

2a) $\Sigma F_{\text{plug}} = 0$

$F - f = 0$

$f = F = \rho g d \cdot A$

$= 997 \cdot 981 \cdot 6 \cdot \pi \left(\frac{240}{2} 10^{-2} \right)^2 \text{ N}$

$= 73.744 \text{ N}$

b) $v = \sqrt{2gd}$

$= \sqrt{2 \cdot 981 \cdot 6} \text{ m/s}$

$= 10,850 \text{ m/s}$

Volume = $A \cdot v \cdot \Delta t$

$= \left(\pi \left(\frac{40}{2} 10^{-2} \right)^2 \right) \cdot 10,850 \cdot 3 \cdot 3600 \text{ m}^3$

$= 147,251 \text{ m}^3$

30. $P_1 = P_2$

$\frac{F_1}{A_1} = \frac{F_2}{A_2}$

$\frac{m_1 \cdot g}{A_1} = \frac{3.75 \times 10^4 \times 5 \cdot 10^{-2}}{18 A_1}$

$m_1 = 10,62 \text{ kg}$

33. $\Sigma F_s = 0$

$F_A = W$

$\rho_{\text{water}} \cdot g \cdot V_{\text{outer}} = \rho_{\text{iron}} \cdot g \cdot (V_{\text{outer}} - V_{\text{inner}})$

$V_{\text{inner}} = \frac{V_{\text{outer}} (\rho_{\text{iron}} - \rho_{\text{water}})}{\rho_{\text{iron}}}$

$\frac{4\pi}{3} \left(\frac{d_{\text{in}}}{2} \right)^3 = \frac{4\pi}{3} \left(\frac{d_{\text{out}}}{2} \right)^3 \left(\frac{7.87-1}{7.87} \right)$

$d_{\text{in}} = 47,786 \text{ cm}$

38. a) $F_A = (\rho_0 + \rho g 2d) \cdot d^2$

$= (1 \cdot 10^5 + 981 \cdot 1000 \cdot 14.0) \cdot 7.0^2 \text{ N}$

$= 1,16 \cdot 10^7 \text{ N}$

b) $F_B = (\rho_0 + \rho \cdot g \cdot \frac{5}{2} d) \cdot d^2$

$= (1 \cdot 10^5 + 981 \cdot 1000 \cdot 17.5) \cdot 7.0^2 \text{ N}$

$= 1,33 \cdot 10^7 \text{ N}$

43a) $A_1 V_1 = \sum_{i=2}^4 A_i V_i = 63 \text{ L/min}$

b) $\frac{V_1}{V_2} = \frac{\frac{63}{\pi \left(\frac{1.9 \cdot 10^{-2}}{2} \right)^2}}{\frac{26}{\pi \left(\frac{1.5 \cdot 10^{-2}}{2} \right)^2}} = 1.51$

57a) Volume = $A \cdot v \cdot \Delta t$

$= \frac{\pi}{4} (0.03)^2 \cdot 23.0 \cdot 20 \cdot 60 \text{ m}^3$

$= 19.51 \text{ m}^3$

b) $V_2 = V_1 \left(\frac{A_1}{A_2} \right)$

$= V_1 \frac{d_1^2}{d_2^2}$

$= 23 \cdot \frac{9}{25} \text{ m/s}$

$= 8.28 \text{ m/s}$

c) $P = \frac{1}{2} \rho (V_1^2 - V_2^2)$

$= \frac{1}{2} \cdot 10^3 (23^2 - 8.28^2) \text{ Pa}$

$= 2.3 \times 10^5 \text{ Pa}$