

Name _____
 TA _____
 Lab Day _____

Study Assignment E: Writing Net Ionic Equations

1. What happens when the following solid salts are added to water? Answer this question by first deciding if the solid salt is soluble in water. Then categorize the salt as an electrolyte or not. For example, when NaCl(s) is added to water, the principal species present are $\text{Na}^+(\text{aq})$ and $\text{Cl}^-(\text{aq})$ since NaCl is an ionic material composed of sodium and chloride ions and because NaCl is highly soluble in water. In other words, NaCl is a strong electrolyte.

	soluble/insoluble	electrolyte or not?	principal species present when placed in water
$\text{FeSO}_4(\text{s})$	soluble	yes	$\text{Fe}^{2+}(\text{aq}), \text{SO}_4^{2-}(\text{aq})$
$\text{Na}_2\text{S}(\text{s})$	soluble	yes	$\text{Na}^+(\text{aq}), \text{S}^{2-}(\text{aq})$
$\text{CuCl}_2(\text{s})$	soluble	yes	$\text{Cu}^{2+}(\text{aq}), \text{Cl}^-(\text{aq})$

2. Strong acids (e.g., hydrochloric acid) and strong bases (e.g., NaOH) are ~fully dissociated into ions in aqueous solution while weak acids (e.g., acetic acid) and weak bases (e.g., NH_3) are much less completely dissociated. The degree of dissociation obviously determines the principal species present (a weak acid will be present mostly as intact molecules, for example). Classify each of the following acids and bases as weak or strong. Then determine if an aqueous solution of the acid or base is likely to be a weak or strong electrolyte. Finally, list the principal species likely to be present when the acid or base is added to water.

	strong or weak acid/base?	strong or weak electrolyte?	principal species present when placed in water
HClO_4	strong acid	strong	$\text{H}^+(\text{aq}), \text{ClO}_4^-(\text{aq})$
Benzoic acid, $\text{C}_6\text{H}_5\text{COOH}$	weak acid	weak	$\text{C}_6\text{H}_5\text{COOH}(\text{aq})$
$\text{Cu}(\text{OH})_2(\text{s})$	weak base	weak	$\text{Cu}(\text{OH})_2(\text{s})$

3. Aqueous solutions of the following compounds are mixed. Write balanced equations to predict the result of mixing. First, write the *whole formula equation* to show that you understand which reactants and products are present. Then, write a *total ionic equation* to reflect the dissociation of electrolytes (soluble salts, strong acids, strong bases). Finally, eliminate spectator ions to arrive at the *net ionic equation*. Be sure to indicate the physical state of each reactant/product and check that you are using proper chemical formulas.

a) sodium carbonate and barium chloride are mixed and a metathesis (double displacement) reaction occurs to produce two salts:

whole formula equation	$\text{Na}_2\text{CO}_3(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow 2\text{NaCl}(\text{aq}) + \text{BaCO}_3(\text{s})$
total ionic equation	$\cancel{2\text{Na}^+} + \text{CO}_3^{2-} + \text{Ba}^{2+} + \cancel{2\text{Cl}^-} \rightarrow$ $\cancel{2\text{Na}^+} + \cancel{2\text{Cl}^-} + \text{BaCO}_3(\text{s})$
net ionic equation	$\text{Ba}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{BaCO}_3(\text{s})$

b) sodium sulfate and lead(II) nitrate are mixed and two products form

whole formula equation	$\text{Na}_2\text{SO}_4(\text{aq}) + \text{Pb}(\text{NO}_3)_2(\text{aq}) \rightarrow 2\text{NaNO}_3(\text{aq}) + \text{PbSO}_4(\text{s})$
total ionic equation	$\cancel{2\text{Na}^+} + \text{SO}_4^{2-} + \text{Pb}^{2+} + \cancel{2\text{NO}_3^-} \rightarrow$ $\cancel{2\text{Na}^+} + \cancel{2\text{NO}_3^-} + \text{PbSO}_4(\text{s})$
net ionic equation	$\text{Pb}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{PbSO}_4(\text{s})$