Chapter 15 Homework

15.34 Determine Molarity

A) $225\text{mL} \times \frac{1\text{L}}{1000\text{mL}} = .225\text{L}$

$M\ KNO_3(aq) = \frac{.754\text{ mol } KNO_3}{.225\text{L soln}} = \boxed{3.35\text{M } KNO_3}$

B) $M\ CaCl_2(aq) = \frac{.0105\text{ moles } CaCl_2}{.0102\text{ L solution}} = 1.03\text{M}$

C) $M\ NaCl(aq) = \frac{3.15\text{ moles NaCl}}{5.00\text{ L solution}} = 0.63\text{M}$

D) $M\ NaBr(aq) = \frac{0.499\text{ moles NaBr}}{.1\text{ L solution}} = 4.99\text{ M}$

15.35 Calculate Molarity

A) $3.51\text{g NaCl} \times \frac{1\text{mol NaCl}}{58.44\text{g NaCl}} = 0.0601\text{mol NaCl}$

$M\ NaCl(aq) = \frac{.0601\text{ mol NaCl}}{.075\text{L solution}} = 2.40\text{M}$

B) $3.51\text{g NaCl} \times \frac{1\text{mol NaCl}}{58.44\text{g NaCl}} = .0601\text{mol NaCl}$

$M\ NaCl(aq) = \frac{.0601\text{ mol NaCl}}{0.050\text{ L solution}} = 1.20\text{M}$

C) $3.51\text{g NaCl} \times \frac{1\text{mol NaCl}}{58.44\text{g NaCl}} = 0.0601\text{mol NaCl}$

$M\ NaCl(aq) = \frac{.0601\text{ mol NaCl}}{0.075\text{L solution}} = 0.801\text{ M}$

D) $3.51\text{g NaCl} \times \frac{1\text{mol NaCl}}{58.44\text{g NaCl}} = .0601\text{mol NaCl}$

$M\ NaCl(aq) = \frac{.0601\text{ mol NaCl}}{1\text{L}} = .0601\text{M}$

15.37 Grams of $CaCl_2$?

$225\text{mL solution} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{0.150\text{ mol } CaCl_2}{1\text{ L solution}} \times \frac{110.98\text{g } CaCl_2}{1\text{mol } CaCl_2}$

$= 3.75\text{g } CaCl_2$

15.49 Calculate number of moles

A) mol Na^+?

$1.00\text{L soln} \times \frac{.751\text{ moles } Na_2SO_4}{1\text{L soln}} \times \frac{2\text{ mol } Na^+}{1\text{mol } Na_2SO_4} = .502\text{ mol } Na^+$

B) mol Cl^-?

$5.50\text{L soln} \times \frac{0.1\text{ moles } FeCl_3}{1\text{L soln}} \times \frac{3\text{mol } Cl^-}{1\text{mol } FeCl_3} = 1.65\text{ mol } Cl^-$

C) mol NO_3^-?

$100\text{mL soln} \times \frac{1\text{L}}{} \times \frac{0.55\text{mol } Ba(NO_3)_2}{} \times \frac{2\text{mol } NO_3^-}{}$ =

$\frac{1000\text{mL}}{1\text{L soln}}$ $\frac{1\text{mol } Ba(NO_3)_2}{}$

$= 0.11 \text{ moles } NO_3^-$

D) mol NH_4^+?

$250\text{mL soln} \times \frac{1\text{L soln}}{1000\text{mL soln}} \times \frac{.350\text{mol } (NH_4)_2SO_4}{1\text{L soln}} \times \frac{2\text{mol } NH_4^+}{1\text{mol } (NH_4)_2SO_4}$

$= 0.175 \text{ mol } NH_4^+$

15.55 New molarity of a dilution

A) $M_1 = 0.119\text{M NaCl}$ $M_2 = ?.$ NaCl

$V_1 = 75\text{mL} \times \frac{1\text{L}}{1000\text{mL}} = .075\text{L}$

$V_2 = 75\text{mL} + 55\text{mL} = 80\text{mL} \times \frac{1\text{L}}{1000\text{mL}} = .08\text{L}$

$M_1V_1 = M_2V_2$

$(0.119\text{M})(.075\text{L}) = M_2(.08\text{L})$

$M_2 = 0.0372\text{ M NaCl (aq)}$

B) $M_1 = 0.701\text{ M NaOH(aq)}$

$V_1 = .0453\text{L}$

$M_2 = ?.$

$V_2 = .0453 + .125 = .170\text{L}$

$M_1V_1 = M_2V_2$

$(.701)(.0453) = M_2(.170)$

$M_2 = .188\text{M NaOH}$

C) $M_1 = 3.01\text{M KOH(aq)}$

$V_1 = .125\text{L}$

$M_2 = ?.$

$V_2 = 125\text{mL} + 550\text{mL} = 675\text{mL} = .675\text{L}$

$(3.01)(.125) = M_2(.675)$

$M_2 = 0.557\text{M KOH}$

D) $M_1 = 2.07\text{M } (CaCl_2\text{ aq})$

$V_1 = .0753\text{L soln}$

$M_2 = ?.$

$V_2 = 335\text{mL} + 75.3\text{mL} = 410.\text{mL} = .410\text{L}$

$(2.07)(.0753) = M_2(.410)$

$M_2 = .380\text{M } CaCl_2\text{ (aq)}$

15.59 $2\text{M NaCl (aq)} \xrightarrow{\text{Need}} .275\text{L of } .350\text{M NaCl}$

$M_1V_1 = M_2V_2$

$2(V_1) = (350)(.275)$

$V_1 = .0491\text{L}$

↳ Take this volume of 2M solution + fill up to .275L w/ water.

