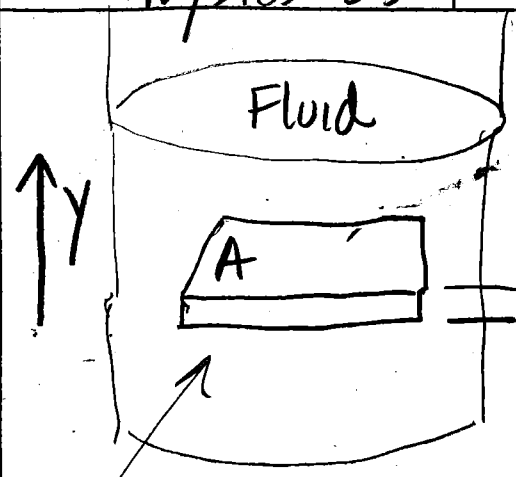
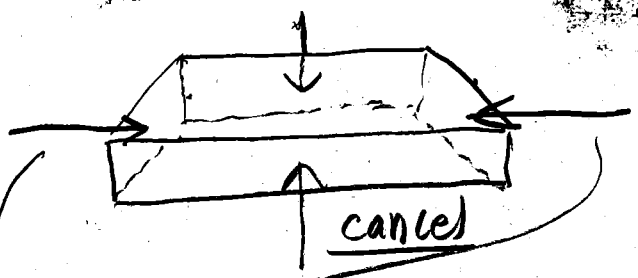


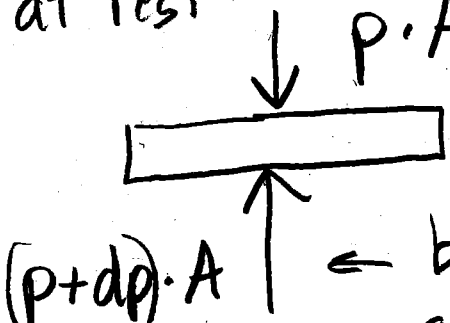
Force



cancel

up down don't cance

- imaginary box of fluid
- at rest



$dm = \rho A dy$ ← bigger to support weight in box

$$(P+dP)A - PA - \rho A dy = 0$$

$$\frac{dP}{dy} = -\rho g$$

$$P = P_0 - \rho g y$$

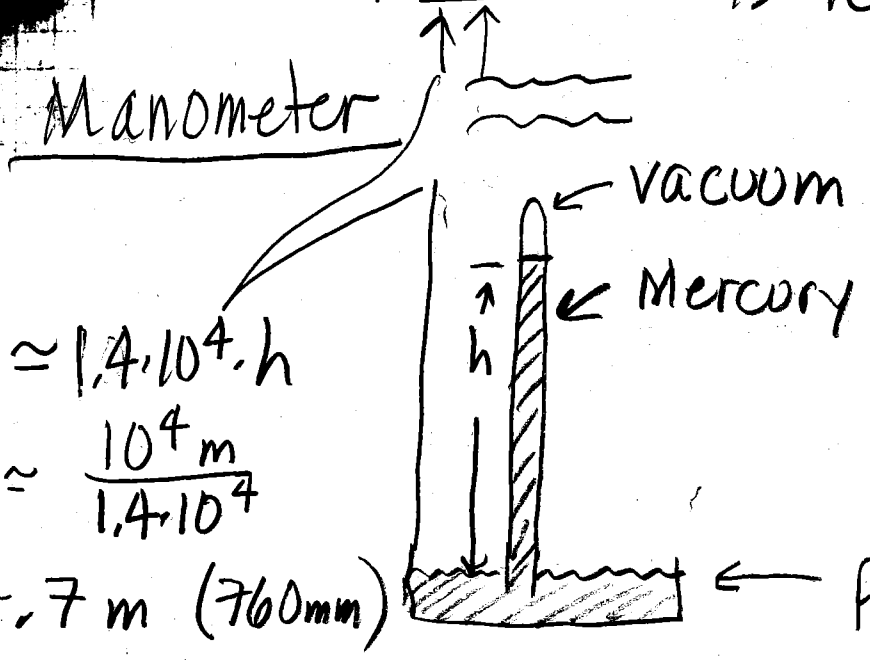
homework

$(\rho A dy)\, a$ ← acceleration

− sign... deeper, higher pressure.

