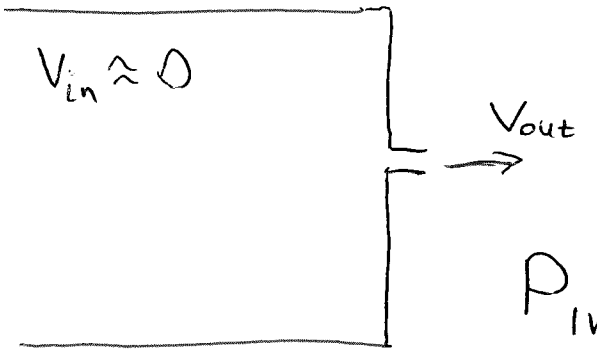
#1



$V_{out} = 10\ m/s$

$V_{in} \approx 0$

$$P_{in} + \frac{1}{2}\rho V_{in}^2 = P_{out} + \frac{1}{2}\rho V$$

Gauge pressure

$$P_{GAUGE} \equiv P_{in} - P_{OUT} = \frac{1}{2}\rho V_{OUT}^2$$

$$= \frac{1}{2} \cdot 1000 \frac{kg}{m^3} \cdot 100 \frac{m^2}{s^2}$$

$$= 5 \times 10^4\ Pa$$

#2

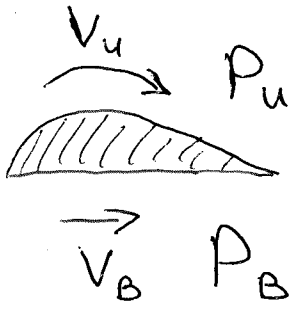
(a) $M \cdot g = \Delta P \cdot A$

$\Delta P = 500\,Pa$, $A = 2 \times 50\,m^2 = 100\,m^2$

$$M = \frac{500\,Pa \cdot 100\,m^2}{10\,m/s^2} = 5000\,\frac{(kg/m\cdot s^2)\times m^2}{m/s^2}$$

$$= 5000\,kg$$

(b)



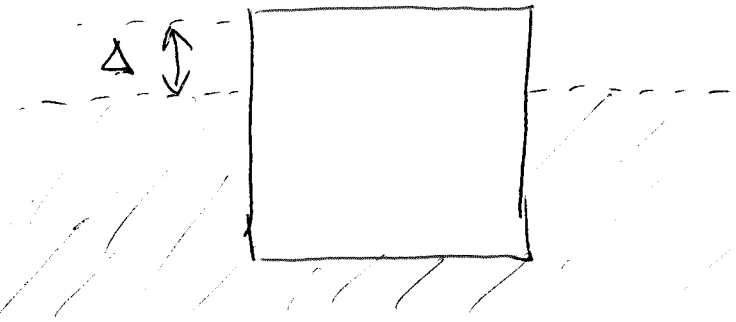
$$\frac{1}{2}\rho_A V_B^2 + P_B = \frac{1}{2}\rho_A V_u^2 + P_u$$

$$\frac{1}{2}\rho_A V_u^2 = \frac{1}{2}\rho_A V_B^2 + \underbrace{(P_B - P_u)}_{\Delta P}$$

$$V_u^2 = V_B^2 + \frac{\Delta P \cdot 2}{\rho} = (80\,m/s)^2 + \frac{1000\,Pa}{1.2\,kg/m^3}$$

$$= \ldots$$

#3



(a) $V_{CUBE} = a^3$

$V_{SUBMERGED} = a^2 \cdot (a - \Delta)$

$\rho_{WOOD} \cdot V_{CUBE} \cdot g = V_{SUBMERGED} \cdot \rho_{WATER} \cdot g$

$\rho_{WOOD} \cdot a^3 = \rho_{WATER} \cdot a^2 (a - \Delta)$

$a - \Delta = \frac{\rho_{WOOD}}{\rho_{WATER}} \cdot a$

$\Delta = a\left(1 - \frac{\rho_{WOOD}}{\rho_{WATER}}\right) = 40_{cm} \cdot 0.3 = 12cm$

(b) $F_B = V_{CUBE} \cdot \rho_{WATER} \cdot g$

$= (0.4m)^3 \cdot 1000 \frac{kg}{m^3} \cdot 10 \frac{m}{s^2} = \ldots$

#4 (a)

$$\begin{cases} P_1 V_1 = n R T_1 \\ P_1 V_2 = n R T_2 \end{cases}$$

$$\frac{V_1}{V_2} = \frac{T_1}{T_2} \qquad T_2 = T_1 \frac{V_2}{V_1} = 2T_1$$

$T_1 = 300^\circ K$

$T_2 = 600^\circ K$

(b) $\Delta L = L \cdot \Delta T \cdot \alpha$

$= 1\,m \cdot 300^\circ K \cdot 5 \times 10^{-5} \frac{1}{K}$

$= 1.5 \times 10^{-2}\,m = 1.5\,cm$

$L + \Delta L$ = $100\,cm + 1.5\,cm = 101.5\,cm$

#5

$$m_V \cdot C_V \cdot (T_{EQ} - T_V)$$

$$= m_W \cdot C_W (T_W - T_{EQ})$$

$$m_V \cdot C_V \cdot T_{EQ} - m_V C_V T_V =$$

$$= m_W C_W T_W - m_W C_W T_{EQ}$$

$$T_{EQ}(m_V C_V + m_W C_W) = m_V C_V T_V + m_W C_W T_W$$

$$T_{EQ} = \frac{m_V C_V T_V + m_W C_W T_W}{m_V C_V + m_W C_W}$$

$$= \frac{2\,kg \cdot 0.9 \frac{cal}{g \cdot °C} \cdot 20°C + 4\,kg \cdot 1 \frac{cal}{g \cdot °C} \cdot 80°C}{2\,kg \cdot 0.9 \frac{cal}{g \cdot °C} + 4\,kg \cdot \frac{cal}{g \cdot °C}}$$

$$= \frac{36\,kg \cdot °C + 320\,kg\,°C}{1.8\,kg + 4\,kg} = \frac{356}{5.6}\,°C =$$

$$= \ldots\ldots$$