

LABEN VICTOR  
161ENG061029 (C.O)

FLUID MECHANICS  
ENG 214

1  $L = 2.0 \text{ m}$   $g = 9.81$

$V_1$  (smaller end) =  $5 \text{ m/s}$

$V_2$  (lower end) =  $2 \text{ m/s}$

$h = \frac{0.35(V_1 - V_2)^2}{2g}$

$P_1$  (smaller head) =  $2.5 \text{ m}$

$\frac{P_2}{\rho} = \frac{P_1}{\rho} + \frac{(V_1^2 + V_2^2)}{2g} + (z_1 - z_2)$

$= \frac{2.5}{1} + \frac{5^2 + 2^2}{2 \times 9.81} + 2 - \frac{(0.35(5-2)^2)}{2 \times 9.81}$

$= \frac{2.5}{1} + \frac{25 + 4}{19.62} + 2 - \frac{3.15}{19.62}$

$= 2.5 + 1.07 + 2 - 0.161$

$= 5.409$

$\approx 5.41$

Pressure at lower bar =  $5.41 \text{ bar}$

2 Inlet diameter =  $0.2 \text{ m}$

throat diameter =  $0.1 \text{ m}$

$C_d = 0.98$

$A_1 = \frac{\pi d^2}{4} = \frac{\pi \times 0.2^2}{4} = 0.0314 \text{ m}^2$

$A_2 = \frac{\pi d^2}{4} = \frac{\pi \times 0.1^2}{4} = 0.00785 \text{ m}^2$

$h = \frac{P_1}{\rho} - \frac{P_2}{\rho}$

$\frac{P_1}{\rho} = \frac{1.765 \times 10^{-2} \text{ N/m}}{9.81}$

$= 1.799 \times 10^{-3}$

$\frac{P_2}{\rho} = 0.5 \times 18.6 = -4.08$

$h = 1.799 \times 10^{-3} - (-4.08)$

$= 4.09 \text{ m}$

$Q = \frac{C_d \times A_1 \times A_2 \times \sqrt{2g \times h}}{\sqrt{A_1^2 - A_2^2}}$

$= \frac{0.98 \times 0.0314 \times 0.00785 \times \sqrt{2 \times 9.81 \times 4.09}}{\sqrt{0.0314^2 - 0.00785^2}}$

$= \frac{0.000242 \times 18.1}{\sqrt{0.00099 - 0.000062}}$

$= \frac{0.000242 \times 18.1}{\sqrt{0.00099 - 0.000062}}$

$= 0.14 \text{ m}^3/\text{s}$

$$3 \quad D_1 = 0.15 \text{ m}, \quad D_2 = 0.3 \text{ m}$$

$$S.G. = 0.9, \quad C_d = 0.64$$

$$A_1 = \frac{\pi d^2}{4} = \frac{\pi \times 0.15^2}{4} = 0.0176 \text{ m}^2$$

$$A_2 = \frac{\pi d^2}{4} = \frac{\pi \times 0.3^2}{4} = 0.07067 \text{ m}^2$$

$$h = 0.15 \left[ \frac{19.6}{0.9} - 1 \right] = 7.05 \text{ m}$$

$$Q = \frac{C_d A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \times \sqrt{2gh}$$

$$= \frac{0.64 \times 0.0176 \times 0.07067}{\sqrt{(0.0176)^2 - (0.07067)^2}} \times \sqrt{2 \times 9.81 \times 7.05}$$

$$= \frac{0.000796 \times 11.7607}{\sqrt{0.000301 - 0.00499}}$$

$$4 \quad A_{\text{tube}} = 15 \text{ m}$$

170 mm of mercury (0.17 m)

Sp of mercury 13.6

Sp of sea water 1.026

$$h = 0.19 \left[ \frac{13.6}{1.026} - 1 \right]$$

$$h = 2.043 \text{ m}$$

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

$$= \sqrt{2 \times 9.81 \times 2.043}$$

$$= 6.39 \text{ m/s}$$