KEY

Review – Solutions – V1

1.) If you dissolve $1.50\ mol$ of aluminum chloride in $2.25\ L$ of water, calculate [ ] of each ion.

Answer – $\frac{1.50\ mol}{2.25\ L} = 0.66667\ M\ AlCl_3$ $\quad \frac{AlCl_3}{0.667\ M} \rightarrow \frac{Al^{+3}}{0.667\ M} + \frac{3\ Cl^-}{2.00\ M}$

$[Al^{+3}] = 0.667\ M$ $\quad [Cl^{-1}] = 2.00\ M$

2.) If you dissolve $0.240\ mol$ of ammonium sulphate in $320\ mL$ of water, calculate [$NH_4^{+1}{}_{(aq)}$].

Answer – $\frac{0.240\ mol}{0.320\ L} = 0.750\ M\ (NH_4)_2SO_4$ $\quad \frac{(NH_4)_2SO_4}{0.750\ M} \rightarrow \frac{2\ NH_4^{+1}}{1.50\ M} + \frac{SO_4^{-2}}{0.750\ M}$

$[NH_4^{+1}] = 1.50\ M$

3.) If the $[Cl^-] = 0.015\ M$ in $75\ mL$ of water, how many moles of iron (III) chloride were there?

Answer – $\frac{FeCl_3}{0.0050\ M} \rightarrow \frac{Fe^{+3}}{0.0050\ M} + \frac{3\ Cl^-}{0.015\ M}$ $\quad 0.075\ L \times \frac{0.0050\ mol}{1\ L} = 0.000375\ mol\ FeCl_3$

$= 0.00038\ mol\ FeCl_3$

4.) How much water would you need if you started with $1.20\ mol$ of sodium oxalate but wanted a solution with $[Na^{+1}] = 0.48M$?

Answer – $\frac{Na_2C_2O_4}{0.24\ M} \rightarrow \frac{2\ Na^+}{0.48\ M} + \frac{C_2O_4^{-2}}{0.24\ M}$ $\quad 1.20\ mol\ Na_2C_2O_4 \times \frac{1\ L}{0.24\ mol} = 5.0\ L$

$= 5.0\ L\ water$

5.) In $1.25\ L$ of a $0.50\ M$ nickel (III) sulphate solution, calculate moles of nickel (III) ions.

Answer – $1.25\ L \times \frac{0.50\ mol}{1\ L} = 0.625\ mol\ Ni_2(SO_4)_3$ $\quad \frac{Ni_2(SO_4)_3}{0.625} \rightarrow \frac{2\ Ni^{+3}}{1.25} + \frac{3\ SO_4^{-2}}{1.875}$

$Ni^{+3} = 1.3\ mol$ $\quad SO_4^{-2} = 1.9\ mol$

Or

$0.625\ mol\ Ni_2(SO_4)_3 \times \frac{3\ mol\ SO_4^{-2}}{1\ mol\ Ni_2(SO_4)_3} = 1.875\ mol\ SO_4^{-2}$ $\quad 0.625\ mol\ Ni_2(SO_4)_3 \times \frac{2\ mol\ Ni^{+3}}{1\ mol\ Ni_2(SO_4)_3} = 1.25\ mol\ Ni^{+3}$

$Ni^{+3} = 1.3\ mol$ $\quad SO_4^{-2} = 1.9\ mol$

6.) How many grams of ammonium chloride are present in a $0.30\ L$ beaker of a $0.40\ M$ solution of ammonium chloride?

Answer – $0.30\ L \times \frac{0.40\ mol}{1\ L} \times \frac{53.50\ g}{1\ mol} = 6.42\ g\ NH_4Cl$

7.) How many litres of a $0.250\ M$ potassium chromate solution contains $38.8\ g$ of K_2CrO_4 solution?

Answer – $38.8\ g\ K_2CrO_4 \times \frac{1\ mol}{194.20\ g} \times \frac{1\ L}{0.250\ mol} = 0.79916\ L\ K_2CrO_4$

$= 0.799\ L\ K_2CrO_4$

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8.) A chemist evaporated $25.0\ mL$ of a sodium chloride solution to dryness. He found $0.585\ g$ of NaCl. What was the original concentration of the salt?

