Physics 113 - November 27, 2012

- Exam 3 cometh
  - Both sides 8.5x11 inch sheet okay
  - Hubbell @ 8 am Next Tuesday (Dec. 4)
  - I sent email out with what is covered

Will try to set up Q+A session

Lectures: Page 6 of 10/16/2012 lecture through page 7 of 11/20/2012 lecture

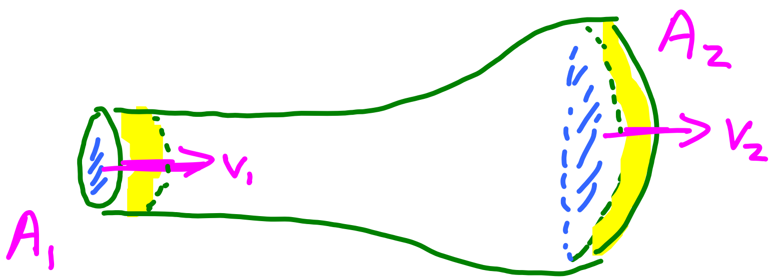
Topics: momentum conservation through static fluids

Text: Chapters 9 through 13 with the exceptions of sections 11-8, 11-9, 12-4 through 12-7 , 13-8 through 13-14, In section 11-2, we are covering the cross product, but I am not having you learn how to calculate the cross product using the techniques in section 11-2 (no determinants)

Workshops 6-11

Last Time

Fluid dynamics



Fluid is:

- incompressible
- nonviscous

Equation of continuity

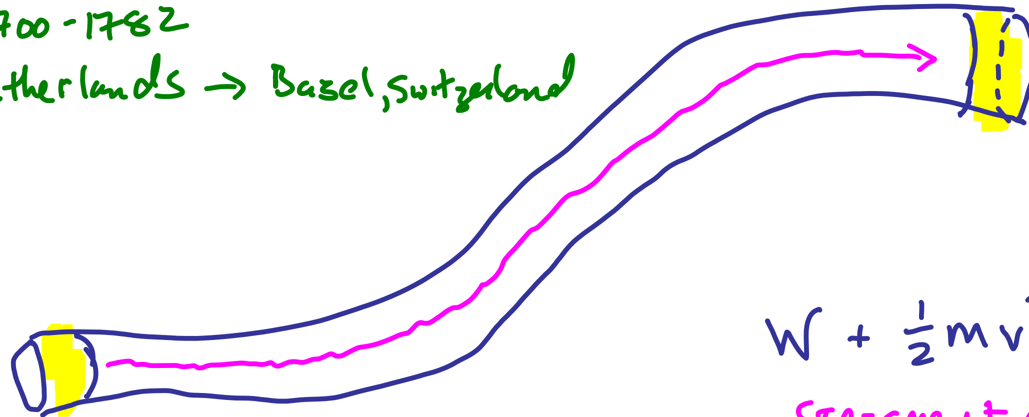
what comes in one end goes out the other end

$$A_1 V_1 = A_2 V_2$$

Daniel Bernoulli
1700 - 1782
Netherlands → Basel, Switzerland

Move fluid element

How much work done?



