**Solubility:**

| | | |
|---|---|---|
| 1) | $(NH_4)_2S_{(aq)}$ | rule #1 |
| 2) | $BaO_{(aq)}$ | rule #6 |
| 3) | $NaCO_{3(aq)}$ | rule #1 |
| 4) | $Hg_2SO_{4(s)}$ | rule #5 |
| 5) | $Pb(ClO_4)_{2(aq)}$ | rule #1 |
| 6) | $SrF_{2(s)}$ | rule #4 |
| 7) | $MgC_2O_{4(s)}$ | rule #7 |
| 8) | $Li_3PO_{4(aq)}$ | rule #1 |
| 9) | $AgI_{(s)}$ | rule #3 |
| 10) | $Mn(OH)_{4(s)}$ | rule #6 |

**Electrolytes:**

| | | |
|---|---|---|
| 1) | $(NH_4)_2S_{(aq)}$ | **strong electrolyte** -- soluble salt |
| 2) | $HC_7H_6O_{2(aq)}$ | **weak electrolyte** -- weak acid |
| 3) | $N_2O_{5(l)}$ | **non electrolyte** -- molecular compound |
| 4) | $Hg_2SO_{4(s)}$ | **weak electrolyte** -- insoluble salt |
| 5) | $HClO_{4(aq)}$ | **strong electrolyte** -- strong acid |
| 6) | $SrF_{2(s)}$ | **weak electrolyte** -- insoluble salt |
| 7) | $Rb_2C_2O_{4(aq)}$ | **strong electrolyte** -- soluble salt |
| 8) | $H_3PO_{4(aq)}$ | **weak electrolyte** -- weak acid |
| 9) | $AgI_{(s)}$ | **weak electrolyte** -- insoluble salt |
| 10) | $Sr(OH)_{2(aq)}$ | **strong electrolyte** -- soluble salt |

**Net ionic equations:**

potassium phosphate and mercury (I) acetate

**M.E.** $\mathbf{2\ K_3PO_{4(aq)} + 3\ Hg_2(C_2H_3O_2)_{2(aq)} \rightarrow 6\ KC_2H_3O_{2(aq)} + (Hg_2)_3(PO_4)_{2(s)}}$

**I.E.** $\mathbf{6\ K^+_{(aq)} + 2\ PO_4^{-3}{}_{(aq)} + 3\ Hg_2^{+2}{}_{(aq)} + 6\ C_2H_3O_2^-{}_{(aq)} \rightarrow 6\ K^+_{(aq)} + 6\ C_2H_3O_2^-{}_{(aq)} + (Hg_2)_3(PO_4)_{2(s)}}$

~~6 K~~$^+_{(aq)}$ + 2 $PO_4^{-3}{}_{(aq)}$ + 3 $Hg_2^{+2}{}_{(aq)}$ + ~~6 $C_2H_3O_2^-{}_{(aq)}$~~ → ~~6 K~~$^+_{(aq)}$ + ~~6 $C_2H_3O_2^-{}_{(aq)}$~~ + $(Hg_2)_3(PO_4)_{2(s)}$

**N.I.E.** $\mathbf{2\ PO_4^{-3}{}_{(aq)} + 3\ Hg_2^{+2}{}_{(aq)} \rightarrow (Hg_2)_3(PO_4)_{2(s)}}$

sodium sulfide with iron (III) nitrate

**M.E.** $\mathbf{3\ Na_2S_{(aq)} + 2\ Fe(NO_3)_{3(aq)} \rightarrow 6\ NaNO_{3(aq)} + Fe_2S_{3(s)}}$

**I.E.** $\mathbf{6\ Na^+_{(aq)} + 3\ S^{-2}_{(aq)} + 2\ Fe^{+3}_{(aq)} + 6\ NO_3^-{}_{(aq)} \rightarrow 6\ Na_{(aq)} + 6\ NO_3^-{}_{(aq)} + Fe_2S_{3(s)}}$

