**Precipitation Notes**

1)Using the solubility table mark with an X which ionic salts will form a precipitate and a "?" for those that might

Table1: Precipitates that should form using solubility table on page 155

| | $Br^-$ | $OH^-$ | $SO_4^{2-}$ | $PO_4^{3-}$ |
|---|---|---|---|---|
| $K^+$ | | | | |
| $Cu^{2+}$ | | **ppt** | | **ppt** |
| $Ag^+$ | **ppt** | **ppt** | **ppt?** | **ppt** |
| $Ba^{2+}$ | | **ppt?** | **ppt** | **ppt** |
| $Fe^{3+}$ | | **ppt** | | **ppt** |
| $Mg^{2+}$ | | **ppt** | | **ppt** |
| $Pb^{2+}$ | **ppt** | **ppt** | **ppt** | **ppt** |

Write Molecular, total Ionic and Net Ionic equation for all reactions that produce a precipitate

Example

Molecular: $Fe(NO_3)_3(aq) + 3\ NaOH(aq) \rightarrow Fe(OH)_3(s) + 3NaNO_3(aq)$

Total Ionic: $Fe^{3+} + 3\ NO_3^- + 3\ Na^+ + 3\ ^-OH \rightarrow Fe(OH)_3(s) + 3Na^+ + 3\ NO_3^-$

Net Ionic: $Fe^{3+} + 3^-OH \rightarrow Fe(OH)_3(s)$

2) Identifying Electrolytes, Weak Electrolytes and use of the Van't Hoff factor (i)

Electrolytes are strong acids/ strong bases and soluble ionic compounds (i = # of ions)
The Van't Hoff Factor (i) indicates the number of particles that will be found in solution
Weak electrolytes are compounds that partially dissociate like weak acids and weak bases (1 < i < 2)
Non-electrolytes are all molecular compounds and insoluble compounds (i = 1)

| Strong Acids | Strong Bases |
|---|---|
| HCl | All group 1 and Group 2 |
| HBr | Metal Hydroxides |
| HI | |
| $HNO_3$ | |
| $H_2SO_4$ | |
| $HClO_3$ | |
| $HClO_4$ | |

Fill in the table below

| Compound | Electrolyte (Strong/ Weak/ Non) | Van't Hoff factor |
|---|---|---|
| $BaSO_4$ | **Non (insoluble)** | **1** |
| HCl | **Strong** | **2** |
| $CH_3COOH$ (acetic acid) | **Weak** | **1 < i < 2** |
| NaOH | **Strong** | **2** |
| $Na_2SO_4$ | **Strong** | **3** |
| Ammonia ($NH_3$) weak base | **Weak** | **1 < i < 2** |
| $C_6H_{12}O_6$ | **Non** | **1** |

2) Using the following equation: **$2\ FePO_4 + 3\ Na_2SO_4 \rightarrow Fe_2(SO_4)_3 + 2\ Na_3PO_4$**

A. If 250 mL of 5.0 M iron (III) phosphate reacts with 250 mL of 5.00 M sodium sulfate, how many grams of iron (III) sulfate could be made?

