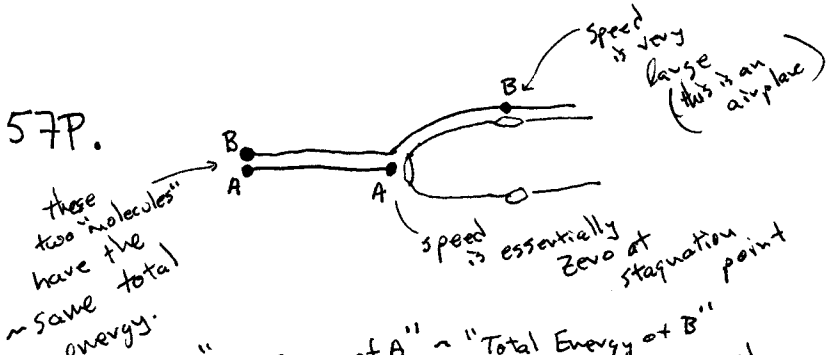
57P.




"Total Energy of A" ≃ "Total Energy of B" at any point along their path

$$P_A + \frac{1}{2}\rho \cancel{v_A^2} + \rho g \cancel{y_A} = P_B + \frac{1}{2}\rho v_B^2 + \rho g \cancel{y_B}$$

0 — very large

the difference between these two terms is very small compared to what happens when we square $v_B$

$$P_A = P_B + \frac{1}{2}\rho v_B^2$$

$$P_A - P_B = \frac{1}{2}\rho v_B^2$$

$$\Delta P = \frac{1}{2}\rho_{air} v_B^2$$

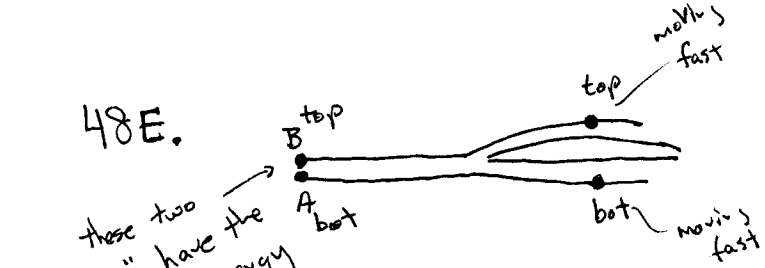
A manometer is used to measure this pressure difference

$\Delta P = \rho_{fluid} g h$

$$\rho_{fluid}\, g h = \frac{1}{2}\rho_{air} v_B^2$$

$$v_B^2 = \frac{2\rho_{fluid}\, g h}{\rho_{air}}$$

48E.




"Total Energy of A" = "Tot Energy of B" at any point along their path

$$P_{bot} + \frac{1}{2}\rho v_{bot}^2 + \rho g \cancel{y_{bot}} = P_{top} + \frac{1}{2}\rho v_{top}^2 + \rho g \cancel{y_{top}}$$

the differences btw these will be small compared to the differences btw the kinetic terms

$$P_{bot} + \frac{1}{2}\rho v_{bot}^2 = P_{top} + \frac{1}{2}\rho v_{top}^2$$

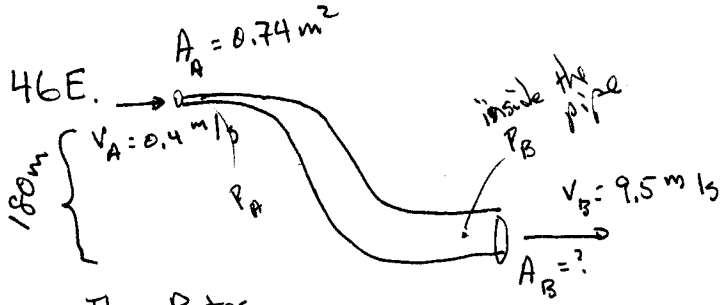
$$P_{bot} - P_{top} = \frac{1}{2}\rho\left(v_{top}^2 - v_{bot}^2\right)$$

$$\Delta P =$$

since pressure = force/area

$$\text{Lift force} = \Delta P \cdot A = \frac{1}{2}\rho A\left(v_{top}^2 - v_{bot}^2\right)$$

46E.




Flow Rates

$$A_A V_A = A_B V_B$$

$$(0.74)(0.4) = A_B (9.5)$$

$$A_B = 0.031\ m^2$$

Bernoulli:

inside the pipe at B

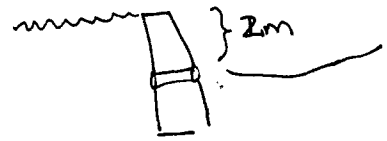
$$P_A + \tfrac{1}{2}\rho v_A^2 + \rho g y_A = P_B + \tfrac{1}{2}\rho v_B^2 + \rho g \cancel{y_B}^{\,0}$$

$$\tfrac{1}{2}\rho(v_A^2 - v_B^2) + \rho g h_A = P_B - P_A$$

$$\tfrac{1}{2}\left[10^3 \tfrac{kg}{m^3}\right]\left[0.4^2 - 9.5^2\right] + 10^3(9.8)(180) = \Delta P$$

$$\Delta P = 1.72 \times 10^6 \text{ Pascal}$$

22.




dia = 1.20 cm  radius = 0.60 cm

$$A = \pi r^2 = 1.13 \times 10^{-4}\ m^2$$

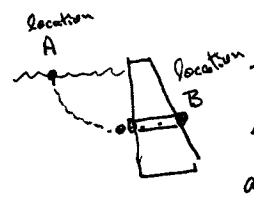
a) $\Delta P = \rho g \Delta h = (1030 \tfrac{kg}{m^3})\ 9.8\ (2)$

$= 2.019 \times 10^4$ Pa

Force $= \Delta P \cdot A = (2.019 \times 10^4)(1.13 \times 10^{-4})$

$= 2.28$ Newtons $\sim \tfrac{1}{2}$ lb.

b)




$$P_A + \tfrac{1}{2}\rho v_A^2 + \rho g \overset{2m}{y_A} = P_B + \tfrac{1}{2}\rho v_B^2 + \rho g \overset{0}{y_B}$$

atm  the water level drops very slowly so $v_A \sim 0$  atm

$$\cancel{\rho} g y_A = \tfrac{1}{2}\cancel{\rho} v_B^2$$

$$9.8(2) = \tfrac{1}{2} v_B^2$$

$$v_B = 6.26\ m/s$$

c) Flow Rate

$$Av = (1.13 \times 10^{-4}\ m^2)(6.26) = 7.07 \times 10^{-4}\ m^3/s$$

1 acre = 4047 $m^2$

$$\text{time} \sim \frac{\text{volume}}{\text{flowrate}} = \frac{(4047)(0.30)}{7.07 \times 10^{-4}}$$

$$= 1.72 \times 10^6 \text{ sec}$$

$\sim$ 20 days.