Fluid mechanics,

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

PH at smaller end = 2.5m

$h_f = \frac{0.35 (v_1 - v_2)^2}{2g}$ $L = 2.0m$

Pr at lower end =

$l = Z_1 - Z_2 = 2m$

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

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

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

$= 2.5 + 1.07 + 2 - 0.16055$

$P_2 = 5.4096 bar$

Pressure at lower end is 5.4096 bar

(2) inlet diameter = 200m

Throat diameter = 100m

Pressure at inlet =

$P_1 = 17.658M$

$y = 300m$ of mercury

$Cd = 0.98$

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

$= 0.0314 m^2$

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

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

$P_1 = 17.658$

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

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

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

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

$h = 4.08018m$

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

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

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

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

$Q = 0.0709 m^3/s$

(3) $D_1 = 15cm$ $D_2 = 30cm$

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

$S.G = 0.9$ $Cd = 0.64$

$A_1 = \frac{\pi d^2}{4} = \frac{(15/100)^2 \times 3.14}{4} = 0.0176m^2$

$A_2 = \frac{\pi d^2}{4} = \frac{(30/100)^2 \times 3.14}{4} = 0.0706m^2$

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

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

$= 7.05m$ of oil

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

$Q = \frac{0.64 \times 0.0176 \times 0.0706 \sqrt{2 \times 9.81 \times 7.05}}{\sqrt{(0.0700)^2 - (0.0970)^2}}$

$Q = \frac{4.35 \times 10^{-3}}{40012}$

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

(4) Axis = 15m

170mm of Mecury (0.17m)

SG of Mecury ~~(0.97m)~~ (13.6)

SG of sea water = 1.026 $v = ?$

$h = y\left(\frac{Sh_1}{S_1} - 1\right)$

$h = 0.17\left[\frac{13.6}{1.026} - 1\right]$

$h = 2.083m$

$v = \sqrt{2gh}$

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

$v = 6.39ms^{-1}$

(5) $0.05m^3/min$

15 bar

1700vPM

$108m^2$ PRV

15NMa