Answer - $0.585\ g\ NaCl \times \frac{1\ mol}{58.44\ g} \times \frac{1}{0.0250\ L} = 0.400\ M\ K_2CrO_4$

$= 0.400\ M\ NaCl$

9.) If you dissolve $316\ g$ of magnesium bromide in $859\ mL$ of water, calculate [ ]'s of each ion.

Answer - $316\ g\ MgBr_2 \times \frac{1\ mol}{184.11\ g} \times \frac{1}{0.859\ L} = 1.9980\ M\ MgBr_2$ $\quad \frac{MgBr_2}{2.00\ M} \rightarrow \frac{Mg^{+2}}{2.00\ M} + \frac{2\ Br^-}{4.00\ M}$

$[Mg^{+2}] = 2.00\ M \qquad [Br^-] = 4.00\ M$

10.) $31.1\ g$ of aluminum sulphate is dissolved in $756\ mL$ of water. Calculate [ ] of each ion.

Answer - $31.1\ g\ Al_2(SO_4)_3 \times \frac{1\ mol}{342.14\ g} \times \frac{1}{0.756\ L} = 0.12024\ M\ Al_2(SO_4)_3$ $\quad \frac{Al_2(SO_4)_3}{0.120\ M} \rightarrow \frac{2\ Al^{+3}}{0.240\ M} + \frac{3\ SO_4{}^{-2}}{0.361\ M}$

$[Al^{+3}] = 0.240\ M \qquad [SO_4{}^{-2}] = 0.361\ M$

11.) $250.0\ mL$ of a $1.2\ M$ $[Pb(NO3)_{2\ (aq)}]$ solution is diluted to $600.0\ mL$. Calculate [$Pb(NO_3)_{2\ (aq)}$] and [$Pb^{+2}{}_{(aq)}$] and [$NO_3{}^{-1}{}_{(aq)}$].

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}} \qquad C_{dil} = \frac{(1.2)(0.250)}{(0.600)} \qquad C_{dil} = 0.50\ M\ Pb(NO_3)_2$

$\frac{Pb(NO_3)_2}{0.50\ M} \rightarrow \frac{Pb^{+2}}{0.50\ M} + \frac{2\ NO_3{}^-}{1.00\ M}$

$[NO_3{}^-] = 1.0\ M \qquad [Pb^{+2}] = 0.50\ M \qquad [Pb(NO_3)_2] = 0.50\ M$

12.) $0.300\ L$ of a sodium sulphate solution is diluted to $0.750\ L$. The **diluted** concentration of sodium ions is $0.72\ M$. Calculate the **original** concentration of the sodium sulphate solution.

Answer - $\frac{Na_2SO_4}{0.36\ M} \rightarrow \frac{2\ Na^+}{0.72\ M} + \frac{SO_4{}^{-2}}{0.36\ M} \qquad C_{conc} = \frac{C_{dil} \times V_{dil}}{V_{conc}} \qquad C_{conc} = \frac{(0.36)(0.750)}{(0.300)}$

$C_{conc} = 0.90\ M\ Na_2SO_4$

13.) In soda pop, the concentration of dissolved sugar is approximately $0.0125\ M$. However, in the syrup mix, the sugar concentration is $5.6\ M$. How many millilitres of the syrup would be needed to make $2.0\ L$ of drinkable soda pop?

Answer - $V_{conc} = \frac{C_{dil} \times V_{dil}}{C_{conc}} \qquad V_{conc} = \frac{(0.0125)(2.0)}{(5.6)} \qquad V_{conc} = 0.0045\ L$

$V_{conc} = 4.5\ mL$

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14.) By accident, $3.57\ mL$ of syrup from the previous question was used instead. Calculate the concentration of the sugar in the $2.0\ L$ soda pop.

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(5.6)(0.00357)}{(2.0)}$ $C_{dil} = 0.010\ M$

15.) A chemist has $46.8\ mL$ of a $0.400\ M$ NaCl solution. How much water should be added to make a $0.250\ M$ solution?

