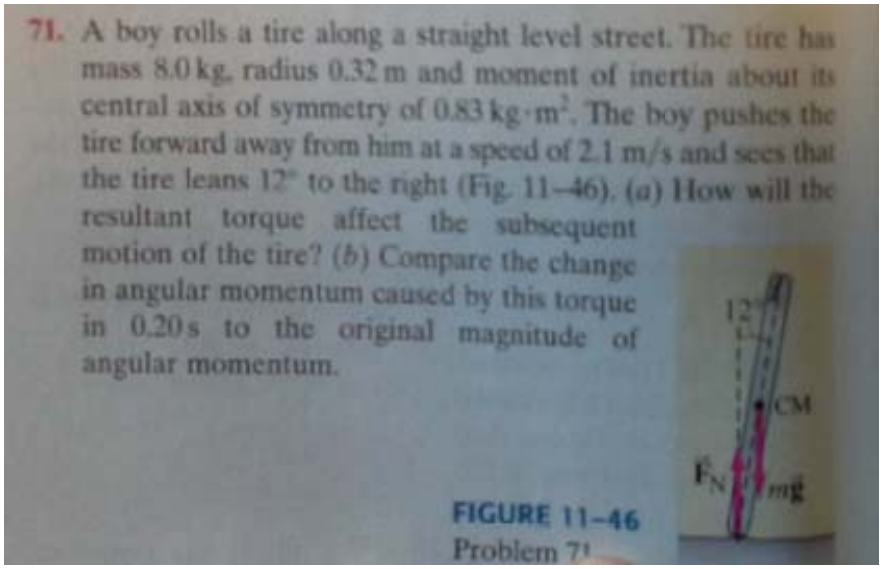
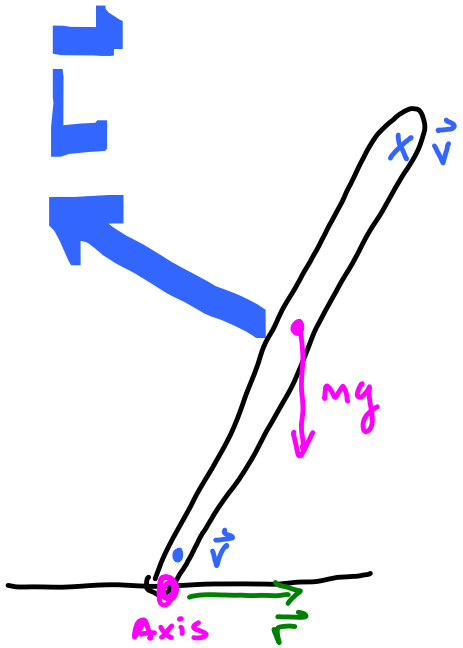
# Physics 113 - November 15, 2012

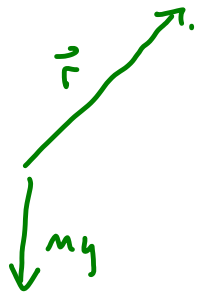
one of you wrote –

I am just wrapping up PS9, and I am pretty confused by part a of #71. I just have no clue how the answer key comes to the conclusion that torque will cause the bicycle to veer to the right. I tried a bunch of orientations of r and F using the RH rule, and I am still lost.

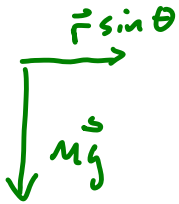





$\vec{r} \times M\vec{g}$ into board




or



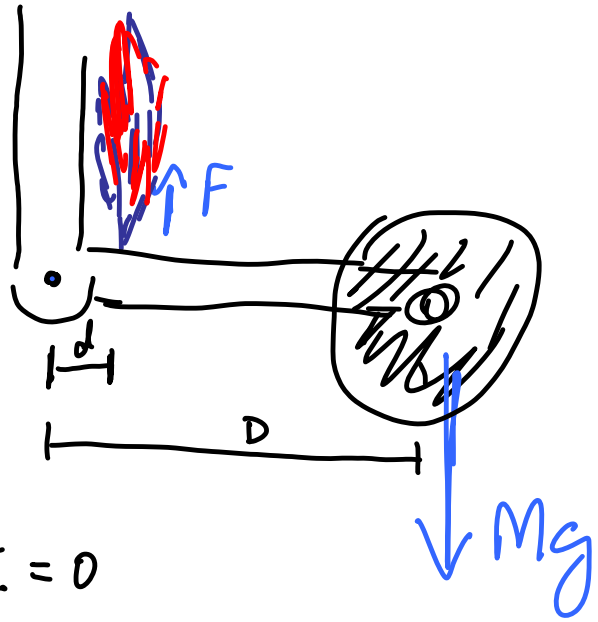

$$\frac{d\vec{L}}{dt} = \vec{\tau}$$

So $\vec{L}$ rotates into board... meaning wheel MUST turn to the right as you are looking at it.

