60 pts

Solution Stoichiometry

Directions: Think! Do all 10 stpes.

1. What mass of sodium chromate is required to precipitate all the silver ions from 75.0 mL of a 0.100 M solution of silver nitrate?

sodium chromate + silver nitrate → silver chromate + sodium nitrate

$Na_2CrO_4(aq) + 2\,AgNO_3(aq) \rightarrow Ag_2CrO_4(s) + 2\,NaNO_3(aq)$

? g — 75.00 mL, .100 mol/L

$M = \frac{mol}{L}$

$75.0mL \times \frac{1L}{1000mL} \times \frac{.100\,mol\,AgNO_3}{L} \times \frac{1\,mol\,Na_2CrO_4}{2\,mol\,AgNO_3} \times \frac{162.0\,g\,Na_2CrO_4}{1\,mol\,Na_2CrO_4} = .608\ g\ Na_2CrO_4$

$mol = L \times M$

2. What volume of 0.100 M sodium phosphate is required to precipitate all the lead (II) ions from 150.0 mL of 0.250 M lead (II) nitrate solution?

sodium phosphate + lead(II) nitrate → sodium nitrate + lead(II) phosphate

$2\,Na_3PO_4(aq) + 3\,Pb(NO_3)_2(aq) \rightarrow 6\,NaNO_3(aq) + Pb_3(PO_4)_2(s)$

? mL, .100 mol/L — 150.0 mL, .250 mol/L

$150.0\,mL \times \frac{.250\,mol\,Pb(NO_3)_2}{1L} \times \frac{2\,mol\,Na_3PO_4}{3\,mol\,Pb(NO_3)_2} \times \frac{1L}{.100\,mol\,Na_3PO_4} = 250.\ mL$

3. What mass of calcium sulfate can be produced from 17.6 mL of a 0.500 M calcium chloride solution reacting with excess potassium sulfate solution?

calcium chloride + potassium sulfate → calcium sulfate + potassium chloride

$CaCl_2(aq) + K_2SO_4(aq) \rightarrow CaSO_4(s) + 2\,KCl(aq)$

17.6 mL, .500 mol/L — ? g

$17.6mL \times \frac{1L}{1000mL} \times \frac{.500\,mol\,CaCl_2}{1L} \times \frac{1\,mol\,CaSO_4}{1\,mol\,CaCl_2} \times \frac{136.1\,g\,CaSO_4}{1\,mol\,CaSO_4} = 1.20\ g\ CaSO_4$

4. How many milliliters of 0.250 M sodium hydroxide solution are needed to completely react with 50.0 mL of a 0.750 M solution of iron (III) nitrate?

sodium hydroxide + iron(III) nitrate → iron(III) hydroxide + sodium nitrate

$3\ NaOH_{(aq)} + Fe(NO_3)_{3(aq)} \rightarrow Fe(OH)_{3(s)} + 3\ NaNO_3$

? mL, .250 mol/L | 50.0 mL, .750 mol/L

$$50.0\text{mL} \times \frac{.750\text{mol } Fe(NO_3)_3}{1\text{L}} \times \frac{3\text{mol NaOH}}{1\text{mol } Fe(NO_3)_3} \times \frac{1\text{L}}{.250\text{mol NaOH}} = 450.\ \text{mL}$$

5. If 18.34 mL of lead (II) nitrate solution is needed to completely react with 25.0 mL of a 0.100 M potassium chloride solution, then what was the concentration of the lead (II) nitrate solution?

lead(II) nitrate + potassium chloride → lead(II) chloride + potassium nitrate

$Pb(NO_3)_{2(aq)} + 2\ KCl_{(aq)} \rightarrow PbCl_{2(s)} + 2\ KNO_{3(aq)}$

? mol/L | 25.0 mL, .100 mol/L

want mol/L

$$25.0\text{mL} \times \frac{.100\text{mol KCl}}{1\text{L}} \times \frac{1\text{mol } Pb(NO_3)_2}{2\text{mol KCl}} \times \frac{1}{18.34\text{mL}} = \frac{.0682\text{ mol } Pb(NO_3)_2}{\text{L}}$$

.0682 M or .0682 mol $Pb(NO_3)_2$/L

6. What mass of solid aluminum hydroxide can be produced when 50.0 mL of 0.200 M aluminum nitrate solution is added to 200.0 mL of 0.100 M potassium hydroxide solution?

aluminum nitrate + potassium hydroxide → aluminum hydroxide + potassium nitrate

$Al(NO_3)_{3(aq)} + 3\ KOH_{(aq)} \rightarrow Al(OH)_{3(s)} + 3\ KNO_{3(aq)}$

50.0 mL, .200 mol/L | 200.0 mL, .100 mol/L | ? g

$$50.0\text{mL} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{.200\text{mol } Al(NO_3)_3}{1\text{L}} \times \frac{1\text{mol } Al(OH)_3}{1\text{mol } Al(NO_3)_3} \times \frac{78.00\text{g } Al(OH)_3}{1\text{mol } Al(OH)_3} = .78\text{ g } Al(OH)_3$$

$$200.0\text{mL} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{.100\text{mol KOH}}{1\text{L}} \times \frac{1\text{mol } Al(OH)_3}{3\text{mol KOH}} \times \frac{78.00\text{g } Al(OH)_3}{1\text{mol } Al(OH)_3} = .52\text{ g } Al(OH)_3$$