Grossmont College Name: \_\_\_\_\_\_\_\_\_Key\_\_\_\_\_\_\_\_\_\_\_\_

Chemistry 142

Spring 2015, Quiz 5 Date: \_\_\_\_\_\_\_\_\_\_\_\_

1. Suppose 250.0 mL thiosulfate titrant is made as described below and standardized again a 0.0500 M solution of potassium iodate, also as described below. If the initial burette reading is 0.15 mL and the final reading is 29.52 mL, what is the molarity of the sodium thiosulfate titrant?

The Thiosulfate titrant solution itself must be standardized against primary Potassium Iodate

IO3- (aq) + 8 I- (aq) + 6 H+(aq) 3 I3-(aq) + 3 H2O

I3- (aq) + 2 S2O32-(aq) 3 I-(aq) + S4O62-(aq)

Volume used of KIO3 = 29.52 mL - 0.15 mL = 29.37 mL KIO3

$$\frac{29.37 mL KIO\_{3} × \frac{0.0500 mol KIO\_{3} }{1000 mL } × \frac{1 mol IO\_{3}^{-}}{1 mol KIO\_{3}} × \frac{3 mol I\_{3}^{-}}{1 mol IO\_{3}^{-}} × \frac{2 mol S\_{2}O\_{3}^{2-}}{1 mol I\_{3}^{-}} × \frac{1 mol Na\_{2}S\_{2}O\_{3}}{1 mol S\_{2}O\_{3}^{2-}}}{0.2500 L}$$

$$\left[Na\_{2}S\_{2}O\_{3}\right]=0.0352 M$$

1. What is the solubility of Magnesium Hydroxide in a neutral solution (pure water)? (Ksp= 1.8×10-11)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Mg(OH)2 (s) $⇌$ | Mg2+ (aq) +  | 2 OH- (aq)  |
| I | n/a | 0 M | 0 M  |
| C | n/a  | + s | +2s |
| E | n/a | s | 2s  |

$$K\_{sp}=\left[Mg^{2+}\right]\left[OH^{-}\right]^{2}$$

$$K\_{sp}=1.8×10^{-11}=(s)(2s)^{2}$$

$$K\_{sp}=1.8×10^{-11}=4s^{3}$$

$$s=1.7×10^{-4} M $$

1. What is the solubility of Magnesium Hydroxide in a solution buffered at pH=12.50?

$$pOH=14 -12.5 =1.5$$

$$\left[OH^{-}\right]= 10^{-1.5}=0.0316$$

|  |  |  |  |
| --- | --- | --- | --- |
|  | Mg(OH)2 (s) $⇌$ | Mg2+ (aq) +  | 2 OH- (aq)  |
| I | n/a | 0 M | 0.03**1**6 M  |
| C | n/a  | + s | +2s |
| E | n/a | s | 0.03**1**6 M + 2s  |

$$K\_{sp}=\left[Mg^{2+}\right]\left[OH^{-}\right]^{2}$$

$$K\_{sp}=1.8×10^{-11}=(s)(0.0316 M + 2s )^{2}$$

$$Assume 2s \ll 00.316$$

$$1.8×10^{-11}=(s)(0.0316 M )^{2}$$

$$s=1.8×10^{-8} M $$

Check

$$\frac{2 × 1.8×10^{-8} M }{0.0316 M} ×100\%=1.1 ×10^{-4 }\% Valid$$

1. Why is the solubility different between questions 2 and 3? What happen to the molar solubility of Magnesium Hydroxide if HNO3 was used? Explain why

If you have a solution and solute in equilibrium, adding a common ion (an ion that is common with the dissolving solid) decreases the solubility of the solute. This is because Le Chatelier's principle states the reaction will shift toward the left (toward the reactants) to relieve the stress of the excess product. When equilibrium is shifted toward the reactants, the solute precipitates.

If you have a solution and solute in equilibrium, adding an acid increases the solubility of the solute (the H+ will react with the OH- in the products generating water and thus reducing the OH- concentration in the products). This is because Le Chatelier's principle states the reaction will shift toward the right (toward the products) to relieve the stress of the removal of product. When equilibrium is shifted toward the products, the solute dissolves.