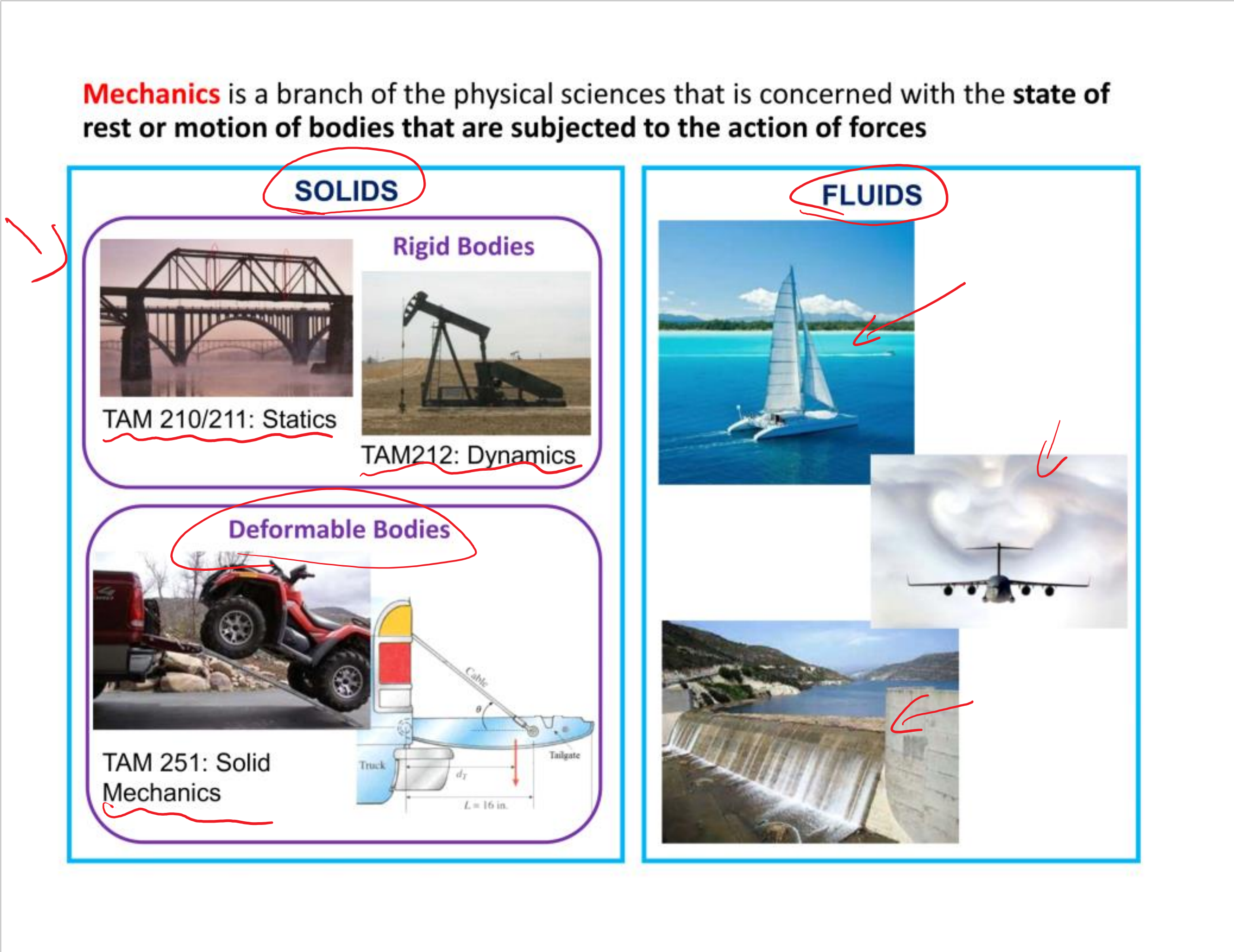
Lec28

Wednesday, November 25, 2020 7:55 AM



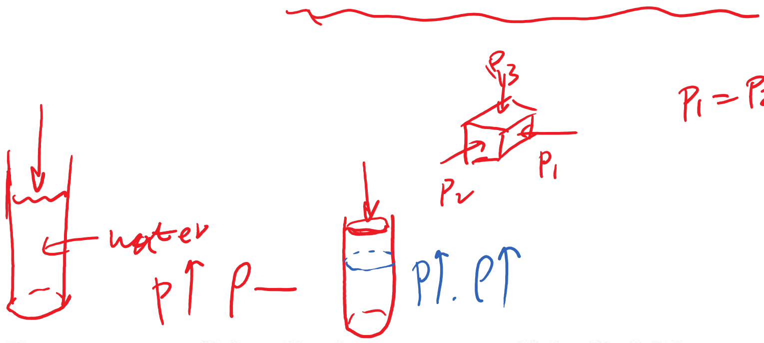
What Makes a Fluid or Solid?

