

Chapter 15 Homework

15.34 Determine Molarity

$$A) 225 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.225 \text{ L}$$

$$M \text{ KNO}_3(\text{aq}) = \frac{0.754 \text{ mol KNO}_3}{0.225 \text{ L soln}} = \boxed{3.35 \text{ M KNO}_3}$$

$$B) M \text{ CaCl}_2(\text{aq}) = \frac{0.0105 \text{ moles CaCl}_2}{0.0102 \text{ L solution}} = \boxed{1.03 \text{ M}}$$

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

$$D) M \text{ NaBr}(\text{aq}) = \frac{0.499 \text{ moles NaBr}}{0.1 \text{ L solution}} = \boxed{4.99 \text{ M}}$$

15.35 Calculate Molarity

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

$$M \text{ NaCl}(\text{aq}) = \frac{0.0601 \text{ mol NaCl}}{0.025 \text{ L solution}} = \boxed{2.40 \text{ M}}$$

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

$$M \text{ NaCl}(\text{aq}) = \frac{0.0601 \text{ mol NaCl}}{0.050 \text{ L solution}} = \boxed{1.20 \text{ M}}$$

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

$$M \text{ NaCl}(\text{aq}) = \frac{0.0601 \text{ mol NaCl}}{0.075 \text{ L solution}} = \boxed{0.801 \text{ M}}$$

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

$$M \text{ NaCl}(\text{aq}) = \frac{0.0601 \text{ mol NaCl}}{1 \text{ L}} = \boxed{0.0601 \text{ M}}$$

15.37 Grams of CaCl_2 ?

$$225 \text{ mL solution} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.150 \text{ mol CaCl}_2}{1 \text{ L solution}} \times \frac{110.98 \text{ g CaCl}_2}{1 \text{ mol CaCl}_2}$$

$$= \boxed{3.75 \text{ g CaCl}_2}$$

15.49 Calculate number of moles

A) mol Na^+ ?

$$1.00 \text{ L soln} \times \frac{0.251 \text{ moles Na}_2\text{SO}_4}{1 \text{ L soln}} \times \frac{2 \text{ mol Na}^+}{1 \text{ mol Na}_2\text{SO}_4} = \boxed{0.502 \text{ moles Na}^+}$$

B) mol Cl^- ?

$$5.50 \text{ L soln} \times \frac{0.1 \text{ moles FeCl}_3}{1 \text{ L soln}} \times \frac{3 \text{ mol Cl}^-}{1 \text{ mol FeCl}_3} = \boxed{1.65 \text{ moles Cl}^-}$$

C) mol NO_3^- ?

$$100 \text{ mL soln} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.55 \text{ mol Ba(NO}_3)_2}{1 \text{ L solution}} \times \frac{2 \text{ mol NO}_3^-}{1 \text{ mol Ba(NO}_3)_2} =$$

$$1000 \text{ mL} \quad 1 \text{ L soln} \quad 1 \text{ mol Ba(NO}_3)_2$$

$$= 0.11 \text{ moles NO}_3^-$$

b) mol NH_4^+ ?

$$250 \text{ mL soln} \times \frac{1 \text{ L soln}}{1000 \text{ mL soln}} \times \frac{.350 \text{ mol (NH}_4)_2\text{SO}_4}{1 \text{ L soln}} \times \frac{2 \text{ mol NH}_4^+}{1 \text{ mol (NH}_4)_2\text{SO}_4}$$

$$= 0.175 \text{ mol NH}_4^+$$

15.55 New molarity of a dilution

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

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

$$V_2 = 75 \text{ mL} + 55 \text{ mL} = 130 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = .13 \text{ L}$$

