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Course: Fluid Mechanics

1) $\frac{P_1}{W} = 2.5m$ $\quad H = \frac{0.35(V_1 - V_2)^2}{2g}$

$\frac{P_1}{W} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{W} + \frac{V_2^2}{2g} + Z + H_L$

$\frac{P_2}{W} = \frac{P_1}{W} + \frac{V_1^2 - V_2^2}{2g} + (Z_1 + Z_2) - \frac{0.35(V_1 - V_2)^2}{2g}$

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

$\frac{P_2}{W} = 2.5 + 1.07 + 2 = 0.161$

2) Where: $d_1 = 20cm = 20 \times 10^{-2} m$

$A = \frac{\pi d^2}{4} = \frac{\pi \times (20 \times 10^{-2})^2}{4}$

$A_1 = 0.0314 m^2$ Throat diameter

$P_1 = 17.663 N/cm^2 = 10 \times 10^{-2} cm$

$= 17.698 \times 10^4 N/m^2$ $\quad \frac{\pi d^2}{4} = \frac{\pi \times (10 \times 10^{-2})^2}{4}$

$C_d = 0.98$

$A_2 = 7.85 \times 10^{-3} m^2$

To get h:

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

$P_1 = 17.663 \times 10^4 N/m^2$

$W = 9.81 \times 10^3 N/m^3$

But we have that throat Vacuum Pressure

$= 30cm$ of $Hg = 0.3m Hg$

$= 0.3 \times 13.6 = 4.08$

$\frac{P_2}{W} = -4.08$ (Since Vacuum Pressure)

Then $\frac{P_1}{W} = \frac{17.658 \times 10^4}{9.81 \times 10^3} = 18$

$\therefore \frac{P_1}{W} - \frac{P_2}{W} = 18 - -4.08 = 22.08$

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

$= 0.98 \times 0.0314 \times 7.85 \times 10^{-3}$

$\times \sqrt{\frac{2 \times 9.81 \times 22.08}{(0.0314^2 - (7.85 \times 10^{-3})^2)}}$

$= 2.4156 \times 10^{-4} \times 684.59$

$= 0.1653$

$Q_{actual} = 0.1653 m^3/s$

3) $D_1 = 5cm$ $D_2 = 30cm$

50cm of mercury $= 0.5m$ $a = ?$

$\Rightarrow S_1 = 0.9$ $\quad S_2 = 0.64$

$A_1 = \pi d^2/4 = \frac{(18/100)^2 \times 3.14}{4} = 0.0176 m$

$A_2 = 0.0706 m$

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

$= 7.05 m$ $\quad 0.1$

$Q = \frac{a_1 - A_1 A_2}{\sqrt{A_2^2 - A_1^2}} \times \sqrt{2gh}$

$Q = \frac{0.04 \times 0.176 - 0.0706}{\sqrt{(0.0706)^2 - (0.0170)^2}}$

$\times \sqrt{2 \times 9.81 \times 7.05}$

$Q = \frac{4.36 \times 10^{-3}}{20\,\text{sec}}$ $Q = \frac{2.33 \times 10^{-3}\ m^3/s}{}$

4) $A_1 = 16m$

17mm of Mercury (0.17m)

Sg Of Mercury (0.17m)

Sg of Sea Water = 1.020

$V = 1$

$h = y\left(\frac{Sh}{Sw} - 1\right)$

$h = 0.17\left(\frac{13.6}{0.16} - 1\right)$

$h = 2.085m$

$V = \sqrt{2gu}$

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

$V = 6.39ms^{-1}$

5) $Q = 0.05dm^3/min = 8.33 \times 10^{-5}\ m^3/sec$

Speed of Rotation = 17 revolutions

28.38841

Normal displacement = $100cm^3/rev = 10^{-4}m^3$