

3.5/10

Chemistry 203

Pre-Lab Assignment:

Semi-micro Qualitative Analysis of Ag⁺, Cu²⁺⁺, Fe³⁺ and Al³⁺

Exp 3

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Lab Section: 8

1. a. Calculate the solubility product constant at for calcium sulfate knowing that its solubility at 25°C is found to be 0.670g/L in pure water.

$$\text{CaSO}_4 \rightarrow \text{Ca}^{2+} + \text{SO}_4^{2-} \quad (n_{\text{CaSO}_4} = n_{\text{Ca}^{2+}} = n_{\text{SO}_4^{2-}}) \Rightarrow n_{\text{CaSO}_4} = \frac{m}{M} = \frac{0.67}{40.32 + 4 \times 16} = 4.93 \text{ mmol}$$

$$K_{sp} = [\text{Ca}^{2+}][\text{SO}_4^{2-}] = s \cdot s = s^2$$

$$= (4.93 \times 10^{-2})^2 = 24.3 \times 10^{-6}$$

$$\Rightarrow [\text{Ca}^{2+}] = [\text{SO}_4^{2-}] = 4.93 \times 10^{-2} \text{ mol/L}$$

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b. Predict what will happen to the solubility of this salt in 0.100M solution of sodium sulfate and calculate its new value.

solubility would decrease



$$[\text{Ca}^{2+}] = s \text{ M}$$

$$[\text{SO}_4^{2-}] = s + 0.1 \text{ M}$$

$$\Rightarrow K_{sp} = (s)(s + 0.100) = 24.3 \times 10^{-6} \Rightarrow s^2 + 0.1s - 24.3 \times 10^{-6} = 0 \Rightarrow s = 2.42 \times 10^{-4} \text{ mol/L}$$

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2. Based on the studied methods of separation, describe how you would separate and identify Fe³⁺ ion from Al³⁺ ion if present in a mixture. Write chemical reactions.

5.5

we add concentrated solution of NaOH to the mixture.

we will get an orange brown solid (precipitate) and a colorless liquid.

we filter the precipitate from the liquid. { separation }

1) we add to precipitate H₂SO₄ concentrated → to get a brown orange solid Fe(OH)₃

then add to solid H₂SO₄ concentrated → to get liquid Fe³⁺

then " KSCN to get FeSCN²⁺ red solution

2) we add HNO₃ to form liquid Al³⁺ then add NH₃ conc → get white gelatinous solid Al(OH)₃

then add HNO₃ → liquid Al³⁺ → add NH₂ → get Al(OH)₃ red pink solid

