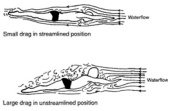
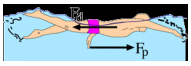
Buoyancy Force

Swimming Kinetics

- Forces acting on the swimmer
  - Gravity
  - Buoyancy
  - Resistive drag
  - Propulsive drag
- Horizontal Motion
  - $\sum F_{Horizontal} = ma_{com\_Horizontal}$
  - $F_{propulsion} - F_{drag} = ma_{com\_Horizontal}$
  - $F_{propulsion} = ma_{com\_Horizontal} + F_{drag}$
- Vertical Motion
  - $\sum F_{Vertical} = ma_{com\_Vertical}$
  - $F_{buoyancy} + -F_{gravity} = ma_{com\_Vertical}$
  - $F_{buoyancy} - F_{gravity} = ma_{com\_Vertical}$





Water

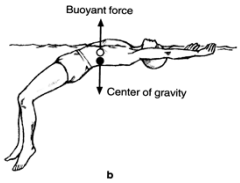
- Density
  - $\rho = m/V$
    - ρ = 'rho' = density
    - m = mass
    - V = volume
  - Units = kg/m^3
  - Water is about 784 times more dense than air.
    - Dependent on temperature

Water

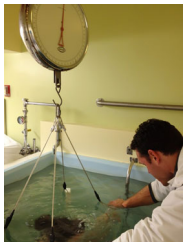
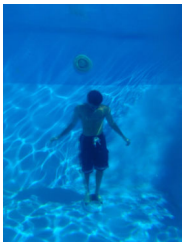
- Specific Gravity
  - The density of a material compared to the density of some standard (e.g., water, 1 g/cm^3).
    - A specific gravity > 1 means the object would sink.
    - A specific gravity < 1 means the object would float.

Water

- Buoyancy Force
  - The upward directed force keeping an object afloat.
  - Equal in magnitude to the weight of water displaced.



Body Composition


Body Composition

Siri Equation

$$\%BF = \frac{495}{D_b} - 450$$

or Schutte Equation

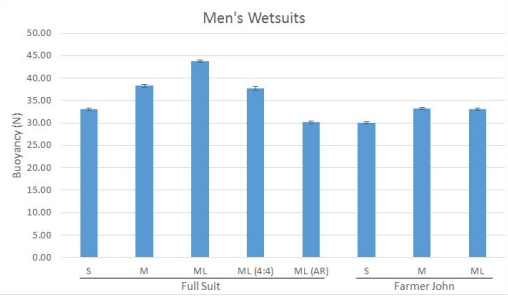
$$\%BF = \frac{437}{D_b} - 393$$

$$D_b = \frac{BW}{\frac{BW - UWW}{D_{H2O}} - (RV + 0.1)}$$

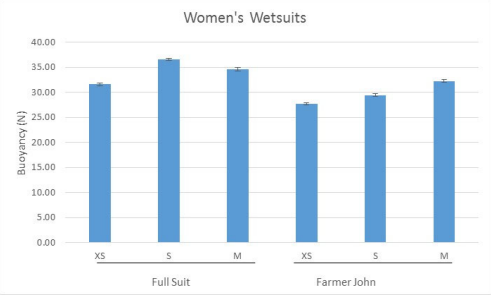
$$RV = (0.0115 \times Age_{(yrs)}) + (0.019 \times Ht_{(cm)}) - 2.24 \quad \text{For Men}$$

$$RV = (0.009 \times Age_{(yrs)}) + (0.032 \times Ht_{(cm)}) - 3.90 \quad \text{For Women}$$

Buoyancy Force Wetsuits



Buoyancy Force Wetsuits



What's next?

- Watch the following videos:
  - Pressure
  - Buoyancy lecture
  - Buoyancy video