$$M_1 V_1 = M_2 V_2$$

$$(0.119 \text{ M})(.075 \text{ L}) = M_2 (.13 \text{ L})$$

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

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

$$V_1 = .6453 \text{ L}$$

$$M_2 = ?$$

$$V_2 = .6453 \text{ L} + .125 \text{ L} = .7703 \text{ L}$$

$$M_1 V_1 = M_2 V_2$$

$$(0.701)(.6453) = M_2 (.7703)$$

$$M_2 = .588 \text{ M NaOH}$$

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

$$V_1 = .125 \text{ L}$$

$$M_2 = ?$$

$$V_2 = 175 \text{ mL} + 550 \text{ mL} = 725 \text{ mL} = .725 \text{ L}$$

$$(3.01)(.125) = M_2 (.725)$$

$$M_2 = 0.517 \text{ M KOH}$$

D) $M_1 = 2.07 \text{ M CaCl}_2 \text{ (aq)}$

$$V_1 = .6753 \text{ L soln}$$

$$M_2 = ?$$

$$V_2 = 335 \text{ mL} + 75.3 \text{ mL} = 410.3 \text{ mL} = .4103 \text{ L}$$

$$(2.07)(.6753) = M_2 (.4103)$$

$$M_2 = 3.380 \text{ M CaCl}_2 \text{ (aq)}$$

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

$$M_1 V_1 = M_2 V_2$$

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

$$V_1 = .0481 \text{ L}$$

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

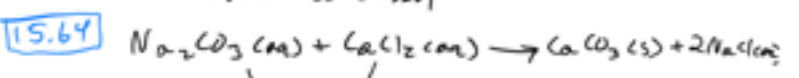
15.61 Have 500 mL of 0.200 M HCl $\xrightarrow{\text{Need}}$ 0.150 M solution

$$M_1 V_1 = M_2 V_2$$

$$(0.20)(.500) = (.150) V_2$$

$$V_2 = .667 L$$

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



Goal:
mL of
.175M
 Na_2CO_3
to precipitate
calcium

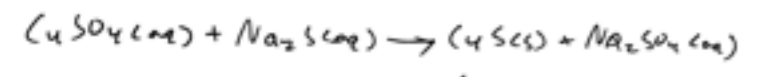
$$1 \text{ mol } Na_2CO_3 = 1 \text{ mol } CaCl_2$$

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

$$= .00391 \text{ mol } Na_2CO_3$$

$$.00391 \text{ mol } Na_2CO_3 \times \frac{1 L}{.175 M Na_2CO_3} = 31.3 L \text{ soln}$$

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



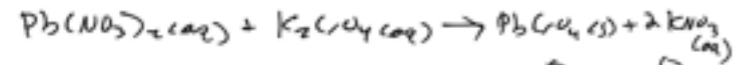
$$1 \text{ mole } CuSO_4 = 1 \text{ mole } Na_2S$$

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

$$= .00333 \text{ mol } Na_2S$$

$$.00333 \text{ mol } Na_2S \times \frac{1 L \text{ soln}}{.105 \text{ mol } Na_2S} \times \frac{1000 \text{ mL soln}}{1 L \text{ soln}} = 31.4 \text{ mL } Na_2S \text{ Solution}$$

15.67 Goal: g $PbCrO_4$ formed?



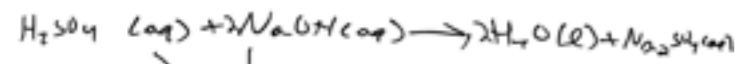
B	.00302	.025	0	0
C	-.00302	-.00302	.00302	.00604
A	0	.022	.00302	.00604

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

$$25 \text{ mL } K_2CrO_4 \times \frac{1 L}{1000 \text{ mL}} \times \frac{.100 \text{ mol } K_2CrO_4}{1 L} = .0025 \text{ mol } K_2CrO_4$$

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

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



$$1 \text{ mol } H_2SO_4 = 2 \text{ mol } NaOH$$

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

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

15.91

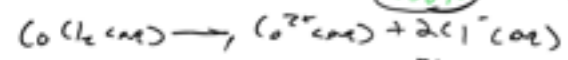
$M \text{ of } Cu^{2+} = \frac{.0175 \text{ mol } Cu^{2+}}{.075 L} = .233 M$

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

Total volume is

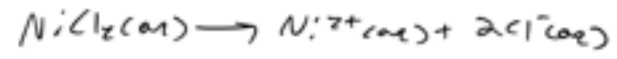
$$50\text{ mL} + 25\text{ mL} = 75\text{ mL}$$

$$M_{\text{Cl}^-} = \frac{.113 + .075}{.567} = \frac{.0250 + .0175}{.075}$$



$$.05\text{ L} \times \frac{.250\text{ mol CoCl}_2}{1\text{ L}} \times \frac{1\text{ mol Co}^{2+}}{1\text{ mol CoCl}_2} = .0125\text{ mol Co}^{2+}$$

$$.05\text{ L} \times \frac{.250\text{ mol CoCl}_2}{1\text{ L}} \times \frac{2\text{ mol Cl}^{-}}{1\text{ mol CoCl}_2} = .0250\text{ mol Cl}^{-}$$



$$.025\text{ L} \times \frac{.300\text{ mol NiCl}_2}{1\text{ L}} \times \frac{1\text{ mol Ni}^{2+}}{1\text{ mol NiCl}_2} = .0075\text{ mol Ni}^{2+}$$

$$.025\text{ L} \times \frac{.300\text{ mol NiCl}_2}{1\text{ L}} \times \frac{2\text{ mol Cl}^{-}}{1\text{ mol NiCl}_2} = .0175\text{ mol Cl}^{-}$$