Answer - $V_{dil} = \frac{C_{conc} \times V_{conc}}{C_{dil}}$ $V_{dil} = \frac{(0.400)(0.0468)}{(0.250)}$ $V_{dil} = 0.0750\ L$

$0.0750 - 0.0468 = 0.028176\ L$ $= 0.0282\ L\ or\ 28.2\ mL$

16.) Stephanie adds water to a $125\ mL, 3.6\ M$ sodium phosphate solution until she has $1.00\ L$. Calculate the [ ] of each ion.

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(3.6)(0.125)}{(1.0)}$ $C_{dil} = 0.45\ M\ Na_3PO_4$

$\frac{Na_3PO_4}{0.45\ M} \rightarrow \frac{3\ Na^+}{1.35\ M} + \frac{PO_4^{-3}}{0.45\ M}$ $[Na^+] = 1.35\ M$ $[PO_4^{-3}] = 0.45M$

17.) $2.0\ L$ of a $0.60\ M$ ferric chloride (iron (III) chloride) solution are mixed with $1.00\ L$ of a $0.90\ M$ barium chloride solution. Calculate the [ ] of each ion.

Answer - $FeCl_{3\ (aq)} \rightarrow Fe^{+3}{}_{(aq)} + 3\ Cl^-{}_{(aq)}$ and $BaCl_{2\ (aq)} \rightarrow Ba^{+2}{}_{(aq)} + 2\ Cl^-{}_{(aq)}$

$[FeCl_3]_{dil} = \frac{(0.60)(2.0)}{(3.0)}$ $[FeCl_3]_{dil} = 0.40\ M$

$[BaCl_2]_{dil} = \frac{(0.90)(1.00)}{(3.0)}$ $[BaCl_2]_{dil} = 0.30\ M$

$\frac{FeCl_3}{0.40\ M} \rightarrow \frac{Fe^{+3}}{0.40\ M} + \frac{3\ Cl^-}{1.2\ M}$ $\frac{BaCl_2}{0.30\ M} \rightarrow \frac{Ba^{+2}}{0.30\ M} + \frac{2\ Cl^-}{0.60\ M}$

$[Cl^-] = 1.2 + 0.60 = 1.8\ M$ $[Fe^{+3}] = 0.40\ M$ $[Ba^{+2}] = 0.30\ M$

18.) $250.0\ mL$ of a $0.30\ M$ potassium sulphate and $450.0\ mL$ of a $0.80\ M$ magnesium chloride solutions are mixed. Calculate the [ ] of each ion.

Answer - $K_2SO_{4\ (aq)} \rightarrow 2\ K^+{}_{(aq)} + SO_4^{-2}{}_{(aq)}$ and $MgCl_{2\ (aq)} \rightarrow Mg^{+2}{}_{(aq)} + 2\ Cl^-{}_{(aq)}$

$[K_2SO_4]_{dil} = \frac{(0.30)(0.250)}{(0.700)}$ $[K_2SO_4]_{dil} = 0.10714\ M$

$[MgCl_2]_{dil} = \frac{(0.80)(0.450)}{(0.700)}$ $[MgCl_2]_{dil} = 0.51428\ M$

$\frac{K_2SO_4}{0.11\ M} \rightarrow \frac{2\ K^+}{0.21M} + \frac{SO_4^{-2}}{0.11\ M}$ $\frac{MgCl_2}{0.51\ M} \rightarrow \frac{Mg^{+2}}{0.51\ M} + \frac{2\ Cl^-}{1.0\ M}$

$[K^+] = 0.21\ M$ $[Mg^{+2}] = 0.51\ M$ $[SO_4^{-2}] = 0.11\ M$ $[Cl^-] = 1.0\ M$

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19.) 20.83 g of $BaCl_2$ is dissolved in 75.0 mL of 2.00 M NaCl. Calculate the concentrations of all ions.

