Chemistry 12 Equilibrium Worksheet #2

1. In the reaction A + B <⟹> C + D the [A] and the [B] at the beginning of the reaction are each 1.00 M. When equilibrium is reached 0.600 M "C" is found.
   a.) Calculate K_{eq}
   b.) using the above reaction find [D] if the final [A] = 0.500 M, [B] = 0.500 M, [C] = 1.00 M.

2. A closed reaction chamber containing PCl_5 was heated to 230 °C at one atmosphere pressure until equilibrium was reached. Analysis showed the following concentration in the chamber: 0.45 M PCl_5, 0.096 M Cl_2, and 0.096 M PCl_3. Calculate K_{eq}.

3. A 1.00 L container has 18.0 g of water sealed in it and the temperature is raised to 1500 °C. At this temperature 5.00% of the water is decomposed according to the equation:

   $2H_2O$ <⟹> $2H_2 + O_2$. Calculate K_{eq} .

4. Methanol is made according to the equation:

   $CO\ (g) + 2H_2\ (g)$ <⟹> $CH_3OH\ (g)$ + heat

   Predict what will happen to K_{eq} with an increase in
   a.) temperature
   b.) pressure

5. 2.00 moles of NH_3 and 1.00 moles of O_2 are introduced into an empty 10.0 L vessel. When equilibrium is established, 0.500 moles of N_2 was found. Calculate Keq.

   $4NH_3\ (g) + 3O_2\ (g)$ <⟹> $2N_2\ (g) + 6H_2O\ (g)$

6. At 340 °C, 500.0 g of Fe_2O_3 is placed in contact with 4.00 moles of H_2 gas in a 2.00 L container. 42.5 g of Fe metal is obtained at equilibrium. Find K_{eq} .

   $Fe_2O_3\ (s) + 3H_2\ (g)$ <⟹> $2Fe\ (s) + 3H_2O\ (g)$

7. 0.397 moles of BrCl are placed in an empty 10.0 L container if $K_{eq} = 1.224 \times 10^{-2}$?
   a.) find $[Br_2]$ at equilbrium
   b.) how many moles of BrCl dissociate at equilibrium

   $2BrCl\ (g)$ <⟹> $Br_2\ (g) + Cl_2\ (g)$

8. At 1000 °C the reaction: $I_2\ (g)$ <⟹> $2I\ (g)$, $K_{eq} = 0.1650$. If 1.00 mole of iodine was placed in a 100.0 mL flask and heated to that temperature
   a.) find [I] at equilibrium
   b.) how many moles of I_2 remain undissociated?

9. At 500 °C, HI dissociates according to the equation:

$$2HI\ (g) \Longleftrightarrow H_2\ (g) + I_2\ (g)$$

a.) At equilibrium, the final concentrations are: [hydrogen] = 0.420 M, [iodine] = 0.420 M, [HI] = 3.52 M. Find Keq .

b.) If an additional 1.00 mol of HI is introduced to a 1.00 L container and equilibrium reestablished, what are the new concentrations of each gas?

10. Using the same equation as number 9, but different conditions Keq = 0.0156. If 1.0 mole of each gas is placed in a 1.0 L container, calculate the final concentration of all components at equilbrium.

----------Answers:

1. a.) 2.25
   b.) 0.563 M

2. 0.020

3. 6.93×10^{-5}

4. a.) decrease
   b.) no change

5. 18

6. 0.0639

7. a.) 3.60×10^{-3} M
   b.) 7.19×10^{-2} moles

8. 1.24 M
   0.938 moles

9. a.) 1.42×10^{-2}
   b.) 0.516 M, 0.516 M, 4.33 M

10. [HI] = 2.4 M, [hydrogen] = [iodine] = 0.3 M