

CM3230a
Chemical Engineering Thermodynamics
Fall 2011
Quiz 1

Name: _____

(Circle only one answer for each item. Each item is worth 20 points. Answer 5 items correctly for full 100 points. If all 6 items are correct, then a bonus of 20 points will be awarded.)

1. Saturated steam of quality $x = 0.85$ at $T = 240^\circ\text{C}$ 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 $P_{surr} = 3 \text{ bar}$. The volume expands from an initial value of $V_i = 1 \text{ m}^3$ to a final value of $V_f = 2 \text{ m}^3$. 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 is given by

$$\frac{C_p}{R} = 1.1 + 0.003T \quad (\text{with } T \text{ in } K)$$

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 is $P_2 = 2 \text{ bar}$ 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