Homework Set 2

CH353, Vanden Bout Summer 2008

Chapter 3

E3.1a, E3.7a, E3.8a, P3.4, P3.6, P3.28 (use the given equation don't derive)

1.

You have two blocks of metal. One has a heat capacity of 1000 J K^{-1} and initial temperature of 10°C. The other block has a heat capacity of 500 J K^{-1} and a temperature of 40°C. You bring the two blocks into contact.

A. What is the final temperature for the two blocks?

B. What is the entropy change for each block and the total entropy change?

2.

You have 2 moles of an IG ($C_{V,m} = 1.5R$) initially at a pressure of 1 bar and a temperature of 300 K. In one step, the external pressure is increased to 10 bar and the system is brought into contact with a constant temperature bath of 500 K. Once the system is at mechanical and thermal equilibrium, what are the entropy changes for the system, the surrounds, and the total?

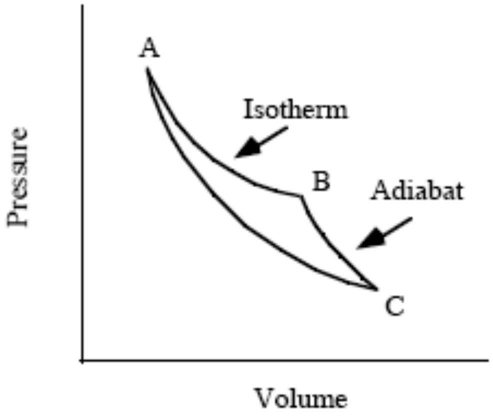
3.

Anthracene sublimes at a temperature of 340 K. Given the following information find the absolute entropy of anthracene vapor at 500 K. You can assume the heat capacities of the solid is constant with temperature. For the vapor you should assume the heat capacity varies linearly with temperature. Use the two data points given to estimate the functional form of the heat capacity.

$\Delta_{SUB}H° = 100$ kJ mol^{-1}
$C_{P,sol} = 210$ J K^{-1} mol^{-1}
$C_{P,vap}(300) = 186$ J K^{-1} mol^{-1}
$C_{P,vap}(500) = 300$ J K^{-1} mol^{-1}
$\Delta_f H°(sol) = 125$ kJ mol^{-1}
$S°(sol, 298) = 208$ J K^{-1} mol^{-1}

4.

Three moles of an ideal gas ($C_{V,M} = 7/2R$) initially at 300K are taken through a series of three compression/ expansions.



A to B: The gas is expanded isothermally and reversibly at 300K. This process involves 10.37 kJ of heat going into the system.

B to C: The gas is expanded reversibly and adiabatically to a new volume and temperature. This process involves no heat.

C to A: The gas is then compressed in a process that is neither adiabatic nor isothermal until it is back in state A where it started. This process involves and unknown amount of heat. But we do know that for the process C to A $\Delta S_{SURROUNDINGS} =$ 40 J K^{-1}.

Find ΔS_{TOTAL} for the process C to A.

5. For the following reaction calculate $\Delta_R H°$, $\Delta_R S°$, $\Delta_R G°$ at 500 K

$$3H_2(g) + N_2(g) \longrightarrow 2NH_3(g)$$