Physics 113 - Nov. 30, 2006

- Server Problems → P.S. 10
  CAN hand in thru tomorrow if needed

- Project ⟷ class topics
  ↓
  No time

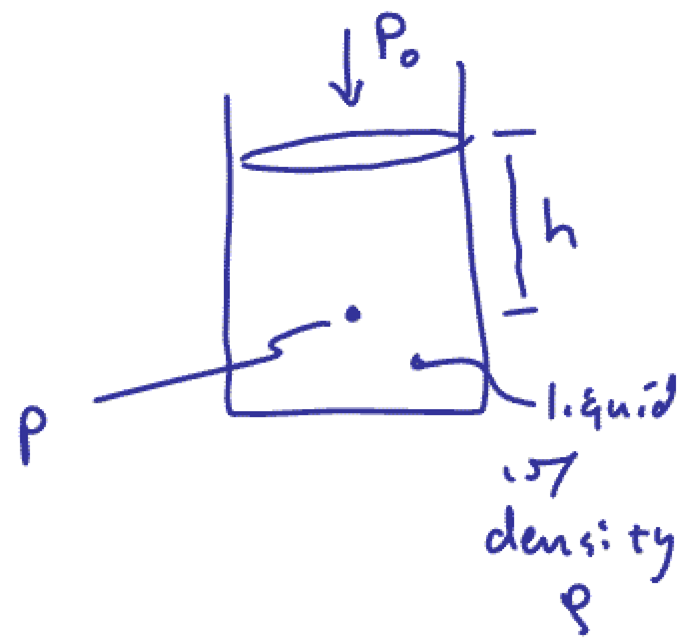
- Exam 3 - in box outside my office door

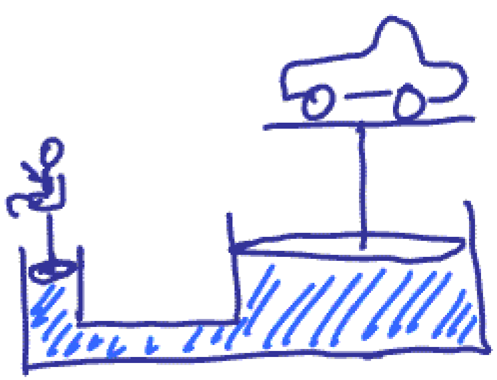
Last time –

Fluids – hydrostatics

Pascal's law: Pressure applied to an enclosed fluid is transmitted undiminished to every point in fluid and the container walls.

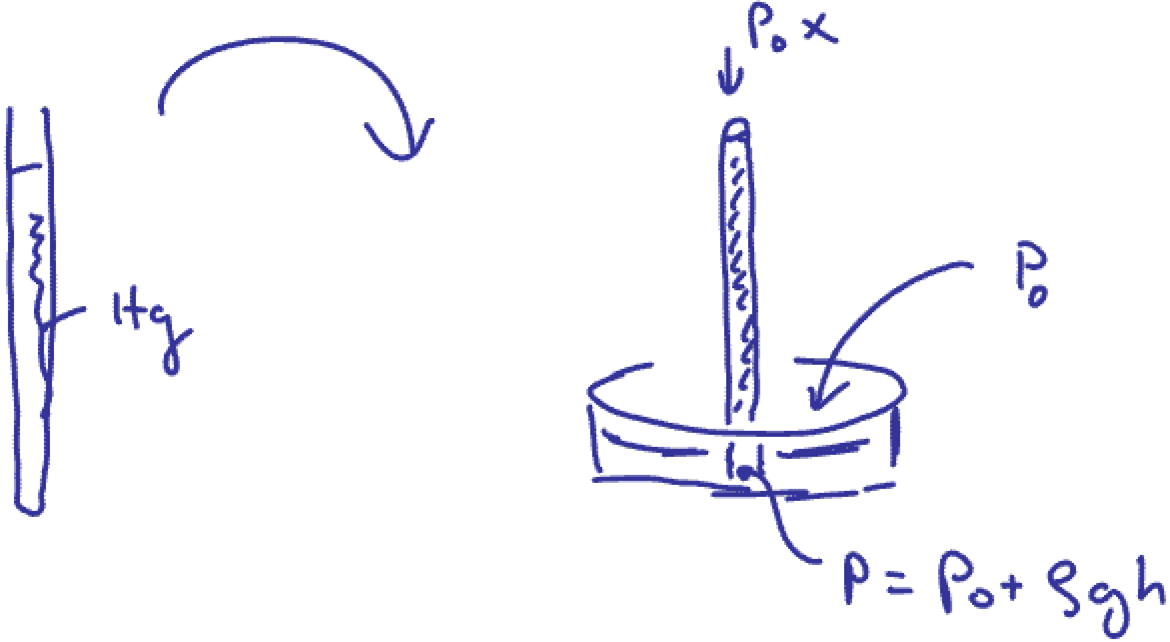
$$P = P_0 + \rho g h$$





Hydraulics

$P = F/A$



1 mm Hg = pressure of 1 Torr

1 atm. $\approx$ 760 mm Hg = 760 Torr

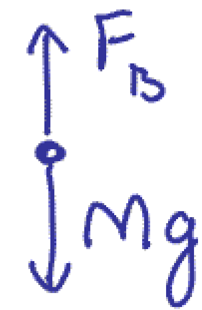
Archimedes' principle

When a body is completely or partially submerged the fluid exerts an upward force on the body equal to the weight of the fluid displaced bouyant force   bouancy

