1. Saturated steam of quality $x = 0.85$ at $T = 240\, ^\circ C$ has a density that is closest to
   a. $10 \, kg/m^3$
   b. $20 \, kg/m^3$
   c. $100 \, kg/m^3$
   d. None of the above

2. An ideal gas a pressure $P_1$ and molar volume $v_1$ is contained in a piston-cylinder and undergoes a reversible-adiabatic expansion to a pressure $P_2$. Assuming $C_p = 3R$, the molar volume at the final condition is given by
   a. $v_2 = v_1 (P_1/P_2)^{3/2}$
   b. $v_2 = v_1 (P_1/P_2)^{2/3}$
   c. $v_2 = v_1 \ln(P_1/P_2)$
   d. None of the above

3. An ideal gas in a piston-cylinder undergoes an irreversible expansion against an external pressure $P_{surr} = 3 \, bar$. The volume expands from an initial value of $V_i = 1 \, m^3$ to a final value of $V_f = 2 \, m^3$. The heat input during the process is $200 \, kJ$. The relationship between the initial temperature and final temperature is
   a. $T_{initial} > T_{final}$
   b. $T_{initial} = T_{final}$
   c. $T_{initial} < T_{final}$
4. An ideal gas has a heat capacity given by
   \[ \frac{C_p}{R} = 1.1 + 0.003T \] (with \( T \) in K)

   The change in molar internal energy from \( T_1 \) to \( T_2 \) is given by
   a. \( \Delta u = R[0.1(T_2 - T_1) + 0.0015(T_2 - T_1)^2] \)
   b. \( \Delta u = R[1.1(T_2 - T_1) + 0.0015(T_2^2 - T_1^2)] \)
   c. \( \Delta u = R[0.1(T_2 - T_1) + 0.0015(1/T_1 - 1/T_2)] \)
   d. None of the above

5. An ideal gas undergoes an irreversible compression from \( P_1 = 1 \text{ bar} \) and \( v_1 = 50 \text{ liters/mol} \) to a final pressure \( P_2 = 2 \text{ bar} \) and final molar volume \( v_2 = 30 \text{ liters/mol} \). The final temperature is closest to
   a. 250°C
   b. 350°C
   c. 450°C
   d. None of the above

6. A rigid insulated vessel contains two compartments of equal volume separated by an impermeable membrane. On one compartment is an ideal gas at \( P = 1 \text{ bar} \) and \( v = 5 \text{ m}^3/\text{kmol} \). The other compartment is a vacuum. After the membrane ruptures, the whole vessel settles to a fixed pressure. The final pressure is
   a. 0.25 bar
   b. 0.5 bar
   c. 1 bar
   d. None of the above