fluid mechanics

① $V_1 = 5 ms^{-1}$ $V_2 = 2 ms^{-1}$

PH at smaller end = 2.5m

$h_f = \frac{(0.35 (v^1 - v^2)^2}{2g}$ $L = 2.0m$

P at lower end =

$l = z_1 - z_2 = 2m$

$\frac{P_1}{w} + \frac{v_1^3}{2g} + z_1 = \frac{P_2}{w} + \frac{v_2^2}{2g} + z_2 + h_f$

$\frac{P_2}{w} = \frac{P_1}{w} + \frac{1}{2g}(v_1^2 + v_2^2) + (z_1 - z_2) + h_f$

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

$= 2.5 + 1.07 + 2 - 0.16055$

$P_2 = 5.409 bar$

Pressure at lower end = 5.409 bar

② inlet diameter = 200m

Inlet diameter = 100m

Pressure at inlet =

$P_1 = 12.658M$

$g = 300 mm of mercury$

$C_d = 0.98$

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

$= 0.0314 m^2$

$A_2 = \frac{\pi d^2}{4} = \frac{(\frac{10}{100})^2 \times 3.14}{4} = 7.853 \times 10^{-3} m^2$

$g = 30cm (0.3m of mercury)$.

$P_1 = 12.658$

$= \frac{12.058}{100} = 1.7658 \times 10^{-3} MM$

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

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

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

$h = 4.08018 M/s$

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

$Q = 0.98 \times \frac{0.0314 \times 7.853 \times 10^{-3}}{\sqrt{(0.0314)^2 - (7.853 \times 10^{-3})^2}}$

$\times \sqrt{2 \times 9.81 \times 4.08018}$

$Q = \frac{0.000241}{0.0304} \times 8.947$

$Q = 0.0709 m^3/s$

③ $D_1 = 15cm$ $D_2 = 30cm$

$300 mm of mercury = 0.3M$ $Q = ?$

$S.G = 0.9$ $C_d = 0.64$

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

$0.0176 m^2$

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

$0.0706 m^2$

$h = 3[\frac{13.6}{0.9} - 1]$

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

$= 7.05 Mof 0.1$

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

$$Q = \frac{0.64 \times 0.01764 \times 0.0706 \sqrt{2 \times 9.81 \times 7.05}}{\sqrt{(0.0720)^2 - (0.0470)^2}}$$

$$Q = \frac{4.35 \times 10^{-3}}{4041.2}$$

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

(4) Axis = 15m

170mm of Mercury (0.17m)

SG of Mercury (13.6)

SG of sea water = 1.026 $\nu = 1$

$$h = \gamma \left(\frac{SG}{S} - 1 \right)$$

$$h = 0.17 \left(\frac{13.6}{1.026} - 1 \right)$$

$$h = 2.085m$$

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

$$v = \sqrt{2 \times 9.81 \times 2.085}$$

$$v = 6.39 ms^{-1}$$

(5) $0.05 m^3/min$

15 bar

1700 RPM

$10 Bm^2$ PRV

15 NMA