$W + \frac{1}{2}mv^2 + mgh \sim \text{CONSTANT}$

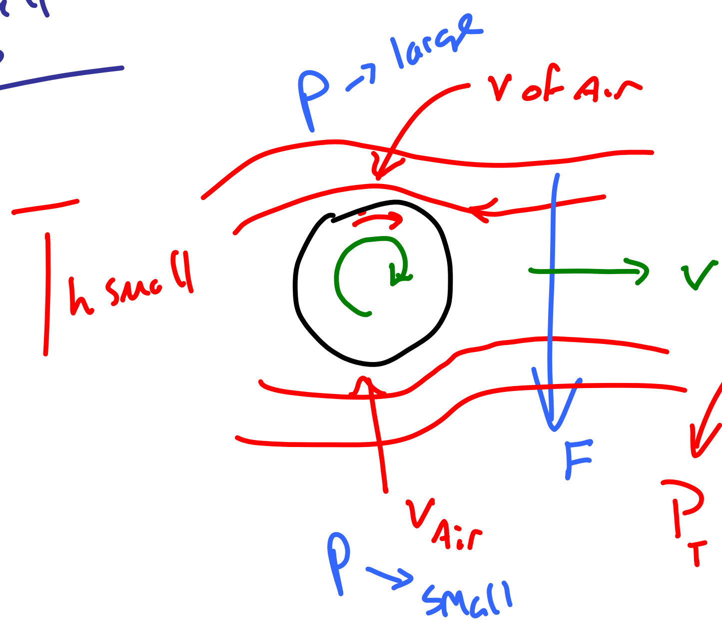
STATEMENT of energy conservation

÷ by volume of fluid element

Bernoulli's Equation

$$P + \frac{1}{2}\rho v^2 + \rho g h \sim \text{CONSTANT}$$

Curve Ball

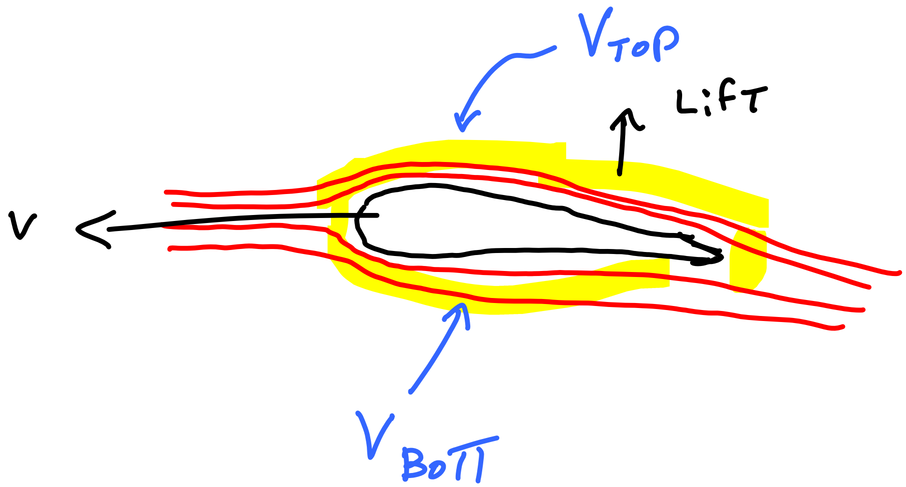


bigger smaller

$$P_T + \frac{1}{2}\rho v_T^2 = P_B + \frac{1}{2}\rho v_b^2$$

$$h_T = h_b$$

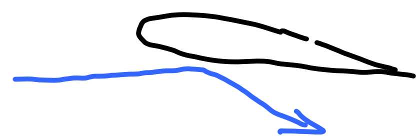
