2) Inlet diameter = 200m

Throat Diameter = 100m

$P_1 = 17.658 H$

$Cd = 0.98$

$$A_1 = \frac{\pi d^2}{4} = \frac{\left(\frac{20}{100}\right)^2 \times 3.142}{4}$$

$$= 0.0314 m^2$$

$$A_2 = \frac{\pi d^2}{4} = \frac{3.142 \times \left(\frac{10}{100}\right)^2}{4}$$

$$= 7.853 \times 10^{-3} m^2$$

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

$P_1 = 17.658$

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

$$\frac{P_1}{\omega} = \frac{1.7658 \times 10^{-3}}{9.81} = 1.8 \times 10^{-14}$$

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

$$h = \frac{P_1}{\omega} - \frac{P_2}{\omega} = 1.8 \times 10^{-1} - (-4.08)$$

$$h = 4.08$$

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

$$Q = \frac{0.98 \times 0.0314 \times 7.853 \times 10^{-3} \times \sqrt{2 \times 9.81 \times 4.08}}{\sqrt{(0.0314^2) - (7.853 \times 10^{-3})^2}}$$

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

$$Q = 0.0709 M^3/S$$

4) Axis = 15m

170mm of Mercury (0.17m)

S.G of mercury 13.6

S.G of sea water = 1.026

$$h = y\left(\frac{S.G\,Hg}{S.G\,H_2O} - 1\right)$$

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

$$h = 2.083 H$$

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

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

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

4)

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

$h_L = \frac{(0.35(V_1^2 - V_2^2))}{2g}$ $L = 2.0m$

ii) Pressure head at smaller Section $\left(\frac{P_1}{W}\right) = 2.5m$

Head loss $(h_L) = \frac{0.35(V_1 - V_2)^2}{2g}$

Using bernoulli's equation

$$\frac{P_1}{W} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{W} + \frac{V_2^2}{2g} + z_2 + h_L$$

$$2.5 + \frac{5^2}{2 \times 9.81} + 2 = \frac{P_2}{W} + \frac{2^2}{2 \times 9.81} + \frac{0.35(5-2)^2}{2g}$$

$$2.5 + 1.274 + 2 = \frac{P_2}{W} + 0.203 + 0.161$$

$$5.774 = \frac{P_2}{W} + 0.3645$$

$$\frac{P_2}{W} = 5.774 - 0.3645$$

$$= 5.4095$$

$$\frac{P_2}{W} = 5.41m$$

The pressure head at the section section is 5.41m

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ENG 214 Assignment

3) Orifice diameter = 15cm ≃ 0.15m

Pipe diameter = 30cm ≃ 0.3m

differential manometer = 50cm ≃ 0.5m

Specific G = 0.9

$C_d = 0.64$

Soln

$d_o =$

$A_o = \frac{\pi d^2}{4} = \frac{\pi \times (0.15)^2}{4} = 0.0177 m^2$

$A_1 = \frac{\pi d^2}{4} = \frac{\pi \times 0.3)^2}{4} = 0.071 m^2$

$y = 0.5m\ Hg$

$h = y\left(\frac{\text{S.g of Mercury}}{\text{S.g of oil}} - 1\right)$

$h = 0.5\left(\frac{13.6}{0.9} - 1\right)$

$h = 0.5(14.11)$

$h = 7.056$

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

$Q = 0.64 \times 0.0177 \times 0.071 \times \sqrt{2 \times 9.81 \times 7.056}$

$Q = \frac{9.35 \times 10^{-3} \sqrt{(0.0707)^2 - (0.0177)^2}}{4.0}$ $= 2.33 \times 10^{-3} m^3/s$ $= 0.64 \times 0.0183 \times 11.77$

$= 0.138 m^3/s$