## Static Equilibrium

$$\sum \vec{F} = 0$$

$$\sum \vec{\tau}_{\text{any axis}} = 0$$




we are neglecting Mass of arm

$\Sigma \tau = 0$

$0 \approx dF - mgD$

For same $|\vec{F}|$, M supported "scales" with d

# Fluid Mechanics

STATICS – Hydrostatics

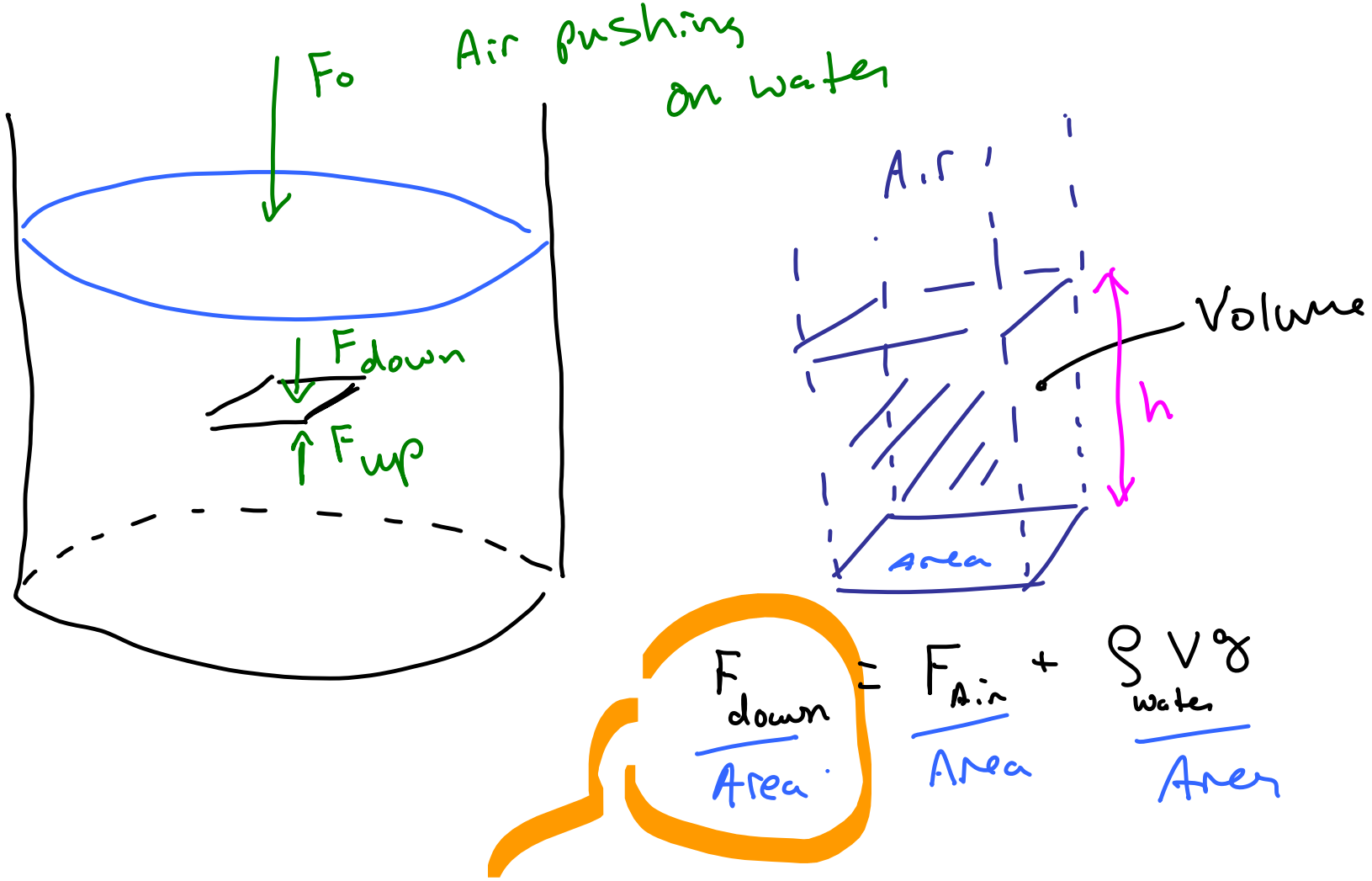
For us ⟶ incompressible

$\rho$ volume density $\quad \frac{\text{Mass}}{\text{Vol.}} \quad \frac{kg}{m^3}$

