## **Density and Buoyancy**

• Density:

 $=\frac{Mass}{Volume}$ 

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



- Buoyancy also acts on objects in gases (think of balloons in air).
- Units of Volume and Density:

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

$$\rho_{H_20} = 1 \frac{g}{ml} = 1000 \frac{kg}{m^3}$$

## Homework

## Problem 1

Imagine that you have extremely accurate digital scales that were calibrated in vacuum (in the presence of regular Earth gravity). How much will they show (in grams) if you weight m=1kg of Aluminum, in the presence of atmosphere? Density of Aluminum is  $\rho_{AI}$ =2.800 kg/m<sup>3</sup>, density of air is  $\rho_{air}$ =1.2 kg/m<sup>3</sup>.

## 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. The mass of the rock is 60 kg, and its density is 3 kg/L. Will the water level in the pool drop/rise or stay the same? If it will change, by how much? Area of the pool surface is 20 m<sup>2</sup>.
- b) Now the person who also weights 60 kg and has density 0.9 kg/l jumps from the boat into the pool, and starts swimming. How much the level will change?