Physics 23 http://hep.ucsb.edu/courses/ph23/

MWF 11:00 am 1640 Broida

Two Sections: Th 1:00 pm 2124 Girvetz
Fr 1:00 pm 1640 Broida

Both Mandatory

Text: first 5-6 Weeks
Young & Freedman, 11TH edition
"University Physics"
Chapters 14-20 Web Page

Remainder: "Electricity & Magnetism"
Purcell, Second Edition

Already Have Homework:

14 - 2, 6, 10, 14, 42, 44

due MONDAY! 10/1

Fluids: air, water, motor oil, maple syrup

more "ideal"

takes shape of container immediately

less ideal

holds its shape

Two Intrinsic Quantities:

1) **Density** $\frac{\text{mass}}{\text{volume}} \equiv \rho$

4.4 N

which weighs more, a pound of feathers or a pound of lead?

4.4 N

neither, but lead is more dense

$\frac{g}{cm^3} \rightarrow$ "cgs" $\Rightarrow \underbrace{\frac{kg}{m^3}}_{\text{mks}}$

↑ we use this

$$1\ \frac{g}{cm^3} = \frac{10^{-3}\ kg/g}{(10^{-2}\ m/cm)^3} \times 1\ \frac{g}{cm^3}$$

$$1\ \frac{g}{cm^3} = 1000\ kg/m^3$$

Air $\rho \simeq 1.2\ kg/m^3$ (!)

(roomful ≈ 72 kg!)

Liquids $\rho \sim 10^3\ kg/m^3$

Solids: Lead ≈ 11 kg/m^3 ; Gold ≈ 19 kg/m^3

2) Pressure: $PV = nRT$

$\frac{\text{Force}}{\text{Area}}$ → direction of force is ⊥ to area

area A

$P = \frac{|\vec{F}|}{A}$

A'

$P' = \frac{|\vec{F}'|}{A'}$

units: $\frac{N}{m^2} \equiv$ Pascal, "very small"

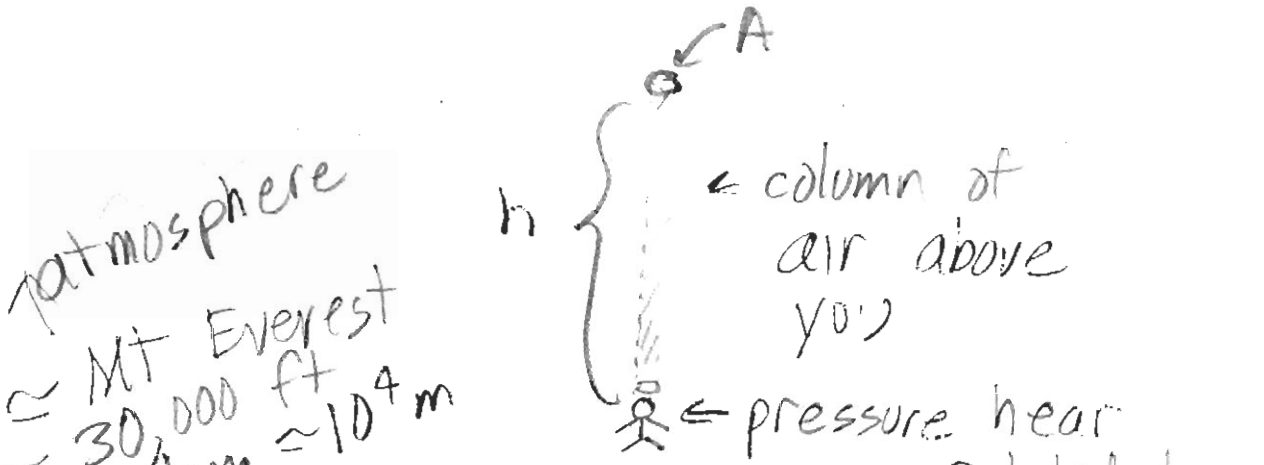
$1\ atm \cong 10^5\ Pa \simeq 1$ "bar"

$\simeq 15\ \frac{lbs}{in^2}$

Pressure versus depth in a fluid

Swimming - go deep, your ears hurt!

Qualitative:



atmosphere
≃ Mt Everest
≃ 30,000 ft
≃ 10^4 km ≃ 10^4 m
earth

Estimate

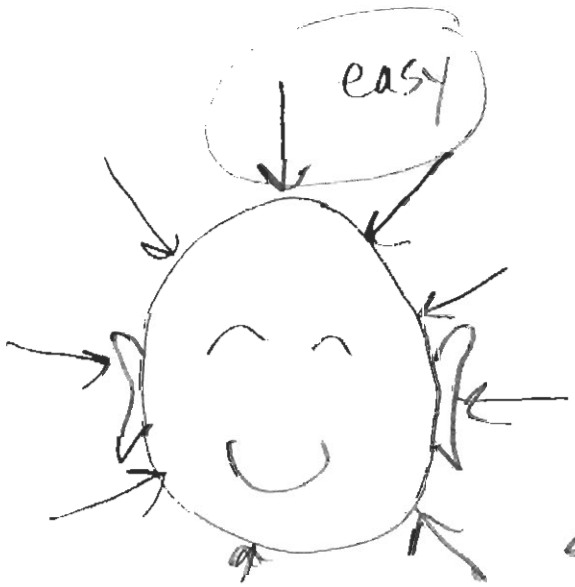
$$W = \underbrace{\rho (A h)}_{\text{mass}} \cdot g$$

top of head

$$P \simeq \frac{W}{A} \simeq 1.2 \cdot 10^4 \cdot 10$$

kg/m^3 m m/s^2

$$P \simeq 1.2 \cdot 10^5 \ \frac{N}{m^2}$$



Pressure "Turns Around" in Ideal Fluids

← in fact, a little higher!