Answer – $20.83\ g\ BaCl_2 \times \frac{1\ mol\ BaCl_2}{208.2\ g\ BaCl_2} \times \frac{1}{0.0750\ L\ BaCl_2} = 1.3334\ M\ BaCl_2$

$\frac{BaCl_2}{1.33\ M} \rightarrow \frac{Ba^{+2}}{1.33\ M} + \frac{2\ Cl^-}{2.66\ M}$ $\qquad$ $\frac{NaCl}{2.00\ M} \rightarrow \frac{Na^+}{2.00\ M} + \frac{Cl^-}{2.00\ M}$

$[Ba^{+2}] = 1.33\ M$ $\qquad$ $[Cl^-] = 2.00 + 2.66 = 4.66\ M$ $\qquad$ $[Na^+] = 2.00\ M$

20.) 71.0 g of aluminum nitrate and 53.4 g of magnesium nitrate are dissolved in 800.0 mL of water. Calculate $[Al(NO_3)_{3\ (aq)}]$, $[Mg(NO_3)_{s\ (aq)}]$, and $[NO_3^{-1}{}_{(aq)}]$.

Answer – $71.0\ g\ Al(NO_3)_3 \times \frac{1\ mol\ Al(NO_3)_3}{213.01\ g\ Al(NO_3)_3} \times \frac{1}{0.8000\ L\ Al(NO_3)_3} = 0.4166\ M\ Al(NO_3)_3$

$53.4\ g\ Mg(NO_3)_2 \times \frac{1\ mol\ Mg(NO_3)_2}{148.33\ g\ Mg(NO_3)_2} \times \frac{1}{0.8000\ L\ Mg(NO_3)_2} = 0.4500\ M\ Mg(NO_3)_2$

$\frac{Al(NO_3)_3}{0.417\ M} \rightarrow \frac{Al^{+3}}{0.417\ M} + \frac{3\ NO_3^-}{1.25\ M}$ $\qquad$ $\frac{Mg(NO_3)_2}{0.450\ M} \rightarrow \frac{Mg^{+2}}{0.450\ M} + \frac{2\ NO_3^-}{0.900\ M}$

$[Al(NO_3)_3] = 0.417\ M$ $\qquad$ $[NO_3^-] = 1.25 + 0.900 = 2.15\ M$ $\qquad$ $[Mg(NO_3)_2] = 0.450\ M$

21.) 123.0 g of sodium acetate and 0.48 mol of strontium acetate are dissolved in 496 mL of water. Calculate the concentration of acetate.

Answer – $0.48\ mol\ Sr(CH_3COO)_2 \times \frac{1}{0.496\ L\ Sr(CH_3COO)_2} = 0.96774\ M\ Sr(CH_3COO)_2$

$123.0\ g\ NaCH_3COO \times \frac{1\ mol\ NaCH_3COO}{82.04\ g\ NaCH_3COO} \times \frac{1}{0.496\ L\ NaCH_3COO} = 3.0227\ M\ NaCH_3COO$

$\frac{NaCH_3COO}{3.02\ M} \rightarrow \frac{Na^+}{3.02\ M} + \frac{CH_3COO^-}{3.02\ M}$ $\qquad$ $\frac{Sr(CH_3COO)_2}{0.967\ M} \rightarrow \frac{Sr^{+2}}{0.967\ M} + \frac{2\ CH_3COO^-}{1.94\ M}$

$[CH_3COO^-] = 3.02 + 1.94 = 4.96\ M$

22.) 40.3 g of ferric nitrate and 97.38 g of ferric chloride are dissolved in 0.25 L of water. Calculate the concentration of the ferric iron ion (Fe^{+3}).

Answer – $40.3\ g\ Fe(NO_3)_3 \times \frac{1\ mol\ Fe(NO_3)_3}{241.88\ g\ Fe(NO_3)_3} \times \frac{1}{0.25\ L\ Fe(NO_3)_3} = 0.6664\ M\ Fe(NO_3)_3$

$97.38\ g\ FeCl_3 \times \frac{1\ mol\ FeCl_2}{162.2\ g\ FeCl_3} \times \frac{1}{0.25\ L\ FeCl_3} = 2.4014\ M\ FeCl_3$

$\frac{Fe(NO_3)_3}{0.66\ M} \rightarrow \frac{Fe^{+3}}{0.66\ M} + \frac{3\ NO_3^-}{2.0\ M}$ $\qquad$ $\frac{FeCl_2}{2.40\ M} \rightarrow \frac{Fe^{+3}}{2.40\ M} + \frac{3\ NO_3^-}{7.20\ M}$

$[Fe^{+3}] = 0.66 + 2.40 = 3.0\ M$

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23.) $150.\,mL$ of $0.80\ M$ $Ca(NO_3)_2$ are mixed with $650.\,mL$ of $1.20\ M$ KNO_3. Calculate the concentration of all ions in the diluted solution.

