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Announcements

- Quiz 5 next week (be sure to register for TAM 211 separately)

- Upcoming deadlines:
- Tuesday (4/9): PL HW12
- Friday (4/12): Written Assignment

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Fluid Pressure

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Mechanics is a branch of the physical sciences that is concerned with the **state of rest or motion of bodies that are subjected to the action of forces**

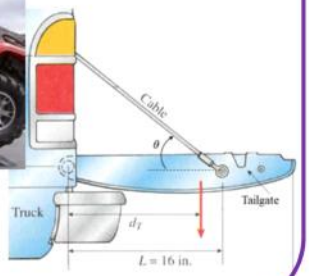
SOLIDS

Rigid Bodies

TAM 210/211: Statics

TAM212: Dynamics

Deformable Bodies



TAM 251: Solid Mechanics

FLUIDS

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What Makes a Fluid or Solid?

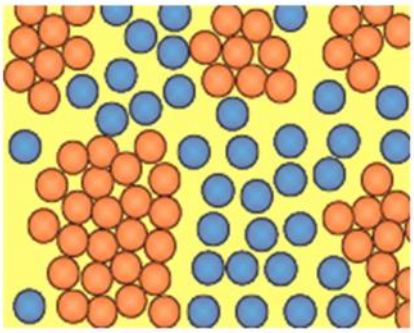
Honey

Rock

They look like a fluid...

Cornstarch + water =

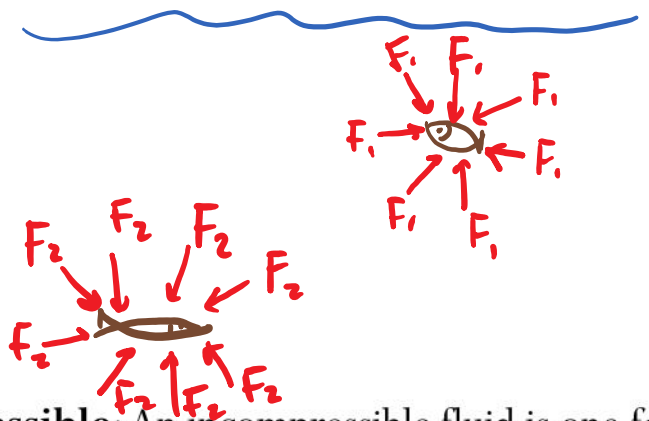
(small, hard particles)



(Mythbusters)

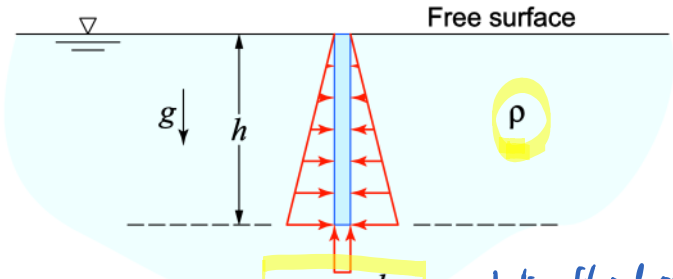
Fluids

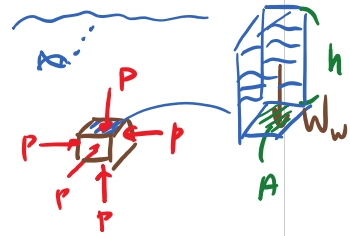
Pascal's law: A fluid at rest creates a pressure p at a point that is the ***same*** in ***all*** directions



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.

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





$W_w = m_w g$

$= \rho V_w g$

$W_w = \rho (Ah) g \rightarrow P = \frac{W_w}{A} = \rho g h$

$p = \rho g h$ - static fluid pressure.

pressure = density • gravitational constant • depth

$[\frac{kg}{m^3}]$ • $[\frac{m}{s^2}]$ • $[m]$ = $[\frac{kg}{s^2 \cdot m}] = [\frac{N}{m^2}]$

$P \neq$ force.

