Mechanics

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

PHQV smaller, end = 2.5m

$h_f = \frac{(0.35(v^1 - v^2)^2}{25}$ $L = 2.0m$

P_h at lower end =

$L = t_1 - t_2 = 2m$

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

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

$= 2.5 + \frac{5^2 - 2^2}{2 \times 9.81} + 2 - \frac{(0.35(5.2)^2}{2 \times 9.81}$

$= 2.5 + 1.07 + 2 - 0.16055$

$P_2 = 5.4095 bar$

Pressure at lower end $\therefore 5.409 bar$

$P_1 = 17.658$

$= \frac{17.658}{1600} = 1.7658 \times 10^{-3} N/m$

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

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

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

$h = 4.08018 m$

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

$Q = 0.98 \times \frac{0.0314 \times 7.853 \times 10^{-3}}{\sqrt{(0.0314)^2 - (7.853 \times 10^{-3})^2}} \times \sqrt{2 \times 9.81 \times 4.08018}$

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

$Q = 0.070 m^3/s$

2.) inlet diameter = 200m

throat diameter = 100m

$P_1 = 17.658m$

3. 300m of Mercury

$Cd = 0.98$

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

$= 0.0314 m$

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

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

③ $D_1 = 15cm$ $D_2 = 30cm$

500m of Mercury $= 0.5m$ $Q = ?$

$S.G = 0.9$ $Cv = 0.64$

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

$= 0.0176 m^2$

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

$0.0706 m^2$

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

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

$= 7.05 \text{ mot } 0.1$

$$a = \frac{((d - A_1 A_2) \times \sqrt{2gh})}{\sqrt{A_1^2 - A_2^2}}$$

$$Q = \frac{0.64 \times 0.0176, 0.070\sqrt{2 \times 9.81 \times 7.05}}{\sqrt{(0.0700)^2 - (0.070)^2}}$$

$$a - \frac{9.35 \times 10^{-3}}{40\Omega}$$

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

4 $A \& S = 15m$

170mm of Mercury (0.17m)

SG of Mercury (13.6)

SG of SG water = 1.026 V=)

$$h = y\left(\frac{SG1}{S_1} - 1\right)$$

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

$$h = 2.083m$$

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

$$V = \sqrt{2 \times 9.81 \times 20.83}$$

$$V = 6.39 m s^{-1}$$

5) $0.05 m^3/min$

15 bar

1700 rpm

$10 Pm^2 P_2 V$

15 NM