UBC MECH327 Assignment 4 Q3

$m_1 = 0.5$ kg, $\quad T_1 = 353$ K, $\quad P_1 = 1$ bar.
$m_2 = 1.0$ kg, $\quad T_2 = 323$ K, $\quad P_2 = 2$ bar.

After the valve is opened and the two connected tanks reach equilibrium,
the air in it has mass m (kg), temperature T (K) and pressure P (bar).

As the tanks are insulated, the sum of heat transfer of both tanks must be zero. $\quad Q = mc\Delta T$.
$m_1 c(T - T1) + m_2 c(T - T2) = 0, \quad m_1(T - T1) = -m_2(T - T2)$,

$$T = \frac{m_1 T_1 + m_2 T_2}{m_1 + m_2} = \frac{0.5 \times 353 + 1.0 \times 323}{0.5 + 1.0} = 333 \text{ K} = 60°\text{C}.$$

Ideal gas assumed: $\quad PV = nRT, \quad PV = \frac{m}{M}RT,\quad$ where M is average molar mass of air.

$$V = \frac{mT}{P} \cdot \frac{R}{M}.$$

$$V = V_1 + V_2, \quad \frac{mT}{P} \cdot \frac{R}{M} = \frac{m_1 T_1}{P_1} \cdot \frac{R}{M} + \frac{m_2 T_2}{P_2} \cdot \frac{R}{M}.$$

$$\frac{T}{P} = \frac{\frac{m_1 T_1}{P_1} + \frac{m_2 T_2}{P_2}}{m_1 + m_2} = 225.333.$$

$$P = \frac{T}{225.333} = \frac{333}{225.333} = 1.47781 \text{ bar}.$$