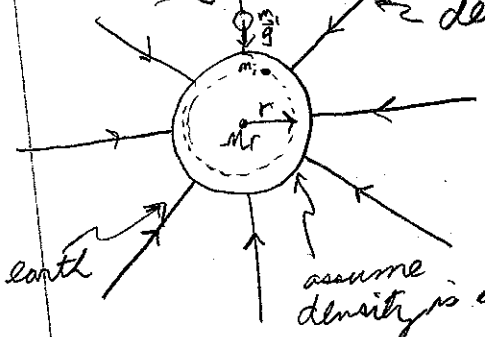
LECTURE 34

(thanks to Brett once more)

- discussed gravitational field concept and basics of fluid physics.

Gravitational Field

← describe the acceleration due to gravity emitted by mass of the earth



$0 < r < R_E$

$$\rho = \frac{\text{mass}}{\text{volume}} = \frac{M_E}{\frac{4}{3}\pi R_E^3} \qquad M_r = \rho \cdot \frac{4}{3}\pi r^3 = \frac{M_E \frac{4}{3}\pi r^3}{\frac{4}{3}\pi R_E^3} = \frac{M_E r^3}{R_E^3}$$

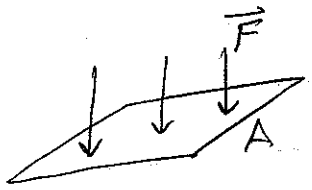
$$g_r = \frac{G M_r}{r^2} \Leftarrow \vec{F}_{grav_1} = m_1 \vec{g}$$

$$= \frac{G M_E r^3}{R_E^3 r^2} = \left(\frac{G M_E}{R_E^2}\right)\frac{r}{R_E} = g\left(\frac{r}{R_E}\right)$$

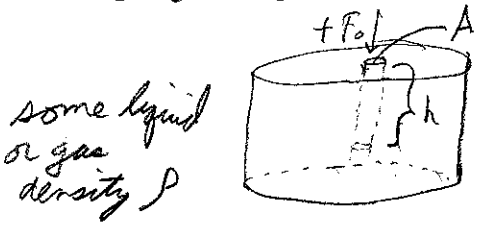
Fluids: Pressure, density, etc...

density: $\rho = \frac{dm}{dV} = \frac{\text{mass}}{\text{volume}}$

Pressure: $P = \frac{\text{force}}{\text{area}} = \frac{dF}{dA}$ (normal force)



Absolute vs. gauge pressure



$$F = mg = \rho A h g$$

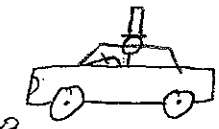
$$P = \frac{F}{A} = \rho g h$$

$$F_{net} = F_0 + \rho A h g$$

$$P_{net} = \frac{F_0}{A} + \rho g h$$

$$P_{net} = P_0 + \rho g h$$

Ex

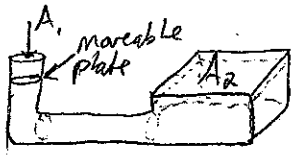


p.s.i. = pounds per sq inch

Concept: Pascal's principle

- pressure is the same at all points in the liquid

Ex



$$P_1 = P_2$$

$$\frac{F_1}{A_1} = \frac{F_2}{A_2} \quad \Rightarrow \quad F_2 = \frac{A_2}{A_1} F_1$$

- We also derived the exponential decay of pressure (and density) as a function of altitude. See Tipler Ex. 13-5 (I would like you to understand that example)