Example

seawater
S.g. 1.03

What fraction iceberg is submerged



$F_{Bouyant}$ = WT of displaced fluid

let Vol iceberg $\equiv V$

submerged fraction $\equiv x$

vol seawater displace

$$Mg = \rho_{ice} V g = (\rho_{seawater} V_s) g$$

$$\rho_{ice} V g = \rho_{seaw}\, x V g$$

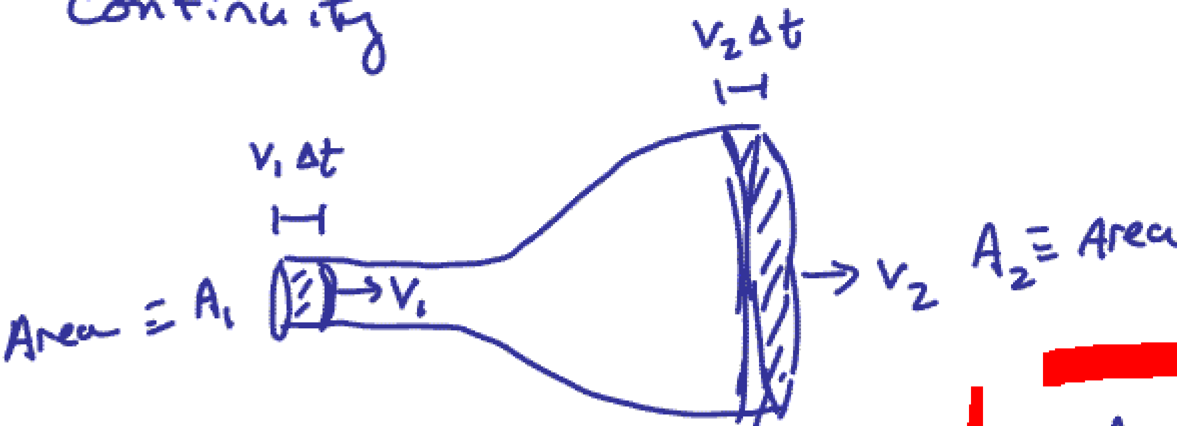
$$\frac{\rho_{ice}}{\rho_{H_2O\ 4^\circ C}} = \frac{\rho_{seaw}}{\rho_{H_2O\ 4^\circ C}}\, x \Rightarrow \frac{(s.g.)_{ice}}{(s.g.)_{sw}} = x$$

$$x = 89\%$$

Fluid dynamics — Hydrodynamics

ideal fluid → No viscosity
internal friction
→ incompressible

Continuity



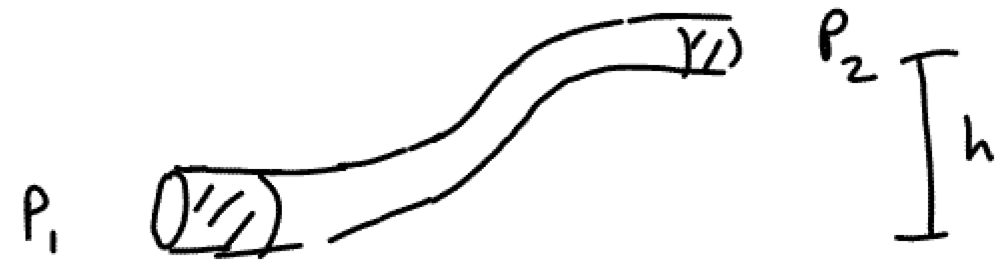
Flowing fluid

incompressible

$$A_1 v_1 \Delta t = A_2 v_2 \Delta t$$

$$\boxed{A_1 v_1 = A_2 v_2}$$

Equ of continuity



E conservation

$$W + \tfrac{1}{2}mv^2 + mgh \sim \text{const}$$

$\mathcal{V} \equiv$ vol of fluid moved

$$\frac{F\cdot d}{\mathcal{V}} + \frac{1}{2}\frac{mv^2}{\mathcal{V}} + \frac{mgh}{\mathcal{V}} \sim \text{Const}$$