~~6 Na~~$^+_{(aq)}$ + 3 $S^{-2}_{(aq)}$ + 2 $Fe^{+3}_{(aq)}$ + ~~6 $NO_3^-{}_{(aq)}$~~ → ~~6 Na~~$_{(aq)}$ + ~~6 $NO_3^-{}_{(aq)}$~~ + $Fe_2S_{3(s)}$

**N.I.E.** $\mathbf{3\ S^{-2}_{(aq)} + 2\ Fe^{+3}_{(aq)} \rightarrow Fe_2S_{3(s)}}$

oxalic acid and cesium hydroxide

**M.E.** $\mathbf{2\ CsOH_{(aq)} + H_2C_2O_{4(aq)} \rightarrow Cs_2C_2O_{4\ (aq)} + 2\ H_2O_{(l)}}$

**I.E.** $\mathbf{2\ Cs^+_{(aq)} + 2\ OH^-_{(aq)} + H_2C_2O_{4\ (aq)} \rightarrow 2\ Cs^+_{(aq)} + C_2O_4^{-2}{}_{(aq)} + 2\ H_2O_{(l)}}$

($H_2C_2O_4$ is a weak electrolyte, so it does **NOT** break up)

~~2 Cs~~$^+_{(aq)}$ + 2 $OH^-_{(aq)}$ + $H_2C_2O_{4(aq)}$ → ~~2 Cs~~$^+_{(aq)}$ + $C_2O_4^{-2}{}_{(aq)}$ + 2 $H_2O_{(l)}$

**N.I.E.** $\mathbf{2\ OH^-_{(aq)} + H_2C_2O_{4\ (aq)} \rightarrow C_2O_4^{-2}{}_{(aq)} + 2\ H_2O_{(l)}}$

mercury (I) perchlorate and lead (II) nitrate

**M.E.** $\mathbf{Hg_2(ClO_4)_{2(aq)} + Pb(NO_3)_{2(aq)} \rightarrow Hg_2(NO_3)_{2(aq)} + Pb(ClO_4)_{2(aq)}}$

**I.E.** $\mathbf{Hg_2^{+2}{}_{(aq)} + 2\ ClO_4^{-}{}_{(aq)} + Pb^{+2}{}_{(aq)} + 2\ NO_3^{-}{}_{(aq)} \rightarrow Hg_2^{+2}{}_{(aq)} + 2\ NO_3^{-}{}_{(aq)} + Pb^{+2}{}_{(aq)} + 2\ ClO_4^{-}{}_{(aq)}}$

$\cancel{Hg_2}^{+2}{}_{(aq)} + \cancel{2\ ClO_4}^{-}{}_{(aq)} + \cancel{Pb}^{+2}{}_{(aq)} + \cancel{2\ NO_3}^{-}{}_{(aq)} \rightarrow \cancel{Hg_2}^{+2}{}_{(aq)} + \cancel{2\ NO_3}^{-}{}_{(aq)} + \cancel{Pb}^{+2}{}_{(aq)} + \cancel{2\ ClO_4}^{-}{}_{(aq)}$

**N.I.E.** **NO REACTION** (when everything cancels on both sides, there is no reaction)

chromium (II) bromide with lithium oxalate

**M.E.** $\mathbf{CrBr_{2(aq)} + Li_2C_2O_{4(aq)} \rightarrow 2\ LiBr_{(aq)} + CrC_2O_{4(s)}}$

**I.E.** $\mathbf{Cr^{+2}{}_{(aq)} + 2\ Br^{-}{}_{(aq)} + 2\ Li^{+}{}_{(aq)} + C_2O_4^{-2}{}_{(aq)} \rightarrow 2\ Li^{+}{}_{(aq)} + 2\ Br^{-}{}_{(aq)} + CrC_2O_{4(s)}}$

$\cancel{Cr}^{+2}{}_{(aq)} + 2\ Br^{-}{}_{(aq)} + 2\ Li^{+}{}_{(aq)} + \cancel{C_2O_4}^{-2}{}_{(aq)} \rightarrow \cancel{2\ Li}_{(aq)} + \cancel{2\ Br}^{-}{}_{(aq)} + CrC_2O_{4(s)}$

