Equilibrium Problems - Set IV

1. When 3.0 moles of I_2 and 4.0 moles of Br_2 are placed in a 2.0 liter vessel at 150°C, the following reaction occurs until equilibrium is reached:

$$I_{2(g)} + Br_{2(g)} \Leftrightarrow 2\ IBr_{(g)}$$

Chemical analysis shows that the vessel contains 3.2 moles of IBr. Calculate the K for this equilibrium system. (3.05)

2. At a certain temperature the reaction $CO_{(g)} + Cl_{2(g)} \Leftrightarrow COCl_{2(g)}$ has an equilibrium constant (K) of 13.8. Is the following mixture an equilibrium mixture ? If not, in which direction (forward or reverse) will the reaction proceed to reach equilibrium ? (forward)

$[CO]_i = 2.5\ M \quad [Cl_2]_i = 1.2\ M \quad [COCl_2]_i = 5.0\ M$

3. When 6 moles of H_2 and 6 moles of N_2 are placed in a 3 L vessel at 400°C, the following reaction occurs until equilibrium is obtained:

$$3H_{2(g)} + N_{2(g)} \Leftrightarrow 2\ NH_{3(g)}$$

Upon analysis it was found that 3 moles of NH_3 as present at equilibrium. What is the value of K for this equilibrium system ? (5.33)

4. The reaction $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$ has the equilibrium constant value K = 0.24 at 300°C .

(a) Is the following reaction mixture at equilibrium: $[PCl_5] = 2.6\ M$; $[PCl_3] = 0.5\ M$; $[Cl_2] = 0.5\ M$? (no)

(b) Predict the direction in which the system will react to reach equilibrium. (forward rx)

5. At 400°C , K = 64 for the equilibrium $H_{2(g)} + I_{2(g)} \Leftrightarrow 2\ HI_{(g)}$

If 1.0 mol of H_2 and 2.0 mol of I_2 are introduced into an empty 0.5 L vessel, find the equilibrium concentrations of all components at 400°C. (.11M ; 2.11M ; 3.78M)