12 Density and Isostasy

Measuring Density

Mass is basically the amount of matter in a substance. Weight is the measurement of the force of gravity on a mass. Density is the mass per volume of a substance.

Provided for your lab are two different rocks, granite (light-colored) and basalt (dark-colored). Use the scale provided to determine the weight (in grams) of four samples of each rock. Use a graduated cylinder with water to find the volume (in ml) of each one of those same samples. Remember, $1ml = 1cm^3$. Fill the cylinder to a known level, add the rock (gently), and note the new water level. The change in water level gives you the volume of your rock. (My daughter did this in second grade!)

Granite			
	Mass (g)	Volume (cm^3)	Density (g/cm^3)
1.			
2.			
3.			
4.			
Average			

Basalt			
	Mass (g)	Volume (cm^3)	Density (g/cm^3)
1.			
2.			
3.			
4.			
Average			

How did you do?

Granite: Most granite has a density of around $2.75 g/cm^3$.

Basalt: Most basalt has a density of $3.3 g/cm^3$.

Why do you think your values are different? In other words, what were your sources of errors?

Understanding Isostasy

Using the wood blocks provided, show your work in determining the following:

	Red Blocks	Brown Blocks
Mass	g	g
Volume	cm^3	cm^3
Density	g/cm^3	g/cm^3
Convert to percentage (water has a density of 1 g/cm^3)	%	%

Float the blocks in water. Mark the waterline. Perform the following measurements to the nearest millimeter:

	Red Blocks	Brown Blocks
Total height of block (H_{total}):	mm	mm
Height below the waterline (H_{below}):	mm	mm
Percentage below waterline (H_{below}/H_{total})	%	%

Compare your results from the two tables. The percentages for each set of blocks should be roughly the same for density as percentage of water and the percentage of the block below the waterline. Assume they would be equal if the experiment was repeated several times with more precision. What equations could you write that would allow you to calculate the portion of a wooden block below the waterline, given the density of the block?

Generalize your answer for the preceding question to determine isostatic equilibrium for any solid of density ρ_{solid} and liquid of density ρ_{liquid}.

If the density of ice is 0.917g/cm^3 and of ocean water is 1.027g/cm^3, then what percentage of an iceberg is beneath the waterline?

Out-of-Class Assignment

1. If the density of liquid mercury (Hg) is 13.56 g/cm^3 and the density of granite is 2.75 g/cm^3, then what percentage of a block of granite is below the surface of the mercury? Show your work.

2. Both temperature and salinity affect density of water. At what temperature does water have its maximum density? How does this compare to the density of ocean water? If ice melts from Greenland's glaciers and the resulting water flows into the oceans, will it sink or stay on top?