Chemistry 230
Problem Set # 3 -- 9/8/99

Recommended Problems: 2.1-2.5, 2.8-2.13, 2.20, 2.33-2.35, 2.42, 2.44, 2.52-2.58, 2.60.

1. The thermal expansivity of ethanol (in units K^{-1}) is given by

$$\alpha = 1.0414 \times 10^{-3} + 1.5672 \times 10^{-6}\theta + 5.148 \times 10^{-8}\theta^2 ,$$

where θ is the Celsius temperature. If an ethanol thermometer is constructed and set to yield true (ideal-gas thermometer) readings at 0.00˚C and 50.00˚C, what will this thermometer read when the true temperature is 30.00˚C?

2. Problem 2.19 in Levine.
3. Problem 2.26.
4. Problem 2.27.
5. Problem 2.28.
6. Problem 2.32.
7. Problem 2.39.
8. A lead bullet is fired at a wooden plank. At what speed must it travel to melt on impact, if its initial temperature is 25˚C and heating of the plank is neglected. The melting point of lead is 327˚C, its heat of fusion is 5.19 kJ/mol, and its heat capacity may be taken as 6.0 cal mol^{-1} K^{-1}.
9. A hypothetical substance has the equation of state $PV_m^2 = BT$, where B is a constant. The substance undergoes a change of state from (T_1, V_1) to (T_2, V_2) along a path where T varies linearly with V, in accord with $T = c_1V + c_2$.
   (a) Find an expression for the work w in terms of B, c_1, c_2, V_1, and V_2.
   (b) Express c_1 and c_2 in terms of T_1, T_2, V_1, and V_2.