Honey

Rock

Fluids

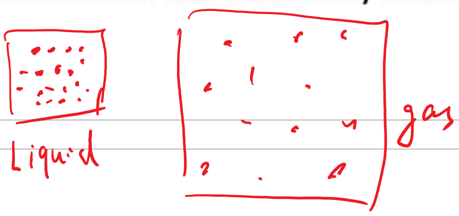
Pascal's law: A fluid at rest creates a pressure p at a point that is the ***same*** in ***all*** directions



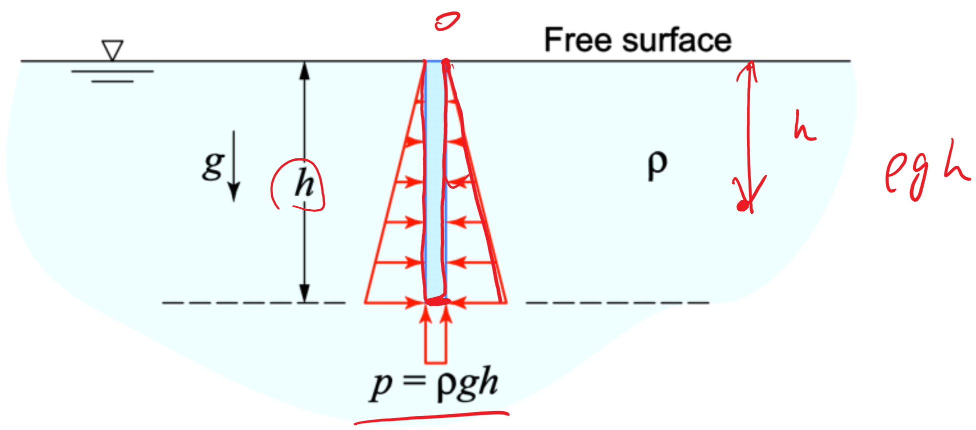
$P_1 = P_2 = P_3$

Incompressible: An incompressible fluid is one for which the mass density is independent of the pressure p. Liquids are generally considered incompressible. Gases are compressible, but may be approximated as incompressible if the pressure variations are relatively small.

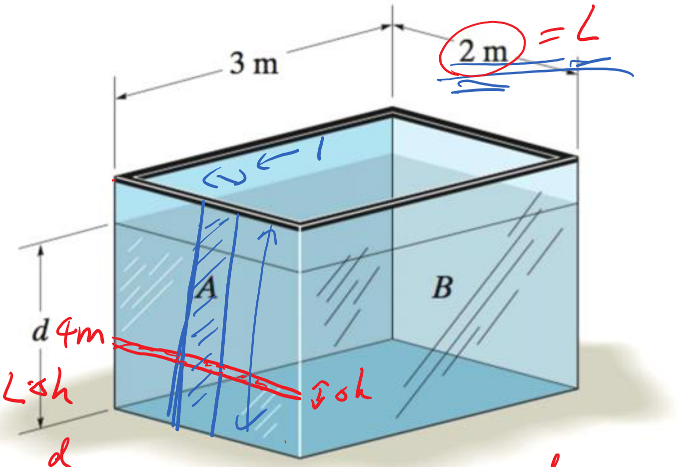
$Ma < 0.3$ $\quad \frac{u}{a}$ $\quad$ 100 $\quad \to \sim 340$



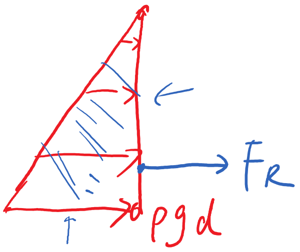
Observe that the pressure varies *linearly* from the free surface, and is *constant* along any horizontal plane (since h is constant):



The tank is filled with water to a depth of d = 4 m. Determine the resultant force the water exerts on side A of the tank. (ρ = 1000 kg/m^3)