$\frac{\rho_{water}}{\rho_{Air}} \cong 10^3$ $\frac{\rho_{Mercury}}{\rho_{Air}} \cong 1.4 \cdot 10^4$

atmosphere is 10^4 m tall



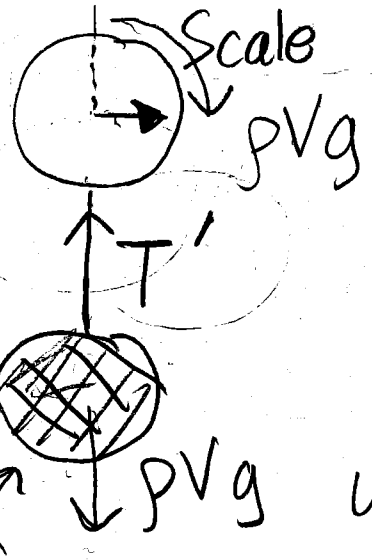
Buoyancy (Archimedes Principle)

You feel "lighter" when in water

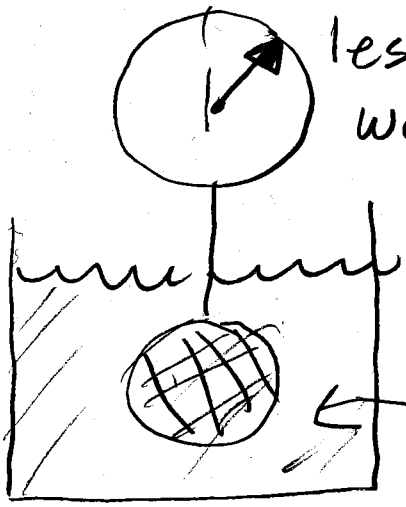
Why?

$\Rightarrow$ It's the weight of the displaced water

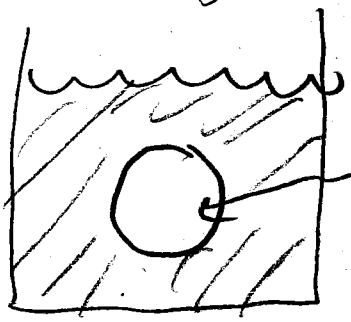
"Eureka" Archimedes cried, as he exited his bath, ran naked to King



uniform sphere volume V, ρ

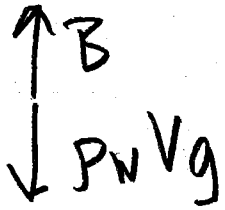


imagine "hole in the water" volume.. V



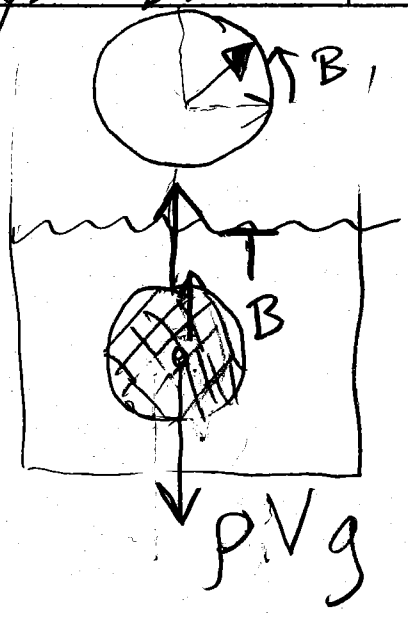
if you filled the hole with water, it would be in static equilibrium..

But water feels gravity... what cancels this is called the Buoyant Force B



$B - \rho_w V g = 0$

$B = \rho_w V g$



$$T + B = \rho V g$$

$$T = (\rho - \rho_w) V g$$

note: $\dfrac{T}{T'} = \dfrac{(\rho - \rho_w) V g}{\rho V g}$

$$\frac{T}{T'} = 1 - \frac{\rho_w}{\rho}$$

$$\frac{\rho_w}{\rho} = 1 - \frac{T}{T'}$$

$$\boxed{\rho = \frac{\rho_w}{1 - \dfrac{T}{T'}}}$$

Gold vs. Lead... Easy!