Airfoil

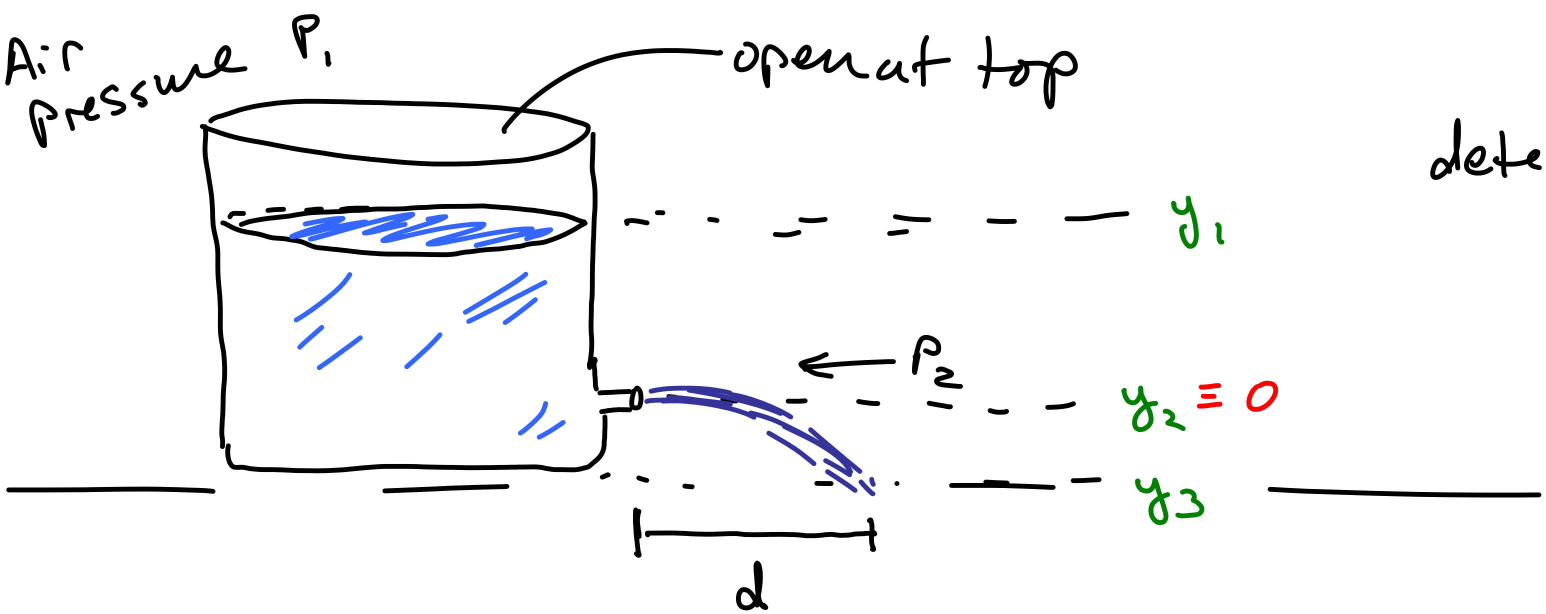


$V_{TOP} > V_{BOTT}$

$P_{TOP} < P_{BOTT}$

Also





determine d

$$\cancel{P_1} + \frac{1}{2}\rho \cancel{v_1^2} + \rho g h_1 = \cancel{P_2} + \frac{1}{2}\rho v_2^2 + \rho g h_2$$

h_1: y_1

h_2: $y_2 \equiv 0$

$v_1 \approx 0$ "Big vat"

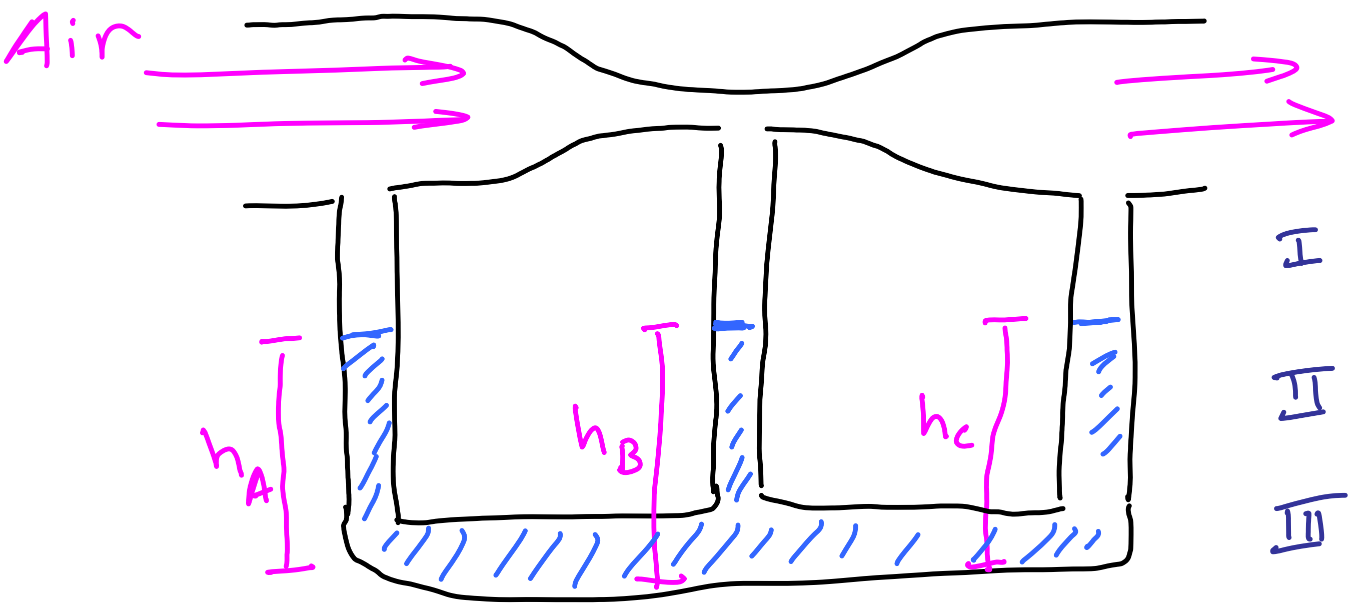
$P_1 \sim P_2 \sim P_{ATM}$

$$\frac{1}{2}\rho v_2^2 = \rho g(y_1 - y_2) = \rho g y_1$$

($y_2 = 0$)