$dF = \rho g h \cdot L \cdot dh$

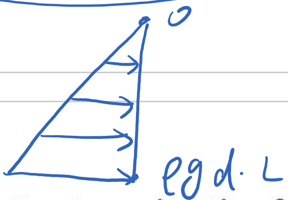


$$F_R = \int_0^d \rho g h \cdot L \cdot dh = \rho g L \cdot \int_0^d h \cdot dh$$

$$= \frac{1}{2} d^2 \cdot \rho g L$$

$\frac{1}{2}\rho g d \, d \cdot L$

$\rho g h \cdot L \rightarrow w$

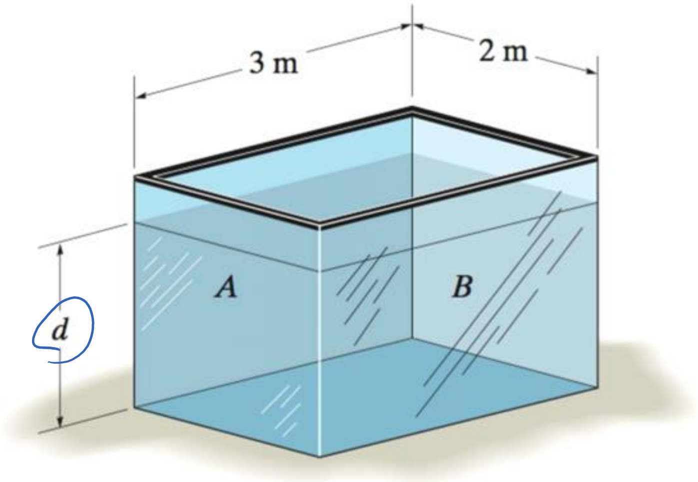


The tank is filled with water to a depth of d = 4 m. Determine the resultant force the water exerts on side B of the tank. (ρ = 1000 kg/m^3)

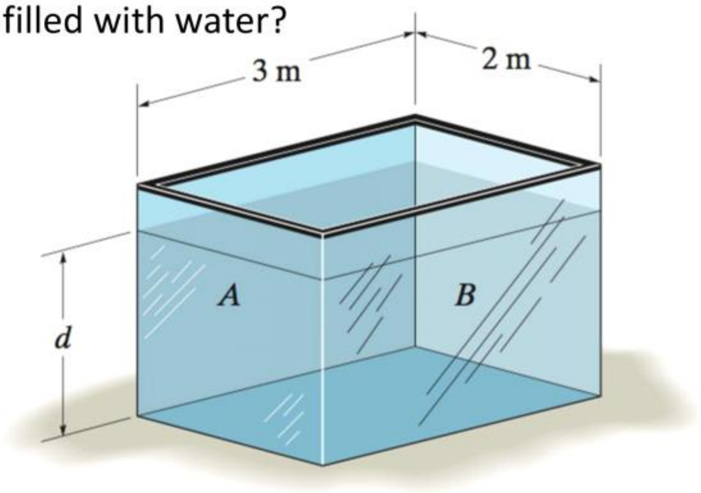
A) $F_A > F_B$

B) $F_A < F_B$

C) $F_A = F_B$



The tank is filled now filled with oil to a depth of d = 4 m. How will the the resultant force the ~~water~~ oil exerts on side *B* of the tank compared to when it was filled with water?

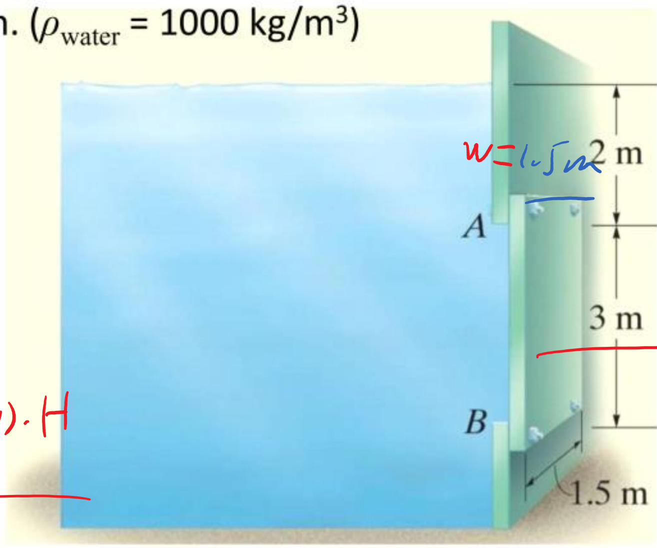


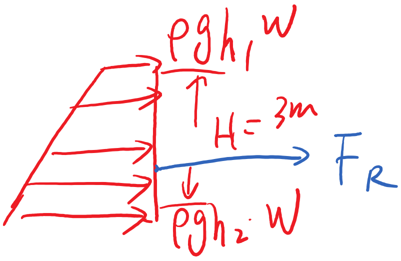
A) $F_{oil} > F_{water}$

B) $F_{oil} < F_{water}$

C) $F_{oil} = F_{water}$

Determine the magnitude and location of the resultant hydrostatic force acting on the submerged rectangular plate *AB*. The plate has width 1.5m. (ρ_{water} = 1000 kg/m^3)