**N.I.E.** $\mathbf{Cr^{+2}{}_{(aq)} + C_2O_4^{-2}{}_{(aq)} \rightarrow CrC_2O_{4(s)}}$

sulfuric acid with rubidium hydroxide

**M.E.** $\mathbf{2\ RbOH_{(aq)} + H_2SO_{4\ (aq)} \rightarrow Rb_2SO_{4\ (aq)} + 2\ H_2O_{(l)}}$

**I.E.** $\mathbf{2\ Rb^{+}{}_{(aq)} + 2\ OH^{-}{}_{(aq)} + 2\ H^{+} + SO_4^{-2}{}_{(aq)} \rightarrow 2\ Rb^{+}{}_{(aq)} + SO_4^{-2}{}_{(aq)} + 2\ H_2O_{(l)}}$
($H_2SO_4$ is a strong acid)

$\cancel{2\ Rb}^{+}{}_{(aq)} + \cancel{2}\ OH^{-}{}_{(aq)} + \cancel{2}\ H^{+} + \cancel{SO_4}^{-2}{}_{(aq)} \rightarrow \cancel{2\ Rb}^{+}{}_{(aq)} + \cancel{SO_4}^{-2}{}_{(aq)} + \cancel{2}\ H_2O_{(l)}$

**N.I.E.** $\mathbf{OH^{-}{}_{(aq)} + H^{+}{}_{(aq)} \rightarrow H_2O_{(l)}}$

calcium hydroxide with periodic acid

**M.E.** $\mathbf{Ca(OH)_{2\ (aq)} + 2\ HIO_{4(aq)} \rightarrow Ca(IO_4)_{2\ (aq)} + 2\ H_2O_{(l)}}$

**I.E.** $\mathbf{Ca^{+2}{}_{(aq)} + 2\ OH^{-}{}_{(aq)} + 2\ HIO_{4(aq)} \rightarrow Ca^{+2}{}_{(aq)} + 2\ IO_4^{-}{}_{(aq)} + 2\ H_2O_{(l)}}$
($HIO_4$ is a weak electrolyte, so it does **NOT** break up)

$\cancel{Ca}^{+2}{}_{(aq)} + \cancel{2}\ OH^{-}{}_{(aq)} + \cancel{2}\ HIO_{4(aq)} \rightarrow \cancel{Ca}^{+2}{}_{(aq)} + \cancel{2}\ IO_4^{-}{}_{(aq)} + \cancel{2}\ H_2O_{(l)}$

**N.I.E.** $\mathbf{OH^{-}{}_{(aq)} + HIO_{4(aq)} \rightarrow IO_4^{-}{}_{(aq)} + H_2O_{(l)}}$
(since the coefficient on each of the remaining pieces was a 2, they were all reduced to 1)

cesium chromate with rubidium oxide

**M.E.** $\mathbf{Cs_2CrO_{4(aq)} + Rb_2O_{(aq)} \rightarrow Cs_2O_{\ (aq)} + Rb_2CrO_{4(aq)}}$

**I.E.** $\mathbf{2\ Cs^{+}{}_{(aq)} + CrO_4^{-2}{}_{(aq)} + 2\ Rb^{+}{}_{(aq)} + O^{-2}{}_{(aq)} \rightarrow 2\ Cs^{+}{}_{(aq)} + O^{-2}{}_{(aq)} + 2\ Rb^{+}{}_{(aq)} + CrO_4^{-2}{}_{(aq)}}$

$\cancel{2\ Cs}^{+}{}_{(aq)} + \cancel{CrO_4}^{-2}{}_{(aq)} + \cancel{2\ Rb}^{+}{}_{(aq)} + \cancel{O}^{-2}{}_{(aq)} \rightarrow \cancel{2\ Cs}^{+}{}_{(aq)} + \cancel{O}^{-2}{}_{(aq)} + \cancel{2\ Rb}^{+}{}_{(aq)} + \cancel{CrO_4}^{-2}{}_{(aq)}$