$$v_2 = \sqrt{2gh}$$

projectile problem



No air flowing in pipe

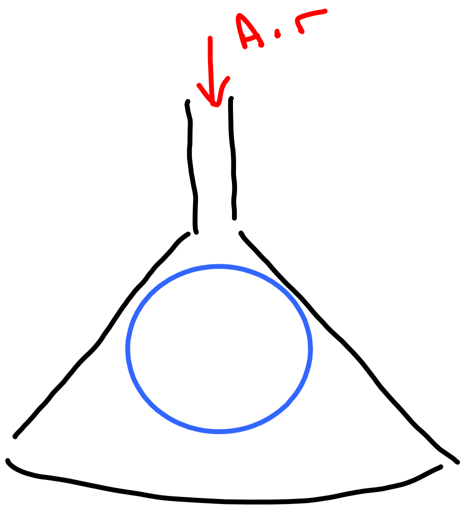
$h_A = h_B = h_C$

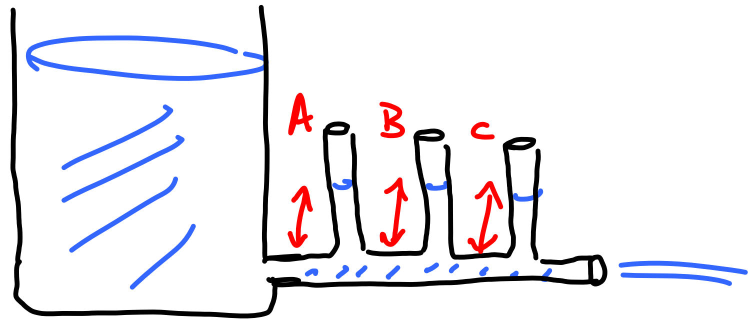
I $h_A > h_B > h_C$

II $h_A < h_B < h_C$

III $h_A < h_B > h_C$, $h_A = h_C$

IV $h_A > h_B < h_C$, $h_A = h_C$





?

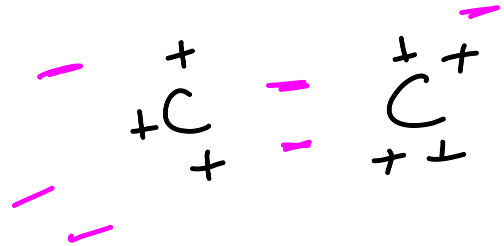
I $h_A = h_B = h_C$

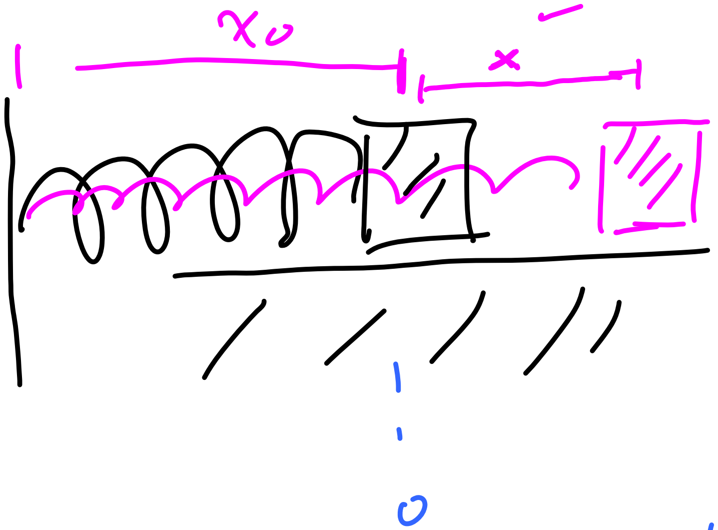
II $h_A > h_B > h_C$

III $h_A < h_B < h_C$

Simple Harmonic Motion SHM

$$F = -\frac{dU}{dx}$$





$x \rightarrow +$

frictionless surface

$$\vec{F} = -k(\vec{x} - x_0)$$

$$|\vec{F}| = kx \qquad x_0 = 0$$

$$F = -kx$$

$$ma = -kx$$

$$m\frac{d^2x}{dt^2} = -kx$$

$$\boxed{\frac{d^2x}{dt^2} + \frac{k}{m}x = 0}$$

2ND order ordinary differential equation

→ equation of Motion for Simple Harmonic Motion