CH1011   Tutorial 6

Name:
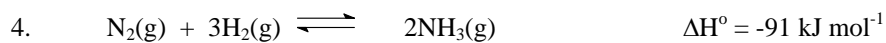
1. Explain the term **standard enthalpy of formation**. Illustrate your answer using $\Delta H^o_f(_{CH4(g)})$ as an example (ie write the balanced equation).

2. Calculate the heat of combustion $\mathbf{\Delta H^o_c(_{CH4(g)})}$ when methane is combusted to form $CO_2(g)$ and $H_2O(l)$.

3. 0.045 mol of $COCl_2$ gas (phosgene) is placed in a reaction vessel at 500^oC. The total pressure in the vessel is   0.60 atm. and the partial pressures of CO and Cl_2 are 0.10 atm. and 0.20 atm., respectively. Write down the expression for K_p and determine the value of K_p in the above system.

Additional information:

$\Delta H^o_f(_{CH4(g)})$ -75 kJ/mol $\Delta H^o_f(_{CO2(g)})$ -394 kJ/mol $\Delta H^o_f(_{H2O(l)})$ -286 kJ/mol

4. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ $\Delta H^o = -91$ kJ mol^{-1}

   In an equilibrium reaction mixture of the above reaction how would p(H_2) and
   K_p change if the temperature of the reaction vessel were raised? Explain your answer.

5. Define the term **free energy** of a substance.
   How is the change in free energy important in a chemical reaction?

6. The combustion of graphite (carbon) forms carbon dioxide.
   Write a **balanced equation** and **calculate K^o** for this reaction at 25°C.

Additional information:

$\Delta G^o_f({}_{CO2(g)})$ -386.2 kJ/mol $\Delta G = -RT \ln K^o$
R = 8.31 J/mol K   0°C = 273K