15.61 Have 500 mL of 0.200 M HCl $\xrightarrow{\text{Need}}$ 0.150M solution

$M_1V_1 = M_2V_2$

$(0.200)(.500) = (.150)V_2$

$V_2 = .667\,L$

* Need to add 0.167 L of water to the original solution

15.64 $Na_2CO_3(aq) + CaCl_2(aq) \rightarrow CaCO_3(s) + 2NaCl(aq)$

Goal: mL of .175M Na_2CO_3 to precipitate calcium

$1\ mol\ Na_2CO_3 = 1\ mol\ CaCl_2$

$.0372\ L\ soln \times \frac{.105\ M\ CaCl_2}{1\ L\ soln} = .00391\ mol\ CaCl_2$

$= .00391\ mol\ Na_2CO_3$

$.00391\ mol\ Na_2CO_3 \times \frac{1\ L}{.175\ mol\ Na_2CO_3} \times \frac{1000\ mL}{1\ L} = \boxed{31.3\ L\ soln}$

15.65 Goal: mL of 0.105 M Na_2S to precipitate all of the copper

$CuSO_4(aq) + Na_2S(aq) \rightarrow CuS(s) + Na_2SO_4(aq)$

$1\ mole\ CuSO_4 = 1\ mole\ Na_2S$

$27.5\ mL\ soln \times \frac{1\ L\ soln}{1000\ mL\ soln} \times \frac{.121\ mol\ CuSO_4}{1\ L\ soln} = .00333\ mol\ CuSO_4$

$= .00333\ mol\ Na_2S$

$.00333\ moles\ Na_2S \times \frac{1\ L\ soln}{.105\ moles\ Na_2S} \times \frac{1000\ mL\ soln}{1\ L\ soln} = \boxed{31.4\ mL\ Na_2S\ solution}$

15.67 Goal: g $PbCrO_4$ formed?

	$Pb(NO_3)_2(aq)$	+ $K_2CrO_4(aq)$	$\rightarrow PbCrO_4(s)$	+ $2KNO_3(aq)$
B	.00302	.025	0	0
C	-.00302	-.00302	.00302	.00604
A	0	.022	.00302	.00604

$1.00\ g\ Pb(NO_3)_2 \times \frac{1\ mole\ Pb(NO_3)_2}{331.2\ g\ Pb(NO_3)_2} = .00302\ mol\ Pb(NO_3)_2$

Before

$25\ mL\ K_2CrO_4 \times \frac{1\ L}{1000\ mL} \times \frac{1.00\ moles\ K_2CrO_4}{1\ L} = .025\ moles\ K_2CrO_4$

$.00302\ mol\ PbCrO_4 \times \frac{323.1937\ g\ PbCrO_4}{1\ mol\ PbCrO_4} = \boxed{0.976\ g\ PbCrO_4}$

15.70 Goal: L of .500 M NaOH to neutralize 40 mL of .4 M H_2SO_4

$H_2SO_4(aq) + 2NaOH(aq) \rightarrow 2H_2O(l) + Na_2SO_4(aq)$

$1\ mol\ H_2SO_4 = 2\ mol\ NaOH$

$40\ mL \times \frac{1\ L}{1000\ mL} \times \frac{.4\ moles\ H_2SO_4}{1\ L\ soln} \times \frac{2\ mol\ NaOH}{1\ mol\ H_2SO_4} = .032\ mol\ NaOH$

$.032\ mol\ NaOH \times \frac{1\ L\ soln}{.5\ mol\ NaOH} = \boxed{.064\ L\ NaOH(aq)}$

15.91

$M\ of\ Co^{2+} = \frac{.0175\ mol\ Co^{2+}}{.075\ L}$

.167

Goal: $M\ of\ Ni^{2+} = .00875$

.075 L

.117

Total volume is

50 mL + 25 mL = 75 mL

$$M \text{ of } Cl^- = \frac{.0250 + .0175}{.075}$$

.567

$$CoCl_2(aq) \longrightarrow Co^{2+}(aq) + 2Cl^-(aq)$$

$$.05\,L \times \frac{.250 \text{ moles } CoCl_2}{1\,L} \times \frac{1 \text{ mol } Co^{2+}}{1 \text{ mol } CoCl_2} = .0125 \text{ mol } Co^{2+}$$

$$.05\,L \times \frac{.250 \text{ moles } CoCl_2}{1\,L} \times \frac{2 \text{ mol } Cl^-}{1 \text{ mol } CoCl_2} = .0250 \text{ mol } Cl^-$$

$$NiCl_2(aq) \longrightarrow Ni^{2+}(aq) + 2Cl^-(aq)$$

$$.025\,L \times \frac{.350 \text{ mol } NiCl_2}{1\,L} \times \frac{1 \text{ mol } Ni}{1 \text{ mol } NiCl_2} = .00875 \text{ mol } Ni^{2+}$$

$$.025\,L \times \frac{.350 \text{ mol } NiCl_2}{} \times \frac{2 \text{ mol } Cl^-}{} = .0175 \text{ mol } Cl^-$$