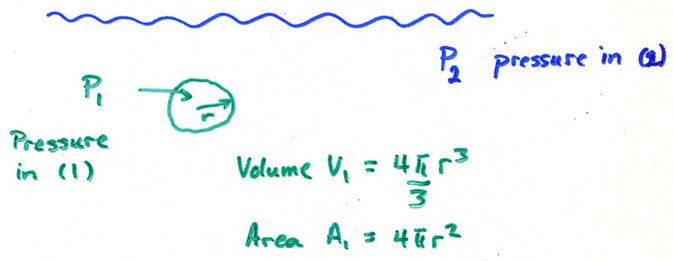
Curved Surfaces

A small sphere of fluid (1) immersed in another fluid (2)



Mechanical Equibilibrium

work done by changing r should be zero

$$-P_1 dV_1 - P_2 dV_2 + \gamma dA = 0 \quad \text{(for equilibrium)}$$

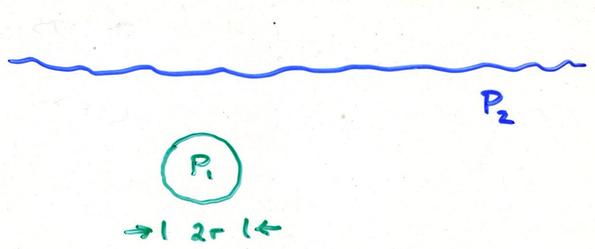
where

$$dV_1 = 4\pi r^2 dr$$

$$dV_2 = -4\pi r^2 dr$$

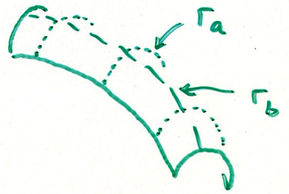
$$dA = 8\pi r dr$$

Laplace's Equation (Mechanical Equilibrium)



$$P_1 - P_2 = \frac{2\gamma}{r}$$

What if the surface isn't a sphere?



Mean radius r_m

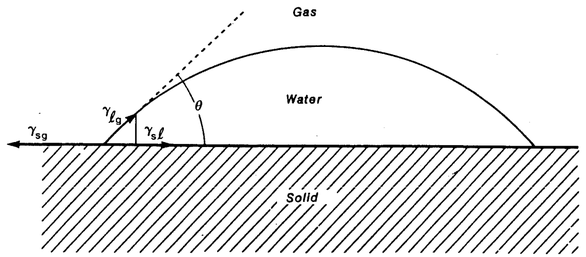
$$\frac{1}{r_m} = \left(\frac{1}{r_a} + \frac{1}{r_b}\right)$$

More General Equation

$$P_1 - P_2 = \frac{2\gamma}{r_m}$$

Solid Surfaces

What happens when we add a solid surface?



There are 3 interfaces

1. γ_{sl} solid - liquid
2. γ_{sg} solid - gas
3. γ_{lg} liquid - gas

each interface behaves like an elastic membrane

Horizontal Force Balance (Young's Equation)

$$\gamma_{sl} + \gamma_{lg} \cos\theta = \gamma_{sg}$$

Wettability

The behaviour of the liquid on the solid depends on the wetting angle θ

Wetting Fluid: $\theta < 90°$

Nowetting Fluid: $\theta > 90°$