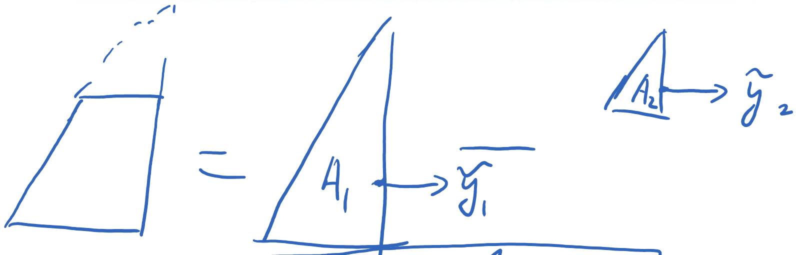
$$F_R = \frac{1}{2}(\rho g h_1 w + \rho g h_2 w)\cdot H$$

$h_1 = 2$ m

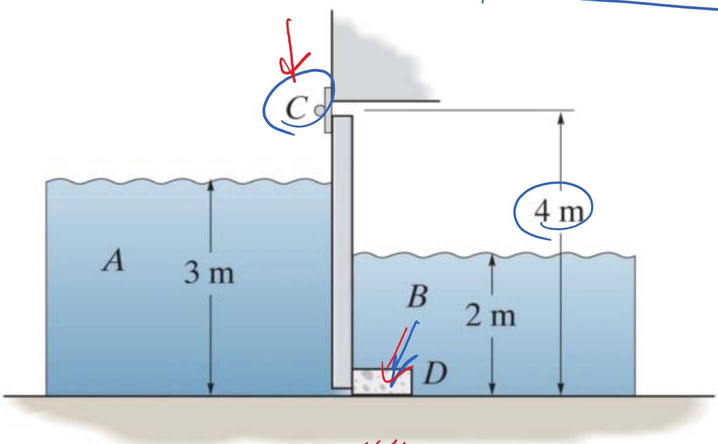
$h_2 = 5$ m

$w = 1.5$ m

$H = 3$ m



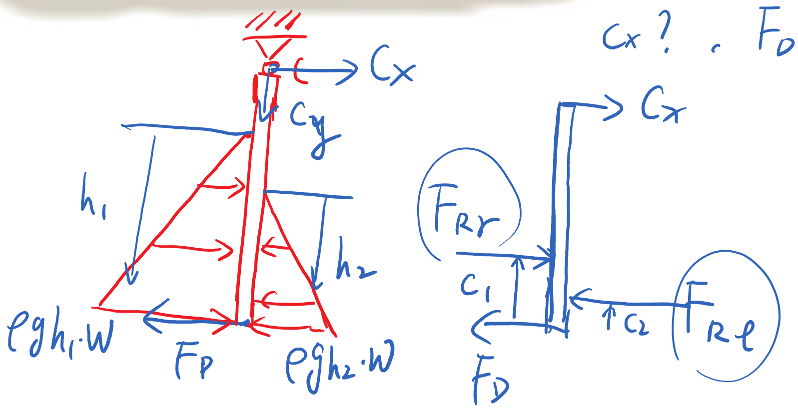
$$\boxed{\bar{y} = \frac{\tilde{y}_1 A_1 + \tilde{y}_2 A_2}{A_1 + A_2}}$$



For the condition of high tide shown, determine the reactions developed at the hinge C and stop block. The length of the gate is 6 m and its height is 4 m. The density of the water is 1000 kg/m^3

$C_y = 0$

C_x ? , F_D ?



$$F_{Rr} = \frac{1}{2}\cdot \rho g h_1 \cdot w \cdot h_1$$

$$F_{Rl} = \frac{1}{2}\rho g h_2 \cdot w \cdot h_2$$

$$c_1 = \frac{1}{3} h_1$$

$$c_2 = \frac{1}{3} h_2$$