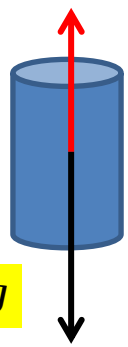
Density and Buoyancy

• Density: $\rho = \dfrac{Mass}{Volume}$

•Archimedes Principle : ***"Buoyancy force = weight of displaced fluid"***

$\text{Bouyancy Force} = \rho_{fluid} Vg$



$F_{buoyancy} = m_{fluid} g = \rho_{fluid} Vg$

$\text{Weight of the body} = m_{body} g$

here V is the volume of the body, g=9.8m/s^2.

• Buoyancy also acts on objects in gases (think of balloons in air).

• Units of Volume and Density:

$$1m^3 = 10^3 l = 10^6 cm^3$$

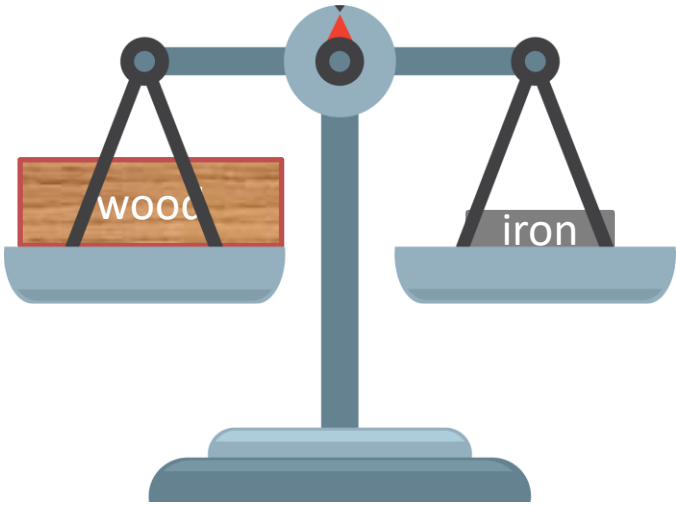
$$1cm^3 = 1ml = 10^{-3} l = 10^{-6} m^3$$

$$\rho_{H_2 0} = 1\frac{g}{ml} = 1000\frac{kg}{m^3}$$

Homework

Problem 1

Imagine that you have extremely sensitive balance scales. You balance them with a piece of iron on the right, and a piece of wood on the left, in the presence of regular Earth gravity but **in vacuum** (see figure). Will the balance change if you now expose these scales with both objects, to air? If yes, how and why?



Problem 2

a) A boat is floating in a pool. A person sitting in the boat takes a big rock (which is originally in the boat as well), and drops it to the bottom of the pool. Will the water level in the pool drop/rise or stay the same? Why?

b) Now the person jumps from the boat into the pool, and starts swimming. Will the water level in the pool drop/rise or stay the same? Why?

Problem 3

Measure a density of any object, by using any household items. Sketch a picture of your experiment, provide the results of your measurements, and show your calculations of the density.