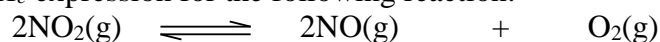


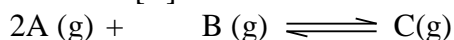
Equilibrium/SS**Name:**

For complete credit show all the work for the calculations and give the answers in the correct significant figures.

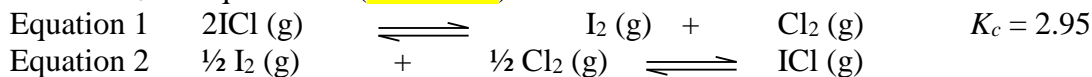
- 1) Write the K_c expression for the following reaction:



- 2) Calculate the K_c for the following reaction if the concentrations are $[\text{A}] = 2.4 \times 10^{-2} \text{ M}$, $[\text{B}] = 4.6 \times 10^{-3} \text{ M}$ and $[\text{C}] = 6.2 \times 10^{-3} \text{ M}$.



- 3) What is the K_c for equation 2? (ans: 0.582)



- 4) At 22°C the equilibrium constant for the following reactions 0.02. If 0.800 mole of N_2 and 0.800 mole of O_2 were injected into a closed 1.0 L container, what would the concentration of the three gases be at equilibrium? (ans: $x=0.0528$)



(Strategy: Use the ICE method)

- 5) For the reaction $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$ $K_c = 54.3$
 If one mole of H_2 and I_2 are placed in a 5.0 L container, what is the concentration of HI at equilibrium? (ans: 0.157)
 (Strategy: Use the ICE method)

- 6) Carbon monoxide reacts with steam to produce carbon dioxide and hydrogen. At 700K the equilibrium constant is 5.10. Calculate the equilibrium concentrations of all species if 1.000 mol of each component is added to a 1.00 L flask. (ans: 0.386)
 (Strategy: a) find the direction of the eq first using Q_c ; b) now use the ICE method)

- 7) The following substances, at the given pressures, are in a 15.5 L reaction vessel at 773 K: 3.68 atm CO, 30.7 atm H_2 , 33.2 atm CH_4 , and 28.4 atm H_2O . In what direction will the net reaction occur to reach the equilibrium? (P52; ans: 8.86×10^{-3} , right)

$$\text{CO(g)} + 3\text{H}_2\text{(g)} \rightleftharpoons \text{CH}_4\text{(g)} + \text{H}_2\text{O(g)} \quad K_p = 102 \text{ at } 773 \text{ K}$$

- 8) Determine the K_c for the following reactions with K_p values given. (P19)
- a) $\text{SO}_2\text{Cl}_2\text{(g)} \rightleftharpoons \text{SO}_2\text{(g)} + \text{Cl}_2\text{(g)}$ $K_p = 2.9 \times 10^{-2}$ at 303 K (ans: 1.2×10^{-3})
- b) $2\text{NO}_2\text{(g)} \rightleftharpoons 2\text{NO(g)} + \text{O}_2\text{(g)}$ $K_p = 0.275$ at 700 K (ans: 4.79×10^{-3})

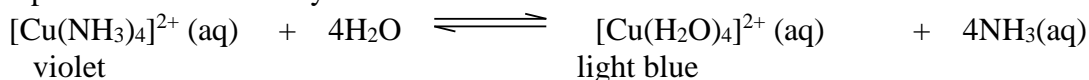
- 9) For the reaction of carbon with steam: $C + H_2O \rightleftharpoons CO + H_2(g)$, $K_c = 0.111$ at 1100 K. if 0.100 mol steam, and 0.100 mol hydrogen are mixed with excess carbon, at this temperature and equilibrium is established. How many mols of CO will be present? No CO is present initially.
(ans: 0.0436 mol)

- 10) Give FOUR the conditions can you apply to shift the equilibrium forward?



Bonus

- 11) Consider the following complex ion equation and answer the following questions with a brief explanation of WHY in your answer:



- a) What will be color of the solution if ammonium hydroxide is added to the solution?
- b) What will happen to equilibrium if a small amount of hydrochloric acid is added to the solution? What will be the color of the solution?
- c) What will happen to equilibrium if a small amount of $CuCl_2 \cdot 5H_2O$ is added to the solution?