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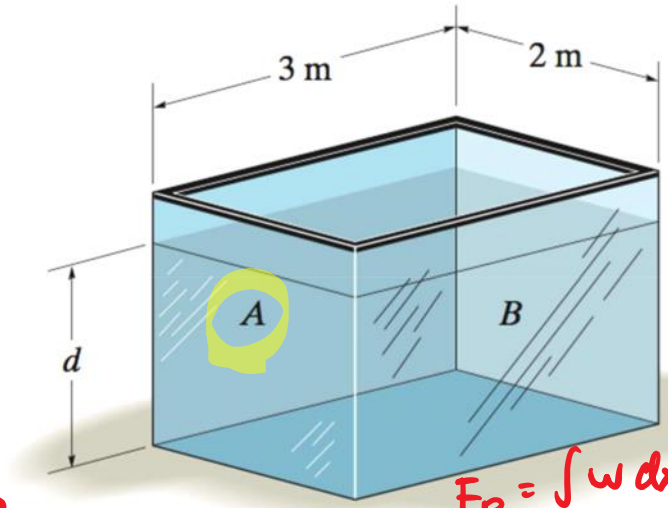
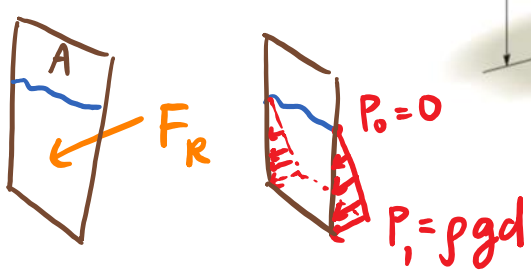
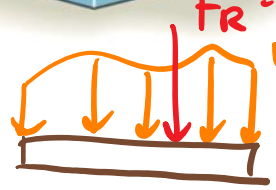
The tank is filled with water to a depth of $d = 4$ m. Determine the resultant force the water exerts on side A of the tank. ($\rho = 1000$ kg/m^3)





$F_R = \int w\,dx$ = Area under the curve.

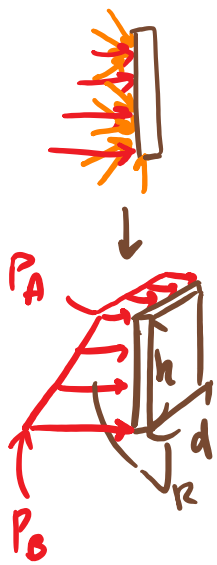


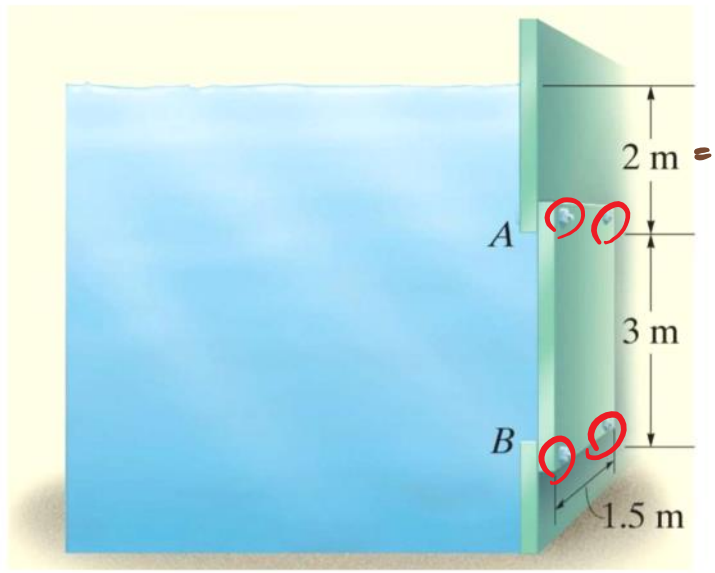
F_R = volume under the curve.

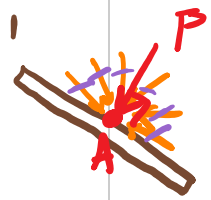
$$F_R = \underbrace{\tfrac{1}{2}P_1 d}\cdot(2m) = \cancel{\tfrac{1}{2}}(\rho g d)(\cancel{2}d)$$

$$\rightarrow F_R = \rho g d^2$$

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







$h = 3m$

$d = 1.5$

$P_A = \rho g l_1 \quad l_1 = 2m.$

$P_B = \rho g l_2 \quad l_2 = (2+3) = 5m$

$F_R = V_R = \frac{1}{2}(P_A + P_B)(h)d$

$= \frac{1}{2}(\rho g)(l_1 + l_2)hd$