Specific gravity of material $= \frac{\rho_{\text{material}}}{\rho_{H_2O \text{ at } 4^\circ C}}$

$> 1$ Sink

$< 1$ Float


Fo
Air pushing on water
Fdown
Fup
Air
Volume
h
Area
F down / Area = F Air / Area + ρ water V g / Area

$\frac{\text{Force}}{\text{Area}} \equiv \text{pressure}$ $\quad \frac{N}{M^2} \equiv \text{Pascal}$ for M/CS

$$P_{\substack{\text{Top} \\ \text{Paper}}} = P_{\substack{\text{Top} \\ \text{Water}}} + \rho g h$$

↑ height of water

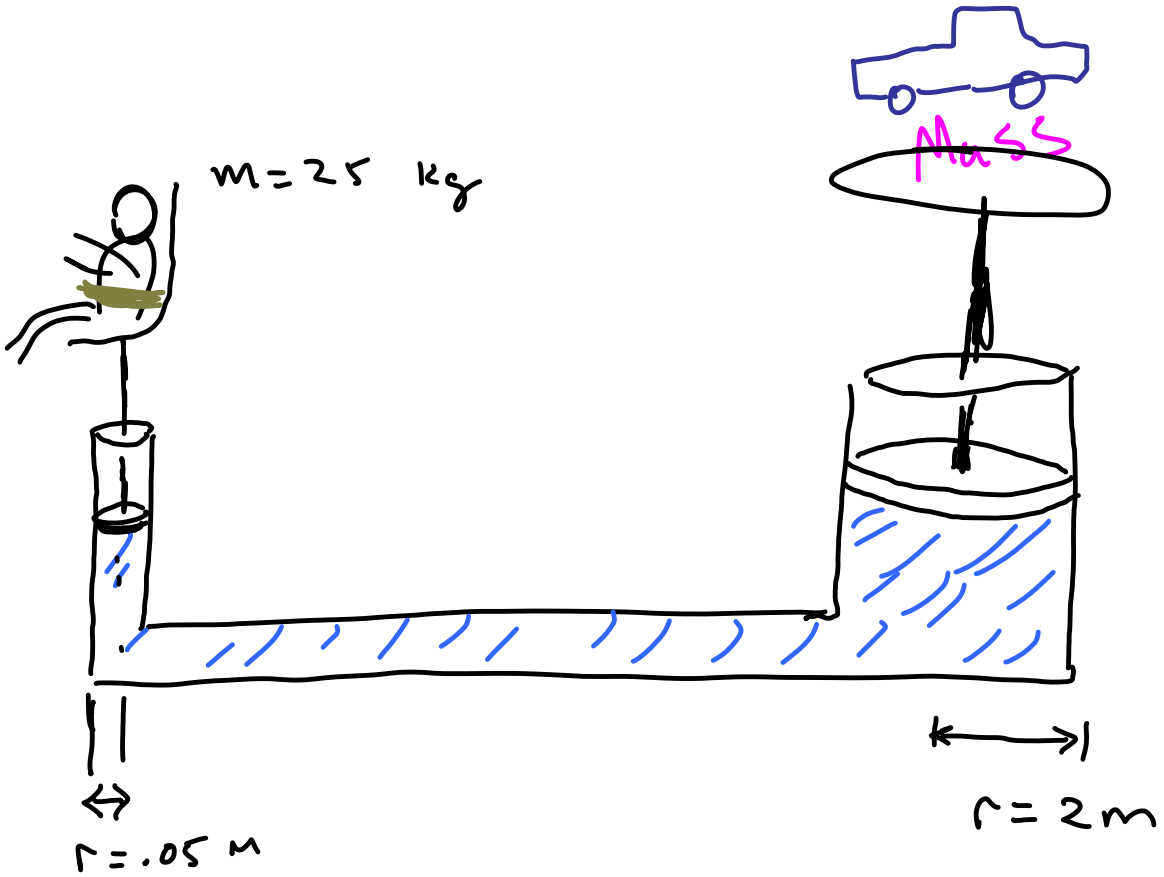
1 Atmosphere

$= 1.013 \times 10^5 \text{ Pa}$

$= 1013$ Millibar

$= 14.70 \text{ lb}/\text{in}^2$

Pascal's Law: Pressure applied to a enclosed fluid is transmitted undiminished to every point in the fluid and the container walls




