BME Cheat Sheet Cheat Sheet

by [deleted] via cheatography.com/27799/cs/8137/

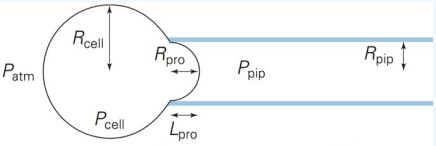
Assumptions

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/m^2 = 1 $^{kg}/(m \cdot s^2)$
	1 atm = 101325 Pa = 2116.22 lbf/ft^2

Micropipette Aspiration



$$P_{cell} - P_{atm} = \frac{2n}{R_{cell}} \qquad P_{cell} - P_{pip} = \frac{2n}{R_{pro}}$$

$$P_{atm} - P_{pip} = \Delta P = 2n\left(\frac{1}{R_{pro}} - \frac{1}{R_{cell}}\right)$$

where ***n*** is the surface tension of the cell [N/m]

if given thickness then n = σt

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]

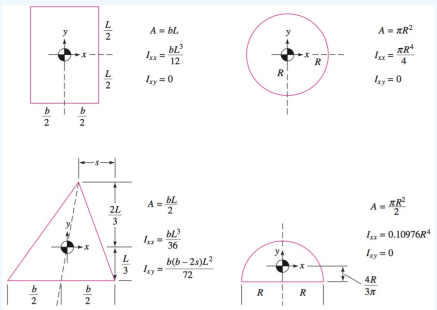
Terms and Facts (cont)

Absolute/-Dynamic Viscosity	μ
Kinematic Viscosity	ν=μ/ρ

Non-Newtown Fluids: $\tau = \mu\dot{\gamma}^{\eta}$

Shear Thinning (η < 1)	Faster you shear it, thinner it becomes; resistance decreases, becomes more uniform.
Shear Thickening (η > 1)	Faster you shear it, thicker it becomes; resistance increases.
Bingham Plastic (τ=μγ+τ_y)	Acts like a solid until the sheet stress reaches a critical value

Centrioidal Moments of Inertia



xcp = $-\gamma \cdot Ixy \cdot \sin\theta \cdot Ixy / Pcg \cdot A = -Ixy \cdot \sin\theta / hcg \cdot A$

ycp = $-\gamma \cdot Ixx \cdot \sin\theta \cdot Ixy / Pcg \cdot A = -Ixx \cdot \sin\theta / hcg \cdot A$

$F = \gamma \cdot hcg \cdot A = P \cdot A$

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 Ixx, and Ixy)

When calculating the moment: remember the reaction forces

Manometer

Pressure = density ✖ gravity ✖ height = ρgh

If given N/m^3 or lbf/ft^3 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 > (-)