p 282 35, 38, 39, 41, 43, 44, 47

(35) $A_1 v_1 = A_2 v_2$

$\pi r_1^2 v_1 = A_2 v_2$

$v_2 = \frac{\pi r_1^2 v_1}{A_2} = \frac{\pi (1.2\ cm)^2 (40\ cms^{-1})}{2.0\ cm^2} = \underline{90\ cms^{-1}} = \underline{.9\ ms^{-1}}$

(38) $\frac{1}{2}\rho v_1^2 + \rho g z_1 + P_1 = \frac{1}{2}\rho v_2^2 + \rho g z_2 + P_2$

assume water at the top does not move $v_1 = 0$

pressure at top and bottom are both the same $P_1 = P_2$

at bottom $z = 0$

$\rho g z_1 = \frac{1}{2}\rho v_2^2$

$v = \sqrt{2gz} = \sqrt{2(9.81\ ms^{-2})(4.6\ m)} = \underline{9.5\ ms^{-1}}$

(39) $\frac{m}{t} = \rho A v$ $\rho = \frac{m}{V}$ $\frac{5}{8}'' = 1.59\ cm$

$\frac{\rho V}{t} = \rho A v$

$t = \frac{V_{pool}}{A_{hose} v} = \frac{\pi d_{pool}^2 h_{pool} 4}{4 \pi d_{hose}^2 v} = \frac{(6.1\ m)^2 (1.2\ m)}{(.0159\ m)^2 (0.4\ ms^{-1})}$

$= \underline{4.4 \times 10^5\ s}$ $(7.4 \times 10^3\ m)$

(120 h)

(5.1 days)

(41) $\frac{1}{2}\rho v_1^2 + \rho g z_1 + P_1 = \frac{1}{2}\rho v_2^2 + \rho g z_2 + P_2$

$z_1 = z_2$ (horizontal pipe)

$\frac{1}{2}\rho v_1^2 + P_1 = \frac{1}{2}\rho v_2^2 + P_2$ $A_1 v_1 = A_2 v_2$

$v_1 = \frac{A_2}{A_1} v_2$

$\frac{1}{2}\rho \left(\frac{A_2}{A_1}\right) v_2^2 + P_1 = \frac{1}{2}\rho v_2^2 + P_2$

41 cont'd

$$V_2 = \sqrt{\frac{P_2 - P_1}{\frac{1}{2}\rho\left(\frac{A_2^2}{A_1^2} - 1\right)}}$$

$$= \sqrt{\frac{24\times10^3\,Pa - 32\times10^3\,Pa}{\frac{1}{2}(1\times10^3\,kg\,m^{-3})\left(\left(\frac{\pi(4.0\,cm)^2\,4}{4\,\pi(6.0\,cm^2)^2}\right)^2 - 1\right)}}$$

$V_2 = 4.47\ ms^{-1}$

$A_2V_2 = \pi(.02\,m)^2(14.47\ ms^{-1}) = \underline{5.6\times10^{-3}\ m^3 s^{-1}}$

(43) $\frac{1}{2}\rho v_1^2 + \rho g z_1 + P_1 = \frac{1}{2}\rho v_2^2 + \rho g z_2 + P_2$

horizontal flat roof $z_1 = z_2$

no wind under the roof $V_2 = 0$

$\frac{1}{2}\rho v_1^2 + P_1 = P_2$

$\Delta P = \frac{F}{A} = \frac{1}{2}\rho v_1^2$

$F = \frac{1}{2}\rho v_1^2 A = \frac{1}{2}(1.29\ kg\,m^{-3})(35\ ms^{-1})^2(240\,m^2)$

$= \underline{1.9\times10^5\ N}$

(44) $\frac{1}{2}\rho v_1^2 + \cancel{\rho g z_1} + P_1 = \frac{1}{2}\rho v_2^2 + \cancel{\rho g z_2} + P_2$

$\Delta P = \frac{F}{A} = \frac{1}{2}\rho\left(v_1^2 - v_2^2\right) A$

$= \frac{1}{2}\left(1.29\ kg\,m^{-3}\right)\left[\left(260\ ms^{-1}\right)^2 - \left(150\ ms^{-1}\right)^2\right] 78\ m^2$

$= \underline{2.3 \times 10^5\ N}$

(47) $\frac{1}{2}\rho v_1^2 + \cancel{\rho g z_1} + P_1 = \frac{1}{2}\rho v_2^2 + \cancel{\rho g z_1} + P_2$

$A_1 V_1 = A_2 V_2$

$\frac{A_1}{A_2} v_1 = v_2$

$\frac{1}{2}\rho v_1^2 + P_1 = \frac{1}{2}\rho\left(\frac{A_1^2}{A_2^2}\right) v_1^2 + P_2$

$\frac{1}{2}\rho v_1^2 A_2^2 + P_1 A_2^2 = \frac{1}{2}\rho A_1^2 v_1^2 + P_2 A_2^2$

$\frac{1}{2}\rho v_1^2 A_2^2 - \frac{1}{2}\rho A_1^2 v_1^2 = P_2 A_2^2 - P_1 A_2^2$

$v_1^2 \frac{1}{2}\rho\left(A_2^2 - A_1^2\right) = A_2^2\left(P_2 - P_1\right)$

$$v_1^2 = \frac{A_2^2\left(P_2 - P_1\right)}{\frac{1}{2}\rho\left(A_2^2 - A_1^2\right)}$$

$$v_1 = A_2\sqrt{\frac{\left(P_2 - P_1\right)}{\frac{1}{2}\rho\left(A_2^2 - A_1^2\right)}}$$