Answer – $Ca(NO_3)_{2\,(aq)} \rightarrow Ca^{+2}{}_{(aq)} + NO_3^{-}{}_{(aq)}$ and $KNO_{3\,(aq)} \rightarrow K^{+}{}_{(aq)} + NO_3^{-}{}_{(aq)}$

$$[KNO_3]_{dil} = \frac{(1.20)(0.650)}{(0.800)} \qquad [KNO_3]_{dil} = 0.975\ M$$

$$[Ca(NO_3)_2]_{dil} = \frac{(0.80)(0.150)}{(0.800)} \qquad [Ca(NO_3)_2]_{dil} = 0.150\ M$$

$$\frac{KNO_3}{0.975\ M} \rightarrow \frac{K^+}{0.975\ M} + \frac{NO_3^-}{0.975\ M} \qquad \frac{Ca(NO_3)_2}{0.150\ M} \rightarrow \frac{Ca^{+2}}{0.150\ M} + \frac{2\ NO_3^-}{0.30\ M}$$

$$[K^+] = 0.975\ M \qquad [Ca^{+2}] = 0.150\ M \qquad [NO_3^-] = 0.975 + 0.30 = 1.3\ M$$

24.) $25\ mL$ of a $4.4\ M$ magnesium sulphate solution are mixed with $75.0\ mL$ of a $1.25\ M$ magnesium phosphate solution. Calculate the concentrations of all ions of the dilute solution.

Answer – $MgSO_{4\,(aq)} \rightarrow Mg^{+2}{}_{(aq)} + SO_4^{-2}{}_{(aq)}$ and $Mg(PO_4)_{2\,(aq)} \rightarrow 3\ Mg^{+2}{}_{(aq)} + 2\ PO_4^{-}{}_{(aq)}$

$$[MgSO_4]_{dil} = \frac{(4.4)(0.025)}{(0.100)} \qquad [MgSO_4]_{dil} = 1.1\ M$$

$$[Mg_3(PO_4)_2]_{dil} = \frac{(1.25)(0.075)}{(0.100)} \qquad [Mg_3(PO_4)_2]_{dil} = 0.9375\ M$$

$$\frac{MgSO_4}{1.1\ M} \rightarrow \frac{Mg^{+2}}{1.1M} + \frac{SO_4^{-2}}{1.1\ M} \qquad \frac{Mg_3(PO_4)_2}{0.9375\ M} \rightarrow \frac{3\ Mg^{+2}}{2.8125\ M} + \frac{2\ PO_4^{-2}}{1.875\ M}$$

$$[Mg^{+2}] = 1.1 + 2.8 = 3.9\ M \qquad [SO_4^{-2}] = 1.1\ M \qquad [PO_4^{-2}] = 1.9\ M$$

25.) $0.200\ L$ of a $0.050\ M$ $AlBr_3$ solution is added to $50.0\ mL$ of a $0.40\ M$ KOH solution.

a.) Will a precipitate form? If so, what is it?

Answer – Yes, $Al(OH)_3$

b.) Write a net ionic equation.

Answer – $Al^{+3}{}_{(aq)} + 3\ OH^{-}{}_{(aq)} \rightarrow Al(OH)_{3\,(aq)}$

c.) Calculate the mass of the precipitate, if a precipitate formed.

Answer – $AlBr_{3\,(aq)} + 3\ KOH_{(aq)} \rightarrow Al(OH)_{3\ (s)} + 3\ KBr_{(aq)}$

$$0.200\ L\ AlBr_3 \times \frac{0.050\ mol\ AlBr_3}{1\ L\ AlBr_3} \times \frac{1\ mol\ Al(OH)_3}{1\ mol\ AlBr_3} = 0.010\ mol\ Al(OH)_3$$

$$0.050\ L\ KOH \times \frac{0.40\ mol\ KOH}{1\ L\ KOH} \times \frac{1\ mol\ Al(OH)_3}{3\ mol\ KOH} = 0.00666\ mol\ Al(OH)_3$$

$$0.00666\ mol\ Al(OH)_3 \times \frac{78.01\ g\ Al(OH)_3}{1\ mol\ Al(OH)_3} = 0.52\ \text{g}\ Al(OH)_3$$

d.) If $0.65\ g$ of precipitate are recovered, calculate the % yield.

