Problem Session # 6

1) Between 0°C and 100°C, the heat capacity of Hg (l) is given by

$$\frac{\mathrm{Cp,m\,(Hg,l)}}{J.K^{-1}.mol^{-1}} = 30.093 - 4.944x10^{-3}\,\frac{T}{K}$$

Calculate ΔH and ΔS if 1.75 moles of Hg (l) are raised in temperature from 0°C to 75°C at constant P.

2) 20 g. of steam at 120°C and 300 g. of liquid water at 25°C are brought together in an isolated flask. The pressure remains at 1 atm throughout.
If $C_p(H_2O, l)$ =1 cal.K/g , $C_p(H_2O, g)$ =0.45 cal.K/g, ΔH_v=540 cal/g

a) What is the final state and the final temperature of the system?
b) Calculate ΔS for the transformation.

3) If an isolated flask 80 g of ice at -10°C are added to 200 g of water at 100°C. Assume ice is completely transformed to liquid state.
If heat capacities are $C_p(H_2O, s)$ =0.5 cal.K/g , $C_p(H_2O, l)$ =1.0 cal.K/g
ΔH_m=80 cal/g

a) What is the final temperature of the system?
b) Calculate ΔS for the transformation.

4) A mole of hydrogen gas is heated from 300 K to 1000 K at constant volume. The gas
may
be treated as ideal with

$$C_{p,m}(JK^{-1}mol^{-1}) = 27.28 + 3.26x10^{-3}T(K) + 5.0x10^{4}T^{-2}(K^{-2})$$

Calculate the entropy change.

5) Calculate the entropy change when 1 mole of ice is heated from 250 K to 300 K. Take
the heat capacities of water and ice to be constant at 75.3 and 37.7 $JK^{-1}mol^{-1}$ respectively and the latent heat of fusion of ice as 6.02 $kJmol^{-1}$.

6) One mole of supercooled water at -10°C and 1 atm pressure turns into ice. Calculate
the entropy change in the system and in the surroundings and the net entropy change.