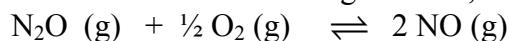


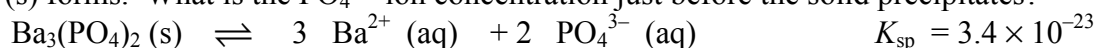
- 1) At 25°C, the value of the K_{eq} is 1.7×10^{-13} for the following reaction,



The following concentrations are determined at equilibrium: $[\text{N}_2\text{O}] = 0.0035 \text{ M}$ and $[\text{O}_2] = 0.0027 \text{ M}$

What is the concentration of NO at this equilibrium position?

- 2) A solution is found to have a Ba^{2+} concentration equal to $5.0 \times 10^{-4} \text{ M}$. A solution of Na_3PO_4 is added until $\text{Ba}_3(\text{PO}_4)_2 \text{ (s)}$ forms. What is the PO_4^{3-} ion concentration just before the solid precipitates?



- 3) K_{sp} is a measure of solubility. Thus, one should be able to convert from solubility to K_{sp} . The solubility of Ca(OH)_2 in water is 0.173g/100 mL (*This is the point at which a saturated solution is formed.*)

Follow these steps to convert from the solubility to the K_{sp} of Ca(OH)_2 .

- a) What is the molarity of a Ca(OH)_2 solution when saturated. (M = moles/L)

- b) Complete the chemical equation: $\text{Ca(OH)}_2 \text{ (s)} \rightleftharpoons$

- c) Write the K_{sp} expression of Ca(OH)_2 : $K_{sp} =$

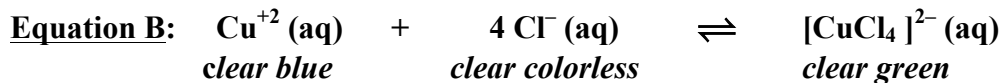
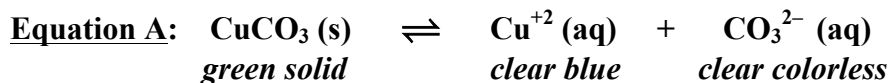
- d) Determine the equilibrium concentrations of Ca^{+2} and OH^-

- e) Solve for the K_{sp}

- 4) A famous technique for producing ammonia gas (NH_3) is called the Haber process. It is an equilibrium process described by this reaction: $\text{N}_2 \text{ (g)} + 3 \text{H}_2 \text{ (g)} \rightleftharpoons 2 \text{NH}_3 \text{ (g)} + \text{heat}$

- a) List five changes that could be made to shift the equilibrium towards products (get more NH_3).

- b) Which change listed above would slow down the RATE of the forward and reverse reactions?



Answer the following questions, by analyzing the equilibrium system described in the reactions above.

- 5) A clear blue $\text{Cu}(\text{NO}_3)_2$ solution is put into a test tube. What ions are in this solution? _____
- 6) A clear colorless Na_2CO_3 solution is added to the test tube. What ions are in the Na_2CO_3 solution? _____

When the Na_2CO_3 solution is added to the test tube, equation A shifts.

- a) In what direction does Eq. A shift? _____
- b) What should be observed when Eq. A makes this shift?
(Discuss formation/dissolution of any solids and any changes in the colors of solutions.)
- c) Use Le Châtelier's Principle to explain why Eq A shifts as you have determined.

- 7) Now, a clear colorless HCl solution is added to the test tube. What ions are in the HCl solution? _____

When the HCl solution is added to the test tube, equation B shifts.

- a) In what direction does Eq. B shift? _____
- b) What should be observed when Eq. B makes this shift?
(Discuss formation/dissolution of any solids and any changes in the colors of solutions.)
- c) Use Le Châtelier's Principle to explain why Eq B shifts as you have determined.

When the HCl solution is added to the test tube, equation A also shifts.

- d) In what direction does Eq. A shift? _____
- e) What should be observed when Eq. A makes this shift?
(Discuss formation/dissolution of any solids and any changes in the colors of solutions.)
- f) Use Le Châtelier's Principle to explain why Eq A shifts as you have determined.