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COURSE : FLUID MECHANICS

(1) $V_1 = 5ms^{-1}$ $V_2 = 2ms^{-1}$

Pt at Smaller end = 2.5m

$h_f = \frac{(0.35(V_1 - V_2)^2}{2g}$ $L = 20m$

P_H at lower end =

$L = t_1 - t_2 = Z_L$

$\frac{P_1}{w} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{w} + \frac{V_2^2}{2g} + Z_2 + h_f$

$\frac{P_2}{w} = \frac{P_1}{w} + \frac{1}{2g}(V_1^2 + V_2^2) + (Z_1 - Z_2) h_f$

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

$= 25 + 1.07 + 2 - 0.16055$

$P_2 = 5.409$ bar

(2) inlet diameter = 20cm

outlet diameter = 10cm

$P_1 = 17.658$ bar

$y = 30cm$ of mercury

$Cd = 0.98$

$A_1 = \frac{\pi d^2}{4} = \frac{\left(\frac{20}{100}\right)^2 \times 3.14}{4}$

$= 0.031 m$

$A_2 = \frac{\pi d^2}{4} = \frac{\left(\frac{10}{100}\right)^2 \times 3.14}{4} = 7.855 \times 10^{-3}$

$y = 30cm$ (0.3m of mercury)

$P_1 = 17.658$

$= \frac{17.658}{1000} = 1.7658 \times 10^{-3} N/m$

$$\frac{P_1}{w} = \frac{1.7658 \times 10^{-3}}{9.81} = 1.8 \times 10^{-4} m$$

$$\frac{P_2}{w} = 0.3 \times 13.6 = -4.08 \text{ of } H_2O$$

$$h = \frac{P_1}{w} - \frac{P_2}{w} = 1.8 \times 10^{-4} - (-4.08)$$

$$h = 4.08018 m/m$$

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

$$Q = 0.98 \times \frac{0.0314 \times 7.853 \times 10^{-5}}{\sqrt{(0.0314)^2 - (7.853 \times 10^{-5})^2}} \times \sqrt{2 \times 9.81 \times -1.08018}$$

$$Q = \frac{0.000241}{0.0307} \times 8.947$$

$$Q = 0.0709 m^3/s$$

③ $D_1 = 15cm$ $D_2 = 30cm$

500mm of mercury $= 0.5m$ $h = ?$

S.G $= 0.9$ $C_v = 0.64$

$$A_1 = \frac{\pi d^2}{4} = \frac{(15/100)^2 \times 3.14}{4} = 0.0176 m^2$$

$$A_2 = \frac{\pi d^2}{4} = \frac{(30/100)^2 \times 3.14}{4} = 0.0706 m^2$$

$$h = y\left[\frac{13.6}{0.9} - 1\right]$$

$$h = 0.5\left[\frac{13.6}{0.9} - 1\right]$$

$$= 7.05m \text{ of } 0.1$$

$$Q = \frac{Cd \cdot A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \times \sqrt{2gL}$$

$$Q = \frac{0.64 \times 0.0176 \times 0.0706 \times \sqrt{2 \times 9.81 \times 7.05}}{\sqrt{(0.0706)^2 - (0.0170)^2}}$$

$$Q = \frac{9.35 \times 10^{-3}}{40.12}$$

$$Q = 2.33 \times 10^{-3} \ m^3/s$$

(4)

Axis = 15m
170mm of mercury (0.17m)
S.G of mercury (13.6)
S.G of Sea water = 1.026 V = ?

$$h = y\left[\frac{S_1}{S_2} - 1\right]$$

$$h = 0.17\left[\frac{13.6}{1.026} - 1\right]$$

$$h = 2.083 \ m$$

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

$$V = \sqrt{2 \times 9.81 \times 2.083}$$

$$V = 6.39 \ ms^{-1}$$

(5)

$0.05 m^3/min$
15 bar
1700 vpm
$10 cm^3$ · PxV
15 NM2