Gravimetric analysis of Ag

What is the silver ion concentration in a solution of $AgNO_3$ if the addition of an excess of K_3PO_4 to 50.0 mL of the $AgNO_3$ solution produces 0.3634 g of precipitate?

Gravimetric analysis of Ag

What is the silver ion concentration in a solution of $AgNO_3$ if the addition of an excess of K_3PO_4 to 50.0 mL of the $AgNO_3$ solution produces 0.3634 g of precipitate? (Ag = 107.8; P = 30.9; K = 39.0)

Solution: Step 1 Determine the identity of the precipitant.

Step 2. Write a balanced equation.

Step 3. Calculate the number of moles of the precipitant.

Step 4. Determine the initial concentration.

Gravimetric analysis of Ag

What is the silver ion concentration in a solution of $AgNO_3$ if the addition of an excess of K_3PO_4 to 50.0 mL of the $AgNO_3$ solution produces 0.3634 g of precipitate? (Ag = 107.8; P = 30.9; K = 39.0)

Solution: The precipitant must be Ag_3PO_4.

The balanced equation is:

$$3\ AgNO_3(aq) + K_3PO_4(aq) \rightarrow 3\ KNO_3(aq) + Ag_3PO_4(s)$$

The number of moles of the precipitant.

$$n_{Ag_3PO_4} = \frac{m_{Ag_3PO_4}}{M_{m,Ag_3PO_4}} = \frac{0.3634\ gm}{418.6\ gm/mol} = 8.68\ x\ 10^{-4}\ mol$$

Which used the molar mass of Ag_3PO_4

$$M_{m,Ag_3PO_4} = 3(107.86) + 31 + 4(16) = 418.5\ amu$$

Gravimetric analysis of Ag

What is the silver ion concentration in a solution of $AgNO_3$ in 50.0 mL?

The number of moles of Ag_3PO_4 is 1/3 of the initial number of moles of $AgNO_3$ by stoichiometry.

$$n_{AgNO_3} = 3\, n_{Ag_3PO_4} = 3(8.68 \text{ x } 10^{-4})\text{mol}$$

Therefore the concentration in 50 mL was:

$$c_{AgNO_3} = \frac{n_{AgNO_3}}{V} = \frac{2.6 \text{ x } 10^{-3}\ mol}{0.05\ L} = 0.052\ M$$