**N.I.E.** **N.R.**

sodium fluoride with nickel (III) sulfate

**M.E.** $\mathbf{6\ NaF_{(aq)} + Ni_2(SO_4)_{3(aq)} \rightarrow 3\ Na_2SO_{4(aq)} + 2\ NiF_{3(aq)}}$

**I.E.** $\mathbf{6\ Na^{+}{}_{(aq)} + 6\ F^{-}{}_{(aq)} + 2\ Ni^{+3}{}_{(aq)} + 3\ SO_4^{-2}{}_{(aq)} \rightarrow 6\ Na^{+}{}_{(aq)} + 3\ SO_4^{-2}{}_{(aq)} + 2\ Ni^{+3}{}_{(aq)} + 6\ F^{-}{}_{(aq)}}$

$\cancel{6\ Na}^{+}{}_{(aq)} + \cancel{6\ F}^{-}{}_{(aq)} + \cancel{2\ Ni}^{+3}{}_{(aq)} + \cancel{3\ SO_4}^{-2}{}_{(aq)} \rightarrow \cancel{6\ Na}^{+}{}_{(aq)} + \cancel{3\ SO_4}^{-2}{}_{(aq)} + \cancel{2\ Ni}^{+3}{}_{(aq)} + \cancel{6\ F}^{-}{}_{(aq)}$

**N.I.E.** **N.R.**

antimony (V) carbonate reacts with sulfuric acid to form carbon dioxide, water, and antimony (V) sulfate

$Sb_2(CO_3)_{5\,(s)} + 5\ H_2SO_{4\,(aq)} \rightarrow Sb_2(SO_4)_{5\,(s)} + 5\ H_2CO_{3(aq)}$

**M.E.** $\mathbf{Sb_2(CO_3)_{5\,(s)} + H_2SO_{4\,(aq)} \rightarrow Sb_2(SO_4)_{5\,(s)} + 5\ H_2O_{(l)} + 5\ CO_{2(g)}}$

**I.E.** $\mathbf{Sb_2(CO_3)_{5\,(s)} + 2\ H^{+} + SO_4^{-2}{}_{(aq)} \rightarrow Sb_2(SO_4)_{5\,(s)} + 5\ H_2O_{(l)} + 5\ CO_{2(g)}}$

**N.I.E.** $\mathbf{Sb_2(CO_3)_{5\,(s)} + 2\ H^{+} + SO_4^{-2}{}_{(aq)} \rightarrow Sb_2(SO_4)_{5\,(s)} + 5\ H_2O_{(l)} + 5\ CO_{2(g)}}$
(nothing cancels, so I.E. and N.I.E. are the same)

lithium acetate with copper (II) nitrate

**M.E.** $\mathbf{2\ LiC_2H_3O_{2(aq)} + Cu(NO_3)_{2(aq)} \rightarrow 2\ LiNO_{3(aq)} + Cu(C_2H_3O_2)_{2(aq)}}$

**I.E.** $\mathbf{2\ Li^{+}_{(aq)} + 2\ C_2H_3O_2^{-}{}_{(aq)} + Cu^{+2}{}_{(aq)} + 2\ NO_3^{-}{}_{(aq)} \rightarrow 2\ Li^{+}_{(aq)} + 2\ NO_3^{-}{}_{(aq)} + Cu^{+2}{}_{(aq)} + 2\ C_2H_3O_2^{-}{}_{(aq)}}$

$\cancel{2\ Li^{+}}_{(aq)} + \cancel{2\ C_2H_3O_2^{-}}_{(aq)} + \cancel{Cu^{+2}}_{(aq)} + \cancel{2\ NO_3^{-}}_{(aq)} \rightarrow \cancel{2\ Li^{+}}_{(aq)} + \cancel{2\ NO_3^{-}}_{(aq)} + \cancel{Cu^{+2}}_{(aq)} + \cancel{2\ C_2H_3O_2^{-}}_{(aq)}$

**N.I.E. NO REACTION**