be able to identify which graduate cylinder contains which chemical based on the information given to you?

Weight the contents of all four cylinders, the mass of the liquid is directly proportional to the density of the liquid when the volume of the liquids are the same.

b) List two intensive and two extensive properties of matter that pertain to each chemical.

The density and the color of the liquid are intensive properties. Mass and volume are extensive, depend on the amount of substance.

3. A 1.000 cubic centimeter sample of lead (density = 11.34 g/cm^3), a 1.000 cubic centimeter sample of glass (density = 2500 kg/m^3), and a 1.00 cm^3 sample of Ebony wood (density = 960 kg/m^3) and Balsa wood (density = 170 kg/m^3). You drop each in separate beaker of water each containing 250 mL of water.

How do the volumes of water displaced by each sample compare? Explain.

Lead: $\mathbf{11.34\ \frac{g}{cm^3}}$

Glass: $\mathbf{2500\ \frac{kg}{m^3}\left(\frac{1\ m}{100\ cm}\right)^3\left(\frac{1000\ g}{1\ kg}\right) = 2.5\ \frac{g}{cm^3}}$

Ebony: $\mathbf{960\ \frac{kg}{m^3}\left(\frac{1\ m}{100\ cm}\right)^3\left(\frac{1000\ g}{1\ kg}\right) = 0.960\ \frac{g}{cm^3}}$

Balsa Wood: $\mathbf{170\ \frac{kg}{m^3}\left(\frac{1\ m}{100\ cm}\right)^3\left(\frac{1000\ g}{1\ kg}\right) = 0.170\ \frac{g}{cm^3}}$

The lead and the glass will displace a full 1 mL of the water since their densities each exceed the density of water. The Ebony will displace less than 1 mL, and the Balsa Wood would displace even less than the Ebony wood.

4. Gold can be hammered into thin sheets called gold leaf. You have 2 gold leaves that your Grand Mother gave you as a gift.

a. Your Grand Mother told you that the first one was made from a 305 mg piece of gold that has been hammered into a sheet measuring 2.44 ft x 1.12 ft. What is the average thickness of the sheet in meters, using scientific notation? (Density = 19.32 g/cm^3)

$\mathbf{2.44\ ft \cdot 1.12\ ft = 2.98\ ft^2}$

$\mathbf{2.98\ ft^2\left(\frac{12\ in}{1\ ft}\right)^2\left(\frac{2.54\ cm}{1\ in}\right)^2 = 2.77 \times 10^3\ cm^2}$

$\mathbf{305\ mg\left(\frac{1\ g}{1000\ mg}\right)\left(\frac{1\ cm^3}{19.32\ g}\right) = 1.58 \times 10^{-2}\ cm^3}$

$\mathbf{\left(\frac{1.58 \times 10^{-2}\ cm^3}{2.77 \times 10^3\ cm^2}\right) = 5.70 \times 10^{-6}\ cm\left(\frac{1\ m}{100\ cm}\right) = 5.70 \times 10^{-4}\ m}$

b. The other gold leaf was made from a 650 mg piece of gold leaf that has been hammered into a sheet measuring 3 cm x 3 cm x 0.00374 cm. What is the density of this gold leaf?

$$\mathbf{650\ mg \left(\frac{1\ g}{1000\ mg}\right) = 0.650\ g}$$

$$\mathbf{density = \left(\frac{0.650\ g}{3\ cm \cdot 3\ cm \cdot 0.00374\ cm}\right) = 19.31\ \frac{g}{cm^3}}$$

Looks like this piece is really gold.

c. If you were to sell these two sheets of gold on e-Bay, what would you expect to sell it for? (Gold cost: $543.00 per ounce)

0.305 g + 0.650 g = 0.955 g

$$\mathbf{0.955\ g \left(\frac{1\ lb}{453.59\ g}\right)\left(\frac{16\ oz}{1\ lb}\right)\left(\frac{\$543}{1\ oz}\right) = \$18.29}$$