Assignment

1) $z_1 = 0$, $z_2 = 2.0m$, $V_1 = 5 m/s$, $V_2 = 2 m/s$

The prasswo,h, $\frac{P_1}{w} = 2.5m$

$\frac{P_2}{w} = ??$

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

$= \frac{0.35(5-2)^2}{2 \times 9.81} = \frac{0.35 \times 9}{2 \times 9.81}$

$= 0.1606m$

Applying Bernoulli's Equation

$\frac{P_1}{w} + \frac{V^2}{2g} + z_1 = \frac{P_2}{w} + \frac{V_2^2}{2g} + z_2 + h_f$

$\frac{P_2}{w} = \frac{P_1}{w} + \frac{V_1^2}{2g} + z_1 - \frac{V_2^2}{2g} - z_2 - h_f$

$= 2.5 + \frac{5^2}{2 \times 9.81} + 0 - \frac{2^2}{2 \times 9.81} - 2.0 - 0.1606$

$= 2.5 + 1.274 - 0.204 - 0.1606 - 2.0$

$= 1.4094m$ $1.4094m$

$= 1.41m$

$h_2, \frac{P_2}{w} = 1.41m$

2) $\lambda_1 A_1 = 20\,cm$

$= \frac{20}{100} = 0.2m$

$\lambda_2 A_2 = 10cm$

$= \frac{10}{100} = 0.1m$

$A_1 = \frac{\pi d^2}{4} = \frac{\pi (0.2)^2}{4}$

$= 0.0314 m^2$

$A_2 = \frac{\pi d^2}{4} = \frac{\pi (0.1)^2}{4}$

$= 0.00785$

$P_1 = 17.6580\,kcm^2$

$= 17.6580 \times 10^4$

$= 176580\,N/m^2$

$P_2 = 30cm$ of mercury

$= 0.5m$ of Hg

$= -0.5\,mHg \times 13.6$

$h_2 = -4.08m$

$h_1 = \frac{P_1}{w} = \frac{176580}{1000 \times 9.81}$

$= 18m$

$h = h_1 - h_2$

$h = 18 - (-4.08)$

$= 18 + 4.08$

$= 22.08$

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

$$= \frac{0.95 \times 0.0314 \times 0.00785 \times \sqrt{2 \times 9.8 \times 22.08}}{\sqrt{(0.0514)^2 - (0.00786)^2}}$$

$$Q = \frac{0.00503}{0.0304}$$

~~$Q = 0.1058\ m^3/s$~~

$$Q = 0.1653\ m^3/s$$

3) Orifice diameter, $d_o = 15cm$
$= 0.15\ m$

Pipe diameter, $d_1 = 30cm$
$= 0.3m$

$$A_o = \frac{\pi d^2}{4} = \frac{\pi (0.15)^2}{4}$$
$$= 0.01767\ m^2$$

$$A_1 = \frac{\pi d_1^2}{4} = \frac{\pi (0.30)^2}{4}$$
$$= 0.070686\ m^2$$

Pitfuential head.

$y = 50cm$
$= 0.5m$

$$h = \frac{P}{w} = y\left(\frac{S.G\ of\ mercury}{S.G\ of\ oil} - 1\right)$$
$$= 0.5\left(\frac{13.6}{0.9} - 1\right)$$
$$= 7.06$$

$h = 7.06m$

$$Q = \frac{C_d \times A_1 A_o \sqrt{2gh}}{\sqrt{A_1^2 - A_o^2}}$$
$$= \frac{0.64 \times 0.01767 \times 0.070686 \times \sqrt{2 \times 9.81 \times 7.06}}{\sqrt{(0.070686)^2 \cdot (0.01769)}}$$
$$= \frac{0.009907}{0.06844}$$
$$Q = 0.1374\ m^2/s$$
$$Q = 0.137\ m^2/s$$