

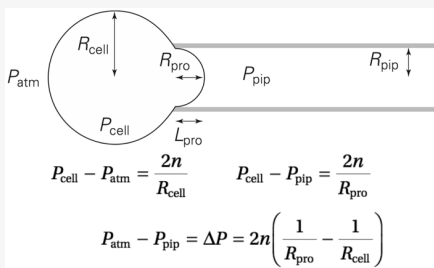
Assumptions

1. The fluid is Newtonian
2. Fluid is isotropic
3. Fluid is incompressible
4. Fluid flow is steady state
5. Fluid flow is laminar
6. Fluid flow is fully developed
7. No slip condition

Units and Conversions

Pressure 1 Pa = 1 N/m² = 1 kg/(m·s²)
 1 atm = 101325 Pa = 2116.22 lbf/ft²

Micropipette Aspiration



where n is the surface tension of the cell [N/m]
 if given thickness then $n = \sigma t$

Buoyancy

Equal volumes feel equal buoyant forces.
 Why? Identical pressure environments and equal water displacement.
 Submerged Object: Archimedes' Principle
 Mass of Object - Submerged Mass =
 Density of Fluid x Volume of Object
 Submerge object → water level increases
 Remove object from boat → water level decreases

Terms and Facts

Viscosity A material property, gives proportionality of shear stress and shear rate [g/cm·s]

Terms and Facts (cont)

Absolute/- μ
 Dynamic
 Viscosity

Kinematic $\nu = \mu/\rho$
 Viscosity

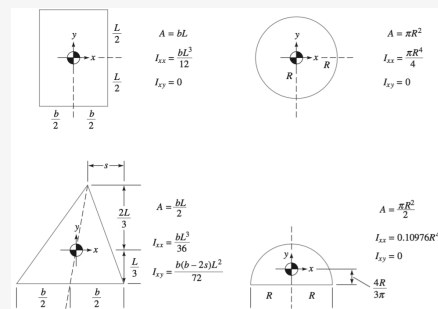
Non-Newton Fluids: $\tau = \mu \dot{\gamma}^n$

Shear Faster you shear it, thinner it becomes; resistance decreases, becomes more uniform.
 Thinning ($n < 1$)

Shear Faster you shear it, thicker it becomes; resistance increases.
 Thickening ($n > 1$)

Bingham Acts like a solid until the shear stress reaches a critical value
 Plastic ($\tau = \mu \dot{\gamma} + \tau_y$)

Centroidal Moments of Inertia



$$x_{cp} = -\gamma \cdot l_{xy} \cdot \sin \theta / P_{cg} \cdot A = -l_{xy} \cdot \sin \theta / h_{cg} \cdot A$$

$$y_{cp} = -\gamma \cdot l_{xx} \cdot \sin \theta / P_{cg} \cdot A = -l_{xx} \cdot \sin \theta / h_{cg} \cdot A$$

$$F = \gamma \cdot h_{cg} \cdot A = P \cdot A$$

The center of gravity and center of pressure are different locations.

The force on the object occurs at the center of gravity.

The pressure on the object occurs at the center of pressure (use l_{xx} , and l_{xy})

When calculating the moment: remember the reaction forces

Manometer

Pressure = density × gravity × height = ρgh

If given N/m³ or lbf/ft³ then do **not** add gravity

Change in elevation → change in pressure

Within a single fluid, pressure is constant along a height

Specific Gravy = [density of X] / [density of water]

move down > (+), move up > (-)