**0.417 mol x 399.7 g/mol =166.7 g**

B. If a 65.0% yield is obtained, how many grams of sodium phosphate were made?

$\frac{65}{100} = \frac{X}{136.8}$ X = 88.92 g

C. What is the concentration of all reagents and products in solution?

0.852 mol/ L $FePO_4$ 0.834 mol/L $Fe_2(SO_4)_3$ 1.67 mol/ L $Na_3PO_4$

| | **$2\ FePO_4$** | **$+ 3\ Na_2SO_4$** | **→** | **$Fe_2(SO_4)_3$** | **$+ 2\ Na_3PO_4$** |
|---|---|---|---|---|---|
| Molarity or **MM** | **5 mol/ L** | **5 mol/ L** | | **399.7 g/ mol** | **164 g/ mol** |
| Amount | **0.25 mL** | **0.25 mL** | | | |
| Moles<br>Gram/ MM or<br>Molarity x L | **5 mol/ L x 0.25 L=<br>1.25 mol** | **5 mol/ L x 0.25 L=<br>1.25 mol** | | | |
| Moles/rxn<br>(divide moles by SC) | **0.625 mol** | **0.417 mol** | | | |
| React<br>(Least Mol/ Rxn) | **-0.417 mol** | **-0.417 mol** | | **+ 0.417 mol** | **+ 0.417 mol** |
| Final Mole/ Rxn | **0.208 mol** | **0** | | **0.417 mol** | **0.417 mol** |
| Final Moles<br>(SC x final mol/ rxn) | **0.416 mol** | **0** | | **0.417 mol** | **0.834 mol** |
| Final Amt<br>(final moles x MM)<br>or Concentration<br>(final mols/ total volume) | **0.426 mol/ 0.5L =<br>0.852 mol/ L** | **0** | | **0.417 mol x 399.7 g/mol =166.7 g<br><br>0.417mol / 0.5 L = 0.834 mol/ L** | **0.834 mol x 164 g/mol =136.7 g<br><br>0.834 mol/ 0.5 L = 1.67 mol/ L** |

4) Using the equation: **$Ca(OH)_{2(aq)} + 2\ HCl_{(aq)} \rightarrow 2\ NaCl_{(aq)} + 2\ H_2O_{(l)}$**

A. How many liters of 0.100 M HCl would be required to react completely with 5.00 grams of calcium hydroxide?
Information about 1 reactant to find out about the other

0.135 mol x $\frac{1\ L}{0.1\ mol}$ = 1.35 L

HAVE (-) NEED (+)

| | **$Ca(OH)_{2(aq)}$** | **$+ 2\ HCl_{(aq)}$** | **→** | **$CaCl_{2(aq)}$** | **$2\ H_2O_{(l)}$** |
|---|---|---|---|---|---|
| Molarity or **MM** | **74 g/mol** | **0.1 mol/ L** | | | |
| Amount | **5 grams** | | | | |
| Moles<br>Gram/ MM or<br>Molarity x L | **5g / 74 g/mol =<br>0.0676 mol** | | | | |
| Moles/rxn<br>(divide moles by SC) | **0.0676 mol** | | | | |
| React<br>(Least Mol/ Rxn) | **-0.0676 mol** | **+ 0.0676 mol** | | | |
| Final Mole/ Rxn | **0** | **0.0676 mol** | | | |
| Final Moles<br>(SC x final mol/ rxn) | **0** | **0.135 mol** | | | |
| Final Amt<br>(final moles x MM)<br>or Concentration<br>(final mols/ total volume) | | | | | |

B. If 15.0 grams of calcium hydroxide is combined with 75.0 mL of 0.500 M HCl, how many grams of calcium chloride would be formed? **20.87g**

HAVE (-) NEED (+)

| | $Ca(OH)_{2(aq)}$ | + 2 $HCl_{(aq)}$ | → | $CaCl_{2(aq)}$ | 2 $H_2O_{(l)}$ |
|---|---|---|---|---|---|
| Molarity or **MM** | **74 g/mol** | **0.5 mol/ L** | | **111g /mol** | |
| Amount | **15 grams** | **0.75 L** | | | |
| Moles<br>Gram/ MM or<br>Molarity x L | **15g / 74 g/mol =<br>0.2 mol** | **0.5 mol/L x 0.75L<br>=<br>0.375 mol** | | | |
| Moles/rxn<br>(divide moles by SC) | **0.2 mol** | **0.188 mol** | | | |
| React<br>(Least Mol/ Rxn) | **-0.188 mol** | **-0.188 mol** | | **+0.188 mol** | +0.188 mol |
| Final Mole/ Rxn | **0.012 mol** | **0** | | **0.188 mol** | |
| Final Moles<br>(SC x final mol/ rxn) | **0.012 mol** | **0** | | **0.188 mol** | |
| Final Amt<br>(final moles x MM)<br>or Concentration<br>(final mols/ total volume) | **0.012 mol x 74 g/ mol =<br>0.89 g** | | | **0.188 mol x 111 g/ mol=<br>20.87g** | |

C. How many grams of the excess reagent will be left over after the reaction is complete?

**0.89 g**