Hydraulics


$$P_{kid} = F/A$$

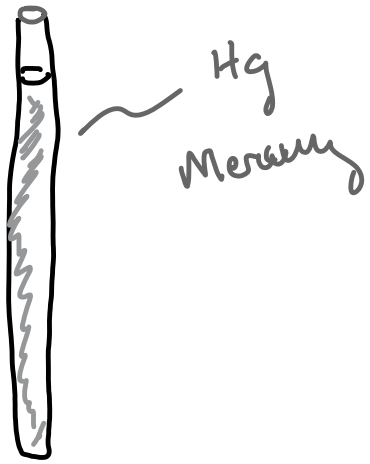
$$= \frac{(25\ kg)(9.8\ m/s^2)}{\pi\,(.05)^2}$$

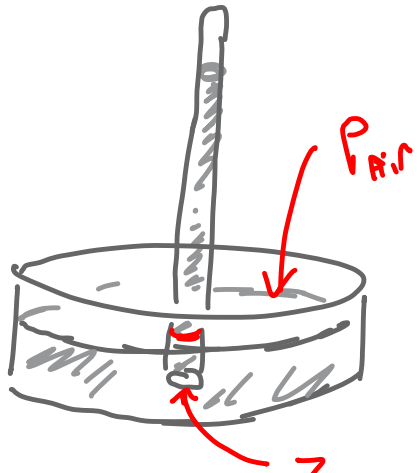
Pascal

$$= \frac{(Mass)(9.8)}{\pi(2)^2}$$

Mass = 40,000 kg

$\sim$ 80,000 lbs




density of Hg

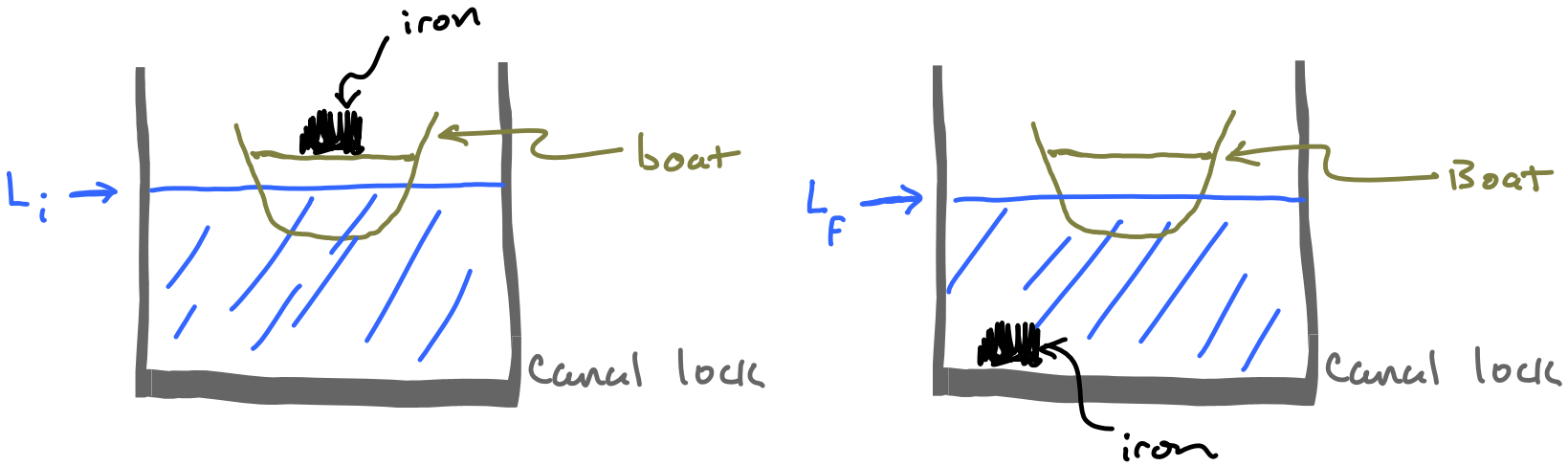
$P = P_0 + \rho g h$

pressure of 1 Torr = 1 mm Hg

1 atm = 760 Torr = 760 mm Hg

## Archimede's Principle

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




(a) Water level unchanged

(b) Water level rises ($L_f > L_i$)

(c) Water level Drops ($L_f < L_i$)