Answer – $percent\ yield = \frac{mass\ of\ product\ obtained}{mass\ of\ product\ expected} \times 100\%$

$$percent\ yield = \frac{0.65\ g}{0.52\ g} \times 100\% = 125\% \qquad 130.\,\%$$

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e.) Calculate the concentrations of spectator ions.

Answer – $AlBr_{3\,(aq)} \rightarrow Al^{+3}{}_{(aq)} + 3\,Br^{-}{}_{(aq)}$ and $KOH_{(aq)} \rightarrow K^{+}{}_{(aq)} + OH^{-}{}_{(aq)}$

$[AlBr_3]_{dil} = \frac{(0.050)(0.200)}{(0.250)}$ $[AlBr_3]_{dil} = 0.040\ M$

$[KOH]_{dil} = \frac{(0.40)(0.050)}{(0.250)}$ $[KOH]_{dil} = 0.080\ M$

$\frac{AlBr_3}{0.400\ M} \rightarrow \frac{Al^{+3}}{0.040M} + \frac{3\,Br^-}{0.12\ M}$ $\frac{KOH}{0.080\ M} \rightarrow \frac{K^+}{0.080\ M} + \frac{OH^-}{0.080\ M}$

$[K^+] = 0.080\ M$ $[Br^-] = 0.12\ M$

26.) $0.25\ L$ of a $0.24\ M$ zinc iodide solution is mixed with an equal volume of a $0.30\ M$ sodium sulphate solution.

a.) Will a precipitate form? If so, what is it?

Answer – No

b.) Write a net ionic equation.

Answer – no net ionic.

c.) Calculate the mass of the precipitate, if a precipitate formed.

Answer – No precipitate.

d.) Calculate the concentrations of spectator ions.

Answer – $ZnI_{2\,(aq)} \rightarrow Zn^{+2}{}_{(aq)} + 2\,I^{-}{}_{(aq)}$ and $Na_2SO_{4\,(aq)} \rightarrow 2\,Na^{+}{}_{(aq)} + SO_4^{-}{}_{(aq)}$

$[ZnI]_{dil} = \frac{(0.24)(0.25)}{(0.50)}$ $[ZnI]_{dil} = 0.12\ M$

$[Na_2SO_4]_{dil} = \frac{(0.30)(0.25)}{(0.50)}$ $[Na_2SO_4]_{dil} = 0.15\ M$

$\frac{ZnI}{0.12\ M} \rightarrow \frac{Zn^{+2}}{0.12M} + \frac{2\,I^-}{0.24\ M}$ $\frac{Na_2SO_4}{0.15\ M} \rightarrow \frac{2\,Na^+}{0.30\ M} + \frac{SO_4^-}{0.15\ M}$

$[Zn^{+2}] = 0.12\ M$ $[Na^+] = 0.30\ M$ $[I^-] = 0.24\ M$ $[SO_4^-] = 0.15\ M$

27.) $200.0\ mL$ of a $0.25\ M$ $AgNO_3$ is mixed with $300.0\ mL$ of a $0.10\ M$ $MgCl_2$ solution.

a.) Will a precipitate form? If so, what is it?

Answer – Yes, AgCl

b.) Write a net ionic equation.

Answer – $Ag^{+}{}_{(aq)} + Cl^{-}{}_{(aq)} \rightarrow AgCl_{(aq)}$

c.) Calculate the mass of the precipitate, if a precipitate formed.

