PHY 221 ch 11 Sharma

(48) → (78)

Bernoulli's Eqn : $P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + gh$

Here $h_1 = h_2$, hence

$$P_1 - P_2 = \frac{1}{2}\rho(v_2^2 - v_1^2) = \frac{1}{2}(1.29\ kg/m^3)[(8.5)^2 - (11)^2]$$

$$= 45.82 \simeq 46\ Pa.$$

x ~~~~~~~~ x ~~~~~~~~ x

(52) Here $P_1 = P_2$, $h_1 = 0$, $h_2 = 5\ m$

$v_1 = ?$ $v_2 = 0$

$$\frac{1}{2}\rho v_1^2 = \rho g h_2 \Rightarrow v_1 = \sqrt{2gh_2} = \sqrt{2 \times 5 \times 9.8} = 9.90$$

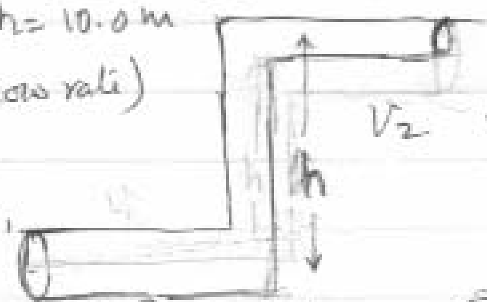
x ~~~~~~~~ x ~~~~~~~~

(58) → (66)

$r_1 = 0.0200$, $r_2 = .0400m$, $h = 10.0m$

$A_1 v_1 = A_2 v_2$ (Same Flow rate)

$$v_1 = \frac{A_2}{A_1} v_2 \quad (1)$$



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

Here $P_1 = P_2$, $h_1 = 0$, $h_2 = h$, and $v_1 = \frac{A_2}{A_1} v_2$

Hence (2) $\Rightarrow$ $\frac{1}{2}\rho\left(\frac{A_2}{A_1}\right)^2 v_2^2 = \frac{1}{2}\rho v_2^2 + \rho g h$

$$\frac{1}{2}\rho\left[\left(\frac{A_2}{A_1}\right)^2 - 1\right]v_2^2 = \rho g h$$

$$v_2 = \sqrt{\frac{2gh}{(A_2/A_1)^2 - 1}} = \sqrt{\frac{2 \times 9.8 \times 10}{\left(\frac{.04}{.02}\right)^4 - 1}} = 3.$$

Hence flow rate for keeping $P_2 = P_1$ → $Q = A_2 v_2 = A_1 v_1$

$$= \pi r_2^2 v_2$$

$$= \pi (.04m)^2 \times (3.61\ m/s)$$

$$= 1.8 \times 10^{-2}\ m^3/s$$