1. A rigid insulated vessel contains two compartments of equal volume separated by an impermeable membrane. On one compartment is 10 moles of an ideal gas while on the other compartment is 5 moles of an ideal gas. After the membrane ruptures, the whole vessel settles to . The entropy change will be closest to
   a. \( \Delta S = +44.2 \text{ J/K} \)
   b. \( \Delta S = +62.4 \text{ J/K} \)
   c. \( \Delta S = +86.4 \text{ J/K} \)
   d. None of the above

2. A 5 kg solid block initially at \( T_{A,\text{init}} = 400\text{K} \) is placed in thermal contact with 5 kg of solid block that was initially at \( T_{B,\text{init}} = 300\text{K} \). The heat capacities are given by \( c_{P,A} = 20 \frac{kJ}{kg\cdot K} \) and \( c_{P,B} = 40 \frac{kJ}{kg\cdot K} \). The final temperature of both blocks settle to the surrounding temperature \( T_f = T_{surr} = 380\text{K} \). The change in entropy of surroundings is then closest to
   a. \( \Delta S_{surr} = -36.8 \frac{kJ}{K} \)
   b. \( \Delta S_{surr} = 0 \frac{kJ}{K} \)
   c. \( \Delta S_{surr} = +42.1 \frac{kJ}{K} \)
   d. None of the above

3. Wet steam of quality \( x_{\text{in}} = 0.60 \) at \( T = 100\degree C \) is fed to a condenser and leaves as saturated liquid water at the same temperature at steady state. At \( T = 100\degree C \), the specific enthalpies of liquid and vapor are given by \( \hat{h}_{l,\text{out}} = 419.0 \text{ kJ/kg} \) and \( \hat{h}_{v,\text{out}} = 2676 \text{ kJ/kg} \), respectively. The entropy change per kg of wet steam fed is closest to
   a. \( \Delta \hat{s} = -2.42 \frac{kJ}{K\cdot kg} \)
   b. \( \Delta \hat{s} = -3.63 \frac{kJ}{K\cdot kg} \)
   c. \( \Delta \hat{s} = -9.03 \frac{kJ}{K\cdot kg} \)
   d. None of the above
4. 100 moles/min of ideal gas with heat capacity $c_p = 2R$ undergoes isentropic expansion through a turbine from $P_{in}$ to $P_{out} = 0.5 P_{in}$. Then the relative change in temperature is closest to
   a. $(T_{out} - T_{in})/T_{in} = -0.25$
   b. $(T_{out} - T_{in})/T_{in} = -0.3$
   c. $(T_{out} - T_{in})/T_{in} = -0.5$
   d. $(T_{out} - T_{in})/T_{in} = -0.75$

5. For an ideal gas undergoing a Carnot cycle, in order for the Carnot efficiency to be $\eta = 0.75$, we need the temperature ratio of hot to cold reservoir closest to
   a. $T_H/T_C = 2$
   b. $T_H/T_C = 3$
   c. $T_H/T_C = 4$
   d. None of the above

6. 5 moles of an ideal gas $A$ is mixed with 10 moles of ideal gas $B$ at constant temperature and pressure. The total change in entropy for the mixing process is closest to
   a. $\Delta S = 40 \frac{J}{K}$
   b. $\Delta S = 68 \frac{J}{K}$
   c. $\Delta S = 80 \frac{J}{K}$
   d. None of the above