Answer – $2\,AgNO_{3\,(aq)} + MgCl_{2\,(s)} \rightarrow 2\,AgCl_{(s)} + Mg(NO_3)_{2\,(aq)}$

$0.2000\ L\ AgNO_3 \times \frac{0.250\ mol\ AgNO_3}{1\ L\ AgNO_3} \times \frac{2\ mol\ AgCl}{2\ mol\ AgNO_3} = 0.050\ mol\ AgCl$

$0.3000\ L\ MgCl_2 \times \frac{0.10\ mol\ MgCl_2}{1\ L\ MgCl_2} \times \frac{2\ mol\ AgCl}{1\ mol\ MgCl_2} = 0.060\ mol\ AgCl$

$0.050\ mol\ AgCl \times \frac{143.32\ g\ AgCl}{1\ mol\ AgCl} = 7.2\ g\ AgCl$

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d.) Calculate the concentrations of spectator ions.

Answer – $AgNO_{3\,(aq)} \rightarrow Ag^{+}_{(aq)} + NO_3^{-}{}_{(aq)}$ and $MgCl_{2\,(aq)} \rightarrow Mg^{+}_{(aq)} + 2\,Cl^{-}_{(aq)}$

$$[AgNO_3]_{dil} = \frac{(0.25)(0.2000)}{(0.5000)} \qquad [AgNO_3]_{dil} = 0.10\ M$$

$$[MgCl_2]_{dil} = \frac{(0.10)(0.3000)}{(0.5000)} \qquad [MgCl_2]_{dil} = 0.060\ M$$

$$\frac{AgNO_3}{0.10\ M} \rightarrow \frac{Ag^{+}}{0.10M} + \frac{NO_3^{-}}{0.10\ M} \qquad \frac{MgCl_2}{0.060\ M} \rightarrow \frac{Mg^{+2}}{0.060\ M} + \frac{2\,Cl^{-}}{0.12\ M}$$

$$[Mg^{+2}] = 0.060\ M \qquad [NO_3^{-}] = 0.10\ M$$

28.) $125\ mL$ of a $0.12\ M$ aluminum sulphate solution is added to $0.25\ L$ of a $0.12\ M$ strontium hydroxide solution.

a.) Will a precipitate form? If so, what is it?

Answer – Yes, $Al(OH)_3$ and $Sr(SO_4)$

b.) Write a net ionic equation.

Answer – $Al^{+3}_{(aq)} + 3\,OH^{-}_{(aq)} + Sr^{+2}_{(aq)} + SO_4^{-2}{}_{(aq)} \rightarrow Al(OH)_{3\,(s)} + SrSO_{4\,(s)}$

c.) Calculate the mass of the precipitate, if a precipitate formed.

$$Al_2(SO_4)_{3\,(aq)} + 3\,Sr(OH)_{2\,(aq)} \rightarrow 2\,Al(OH)_{3\,(s)} + 3\,SrSO_{4\,(s)}$$

$$0.125\ L\ Al_2(SO_4)_3 \times \frac{0.12\ mol\ Al_2(SO_4)_3}{1\ L\ Al_2(SO_4)_3} \times \frac{2\ mol\ Al(OH)_3}{1\ mol\ Al_2(SO_4)_3} = 0.030\ mol\ Al(OH)_3$$

Limiting → $$0.25\ L\ Sr(OH)_2 \times \frac{0.12\ mol\ Sr(OH)_2}{1\ L\ Sr(OH)_2} \times \frac{2\ mol\ Al(OH)_3}{3\ mol\ Sr(OH)_2} = 0.020\ mol\ Al(OH)_3$$

$$0.020\ mol\ Al(OH)_3 \times \frac{78.01\ g\ Al(OH)_3}{1\ mol\ Al(OH)_3} = 1.6\ \mathrm{g}\ Al(OH)_3$$

$$0.25\ L\ Sr(OH)_2 \times \frac{0.12\ mol\ Sr(OH)_2}{1\ L\ Sr(OH)_2} \times \frac{3\ mol\ Al(OH)_3}{3\ mol\ Sr(OH)_2} = 0.030\ mol\ SrSO_4$$

$$0.030\ mol\ SrSO_4 \times \frac{183.68\ g\ SrSO_4}{1\ mol\ SrSO_4} = 5.5\ \mathrm{g}\ SrSO_4$$

d.) Calculate the concentrations of spectator ions.

Answer – N/A.