Equilibrium problems

1. At a certain temperature a mixture of H_2 and I_2 was used to prepare HI by placing a 0.100 mol of H_2 and 0.100 mol of I_2 into a 1.0 L liter flask. After a period of time the equilibrium was achieved for the reaction $H_2(g) + I_2(g) \leftrightarrow 2HI(g)$ When the system attained equilibrium the concentration of I_2 dropped to 0.020 mol/L. What is the value of Kc for this reaction?
   Ans. Ke or Kc = 64

2. The reversible reaction $CH_{4(g)} + H_2O_{(g)} \leftrightarrow CO_{(g)} + 3H_{2(g)}$ Equilibrium concentrations of [CO] = 0.300M, $[H_2]$=0.800 M, and $[CH_4]$=0.400M at 1500 ^oC. Kc for the reaction is 5.67 for this reaction. What is the equilibrium concentration of H_2O in this mixture? Ans. $[H2O_{(g)}]$ = 0.0678 M

3. The reaction $CO(g) + H_2O(g) \leftrightarrow CO_2(g) + H_2(g)$ Has a Kc = 4.06 at 500 ^oC. If 0.100 mol of CO(g) and 0.100 mol of $H_2O(g)$ are placed in a 1 liter reaction vessel at this temperature, what are the concentrations of the reactants and products when the system attain equilibrium Ans: x = 0.0668 M

4. Decomposition of water at 1000 ^oC has a Kc value for the reaction which is 7.3×10^{-18}

   $2H_2O(g) \leftrightarrow 2H_2(g) + O_2(g)$

   If 0.100 M is the initial concentration of water, what will the H_2 concentration be at equilibrium. Ans: $x = 5.26 \times 10^{-7}$

5. How many moles of HI are present at equilibrium when 2.0 moles of H_2 is mixed with 1.0 moles of I_2 in a 0.50 L container and allowed to react at 448^{o}C. At this temperature K_{eq} = 50. [Ans: 1.9 moles of HI Use quadratic equation to solve for x the concentration of the reactant]

6. At 500 degrees Celsius for the reaction between nitrogen and hydrogen to produce ammonia, the Kc value is found to be 6.0 x 10^{-2} What is the value of Kp for the same reaction. Value of R = 0.0821 L atmK^{-1} mol^{-1} or R = 8.314 J$K^{-1}$$mol^{-1}$ When R = 0.0821 Ans: 1.5 x 10^{-5} (Converting Kc to Kp problem)