Jake Sauter
Physics III
Quiz #1 (Fluids)

- A fluid is a substance that can flow and conform to a container
- Force is applied perpendicular to the fluid's surface

(density) $\rho = \frac{m}{V}$ (units) $1\,atm = 1.01 \times 10^5\,Pa = 760\,torr = 14.7\,lb/in^2$

(pressure) $p = \frac{F}{A}$ (Balance of Buoyant Force) $F_2 = F_1 + mg$

$p = p_0 + \rho g h$ (below a fluid's surface)

* The pressure at a point in a fluid in static equilibrium depends on the depth of that point but not on any horizontal dimension of the fluid or its container

* Guage Pressure = Absolute Pressure − Atmospheric Pressure

Pascal's Principle

$\Delta P_{int} = \Delta P_{ext}$ (h independent) ; $P_i = P_0 - (P = \frac{F}{A}) \rightarrow \frac{F_i}{A_i} = \frac{F_o}{A_o}$

$\rightarrow F_o = F_i \frac{A_o}{A_i}$; $\rightarrow d_o = d_i \frac{A_i}{A_o}$; $W = F_o d_o = (F_i \cancel{\frac{A_o}{A_i}})(d_i \cancel{\frac{A_i}{A_o}}) = F_i d_i$

(small force)(large distance) = (large force)(small distance)

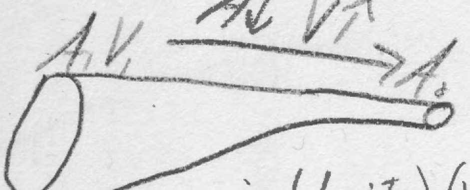
Archimedes' Principle

$F_B = m_f g$ (Buoyant Force = weight of displaced fluid)

$F_B = F_g$ (floating) $\rightarrow F_g = m_f g$; (apparent weight) = (actual weight) − (buoyant force)

Equation of continuity

$A_1 V_1 = A_2 V_2$



$R_V = AV = const$ (Volume flow rate)

$R_m = \rho R_V = \rho A V = const$ (Mass flow rate)

(density)(Volume flow rate) = Mass flow rate ($\rho R_V = R_m$)

$\boxed{\text{flow in = flow out}}$

Bernoulli's Equation

$p_1 + \frac{1}{2}\rho V_1^2 + \rho g y_1 = p_2 + \frac{1}{2}\rho V_2^2\, y_2$; $p_1 + \frac{1}{2}\rho V^2 + \rho g y = const$

kinetic energy density

(horizontal pipe) $p_1 + \frac{1}{2}\rho V_1^2 = p_2 + \frac{1}{2}\rho V_2^2$