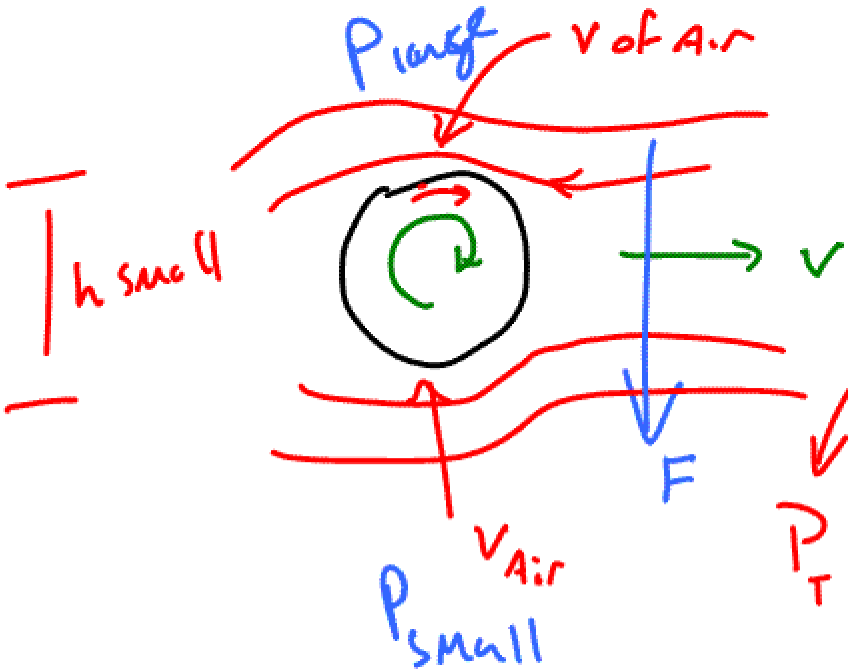
P

$$\frac{F\cdot \cancel{d}}{A\cdot \cancel{d}} + \tfrac{1}{2}\rho v^2 + \rho g h \sim \text{const}$$

$$\boxed{P + \tfrac{1}{2}\rho v^2 + \rho g h = \text{const}}$$

Bernoulli's equation

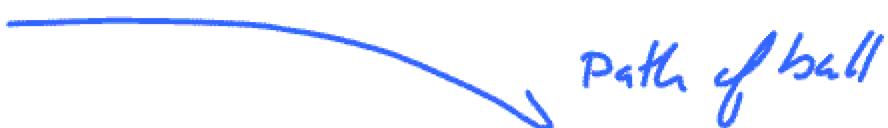
curveball in baseball

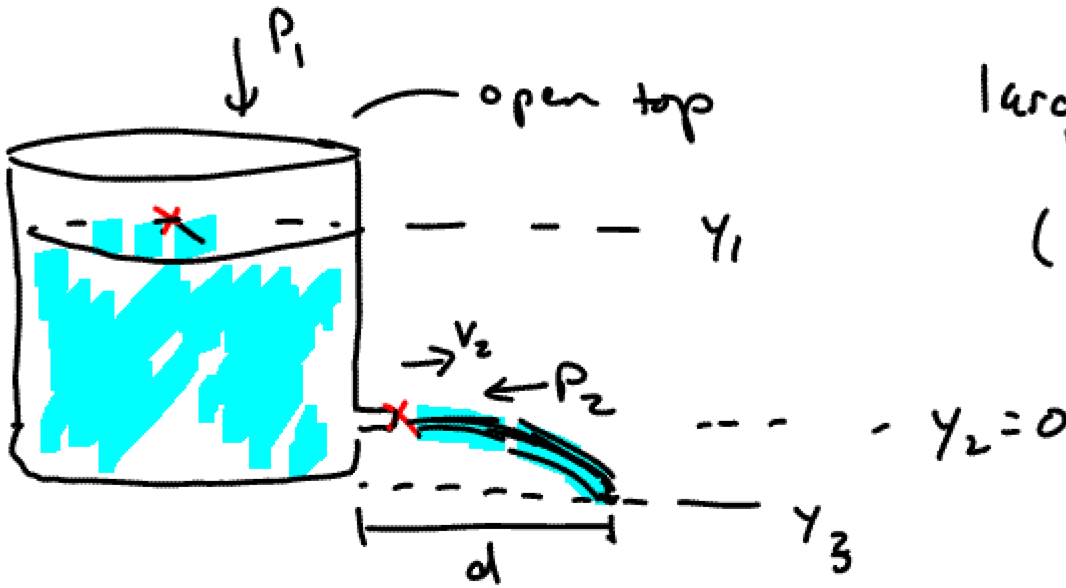


bigger smaller

$$P_T + \tfrac{1}{2}\rho v_T^2 = P_B + \tfrac{1}{2}\rho v_b^2$$

$$h_T = h_b$$





large vat
(bucket)

determine d

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g \underset{y_1}{h} = P_2 + \frac{1}{2}\rho v_2^2 + \rho g \underset{y_2 \equiv 0}{h}$$

$P_1 \approx P_2 \approx P_{ATM}$ $\qquad h = y_1 - y_2 \sim y_1$

$v_1 = 0$ because vat is large

$$\rho g y_1 = \frac{1}{2}\rho v_2^{\,2} \qquad v_2 = \sqrt{2gh}$$

At this point
it's a projectile
problem