Problem Session #2

1) The heat capacity of a gas may be represented by

$$\bar{C}_p = \alpha + \beta T + \gamma T^2$$

For N_2 α=26.984 $JK^{-1}mol^{-1}$, β=5.910 x 10^{-3} $JK^{-2}mol^{-1}$ and Υ= -3.377 x 10^{-7} $JK^{-3}mol^{-1}$. How much heat is required to heat a mole of N_2 from 300 K to 1000 K?

2) Evaluate ΔE for 1.00 mole of oxygen, O_2, going from -20.0°C to 37.0°C at constant volume in the following cases.

a) It is an ideal gas with $\bar{c}_v$ = 20.78 J/mol.K.

b) It is a real gas with an experimentally determined $\bar{c}_v$ = 21.6 + 4.18 x 10^{-3}T – (1.67 x 10^5)/T^2.

3) If the Joule-Thomson coefficient for carbon dioxide, CO_2, is 0.6375 K/atm, estimate the final temperature of carbon dioxide at 20 atm and 100°C that is forced through a barrier to a final pressure of 1 atm.

4) Suppose 0.100 mol of a perfect gas having $C_{v,m}$=1.50 R independent of temperature undergoes the reversible cyclic process 1→2→3→4→1 shown in the below figure, where either P or V is held at constant in each step. Calculate Q, W and ΔE for each step and for the complete cycle.