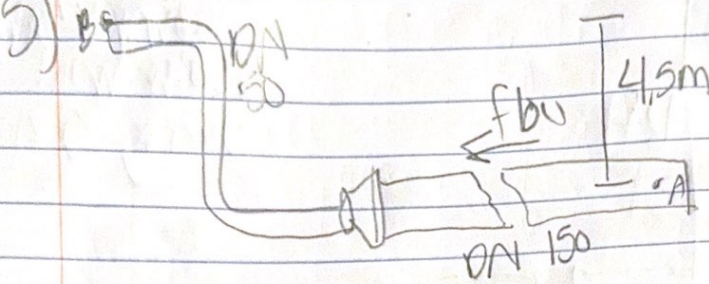
Ch 11 5, 13, 20, 22, 23, 24

5)



design
incompressible
isothermal
steady state

data
FBW rate = .015 m³/s
γ = 8.81 kN/m³
ν = 2.12 x 10⁻⁵ m²/s
L DN150 = 180
L DN150 = 8m
p_B = 12.5 mPa
p_n

$$\frac{p_A}{\gamma} + \frac{V_A^2}{2g} + z_A = \frac{p_B}{\gamma} + \frac{V_B^2}{2g} + z_B + h_{L_{AB}}$$

$$p_A = (z_B + h_{L_{AB}} + p_B)\gamma$$

f_2 T = .019
Ch 10

h_1(entrance) = $K(V_1^2/2g)$
h_2(2 90° elbows) = $f_2 T (L_e/D)(V_2^2/2g)$
h_3(DN 150) = $f(L/D)(V_1^2/2g)$
h_4(DN 150) = $1.0(V_2^2/2g)$

$$V_1 = \frac{Q}{A} = \frac{.015}{\frac{1}{4}\pi(.05)^2} = 8.19 m$$

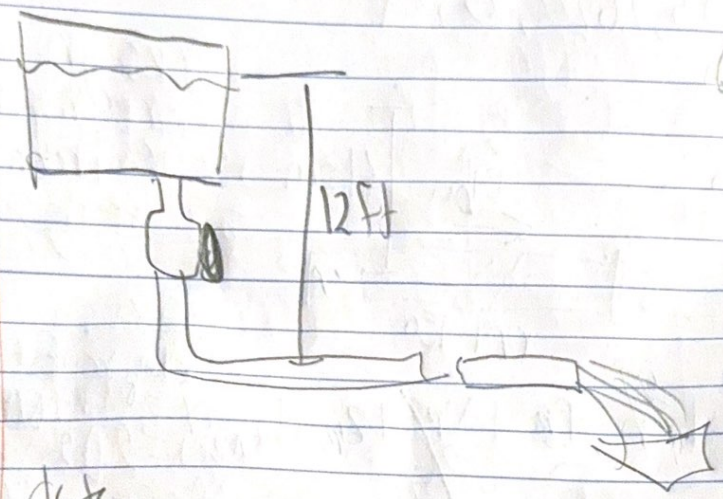
$$V_2 = \frac{Q}{A} = \frac{.015}{\frac{1}{4}\pi(.15)^2} = 0.68 m$$

$h_1 = .5(8.19^2/2(9.81)) = 2.02 m$
$h_2 = .019(346)(.68^2/2(9.81)) = .15 m$
$h_3 = .019(346)(8.19^2/2(9.81)) = 22.14 m$
$h_4 = 1(.68^2/2(9.81)) = .024 m$

$h_{LAB} = h_1 + h_2 + h_3 + h_4 = 24.3 m$

$p_A = (4.5_m + 24.3_m)(12.5 mpa)\ 8.8 kN/m^3 = 13.98 mpa$

20)



Assum
incompressible
isothermal
steady state

fluid
flow rate = 400gal/min = 1.78ft³/s
L = 75ft
γ = 62.4 lb/ft²
ν = 1.21×10⁻⁵ ft/s

$h_L = (p_1/\gamma - p_2/\gamma) + z_1 - z_2 = 12\text{ft}$

Q = 1.78ft³/s L = 75ft g = 32.2 ft/s²
h = 12ft ε = 1.5×10⁻⁴ ft ν = 1.21×10⁻⁵ ft²/s

$$D = .66\left(\varepsilon^{1.25}\left(\frac{LQ^2}{gh_L}\right)^{4.75} + \nu Q^{9.4}\left(\frac{L}{gh_L}\right)^{5.2}\right)^{.04}$$

$$= .66\left(1.5\times10^{-4(1.25)}\left(\frac{75(1.78)^2}{32.2(12)}\right)^{4.75} + 1.21\times10^{-5(9.4)}\left(\frac{75}{32.2(12)}\right)^{5.2}\right)^{.04}$$

D = 0.996ft