Gaseous Equilibrium (GE) Part I

1. At 25 °C, Kc = $2.2 * 10^{-3}$ for the reaction
   $ICl (g) \leftrightarrow \frac{1}{2} I_2 (g) + \frac{1}{2} Cl_2 (g)$

   a. Calculate Kc at 25 °C for $2 ICl (g) \leftrightarrow I_2 (g) + Cl_2 (g)$
   b. Calculate Kc at 25 °C for $2 I_2 (g) + 2 Cl_2 (g) \leftrightarrow 4 ICl (g)$

2. Given the following data at 25 °C
   $2 NO (g) + Br_2 (g) \leftrightarrow 2NOBr (g)$ Kc = $2.0 * 10^{3}$
   $2 NO (g) \leftrightarrow N_2 (g) + O_2 (g)$ Kc = $1.0 * 10^{30}$

   Calculate Kc for the following reaction:
   $\frac{1}{2} N_2 (g) + \frac{1}{2} O_2 (g) + \frac{1}{2} Br_2 (g) \leftrightarrow NOBr (g)$

3. Write the equilibrium constant expressions (Kc and Kp) for the following reactions:
   a. $IF (g) \leftrightarrow \frac{1}{2} I_2 (g) + \frac{1}{2} F_2 (g)$
   b. $2 C_5H_6 (g) \leftrightarrow C_{10}H_{12} (g)$
   c. $P_4O_{10} (g) + 6 PCl_5 (g) \leftrightarrow 10 POCl_3 (g)$

4. Write a balanced chemical equation for an equilibrium system that would lead to the following expressions for Kc:
   a. $\frac{[H_2][Br_2]}{[HBr]^2}$ b. $\frac{[CH_3OH]}{[CO][H_2]^2}$ c. $\frac{[C_2H_4][H_2]}{[C_2H_6]}$

5. For the system $CO (g) + 3 H_2 (g) \leftrightarrow CH_4 (g) + H_2O (g)$ analysis shows that at a certain temperature, the equilibrium concentrations of methane, steam, hydrogen gas and carbon monoxide gas are 0.150 M, 0.233 M, 0.259 M, and 0.513 M respectively. Calculate Kc at that temperature.

6. At 227 °C carbon monoxide gas reacts with hydrogen gas to form one mole of methanol, CH_3OH. *At equilibrium* and 227 °C, a 10.0 L flask contains 0.114 moles of methanol gas, 0.718 moles of carbon monoxide gas, and 1.23 moles of hydrogen gas.
   a. Write a balanced equation for the r eaction
   b. Calculate Kc for the reaction at 227 °C.