

## Chemistry Notes 9/25/13

### Example

1. What is the total molar concentration of ions in a 0.350M solution of sodium sulfate?
  - a.  $\text{Na}_2\text{SO}_4 \rightarrow 2\text{Na} + \text{SO}_4$
  - b. Molarity = Moles / Liters
  - c. Three times as many moles of product
  - d. Therefore,  $3 \cdot (.350\text{M}) = 1.05\text{M}$

### Molecular Equation

- All species are written out using full formulas
- $\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \rightarrow 2\text{KNO}_3(\text{aq}) + \text{PbI}_2(\text{s})$

### Complete Ionic Equation

- All strong electrolytes (CPDs that dissociate) are shown in their dissociated form
- $\text{Pb}^{+2}(\text{aq}) + 2\text{NO}_3^-(\text{aq}) + 2\text{K}^+(\text{aq}) + 2\text{I}^-(\text{aq}) \rightarrow 2\text{K}^+(\text{aq}) + 2\text{NO}_3^-(\text{aq}) + \text{PbI}_2(\text{s})$ 
  - o Note: Solids, liquids, and gases do not dissociate
  - o Spectator Ions: Those that do not participate in the reaction or undergo change
    - Ex.  $2\text{NO}_3$  and  $2\text{K}$

### Net Ionic Reaction

- $\text{Pb}^{+2}(\text{aq}) + 2\text{I}^-(\text{aq}) \rightarrow \text{PbI}_2(\text{s})$ 
  - o Leave out the spectator ions

### Example

1. Write a net ionic equation for:  $2\text{HCl}(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{H}_2(\text{g}) + \text{ZnCl}_2(\text{aq})$ 
  - a.  $2\text{H}^+(\text{aq}) + 2\text{Cl}^-(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{H}_2(\text{g}) + \text{Zn}^{+2}(\text{aq}) + 2\text{Cl}^-(\text{aq})$
  - b.  $2\text{H}^+(\text{aq}) + 2\text{Cl}^-(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{H}_2(\text{g}) + \text{Zn}^{+2}(\text{aq}) + 2\text{Cl}^-(\text{aq})$
  - c.  $2\text{H}^+(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{H}_2(\text{g}) + \text{Zn}^{+2}(\text{aq})$

### Solubility Rules (Memorize)

1. Any compounds containing group I cations/anions ( $\text{Li}^+$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Rb}^+$ , ...) or the  $\text{NH}_4^+$  ion are soluble.
2. Compounds containing  $\text{NO}_3^-$  (Nitrate),  $\text{ClO}_4^-$  (Perchlorate),  $\text{NO}_2^-$  (Nitrite),  $\text{ClO}_3^-$  (Chlorate), or  $\text{C}_2\text{H}_3\text{O}_2^-$  (acetate) are soluble
3. Compounds containing  $\text{Cl}^-$ ,  $\text{Br}^-$ , or  $\text{I}^-$  are soluble **except** with  $\text{Ag}^+$ ,  $\text{Pb}^{2+}$ , or  $\text{Hg}_2^{2+}$
4. Compounds containing  $\text{SO}_4^{2-}$  are soluble **except**  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Pb}^{2+}$ , and  $\text{Hg}_2^{2+}$

### Example

1. ZnS is (soluble/insoluble)
2. PbCl<sub>2</sub> is (soluble/insoluble)
3. Pb(NO<sub>3</sub>)<sub>2</sub> is (soluble/insoluble)

### Precipitation Reactions

- A solution of silver nitrate is mixed with a solution of sodium chloride. Write the molecular equation.
  - $\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \rightarrow$
  - $\text{Ag}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) + \text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow$
  - $\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) +$
  - $\text{Ag}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) + \text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NO}_3^-(\text{aq}) + \text{Na}^+(\text{aq})$
  - $\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NO}_3^-(\text{aq}) + \text{Na}^+(\text{aq})$
- What precipitate forms if any?  $\text{Ba}(\text{NO}_3)_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow$ 
  - $\text{Ba}^{+2}(\text{aq}) + 2\text{NO}_3^-(\text{aq}) + 2\text{Na}^+(\text{aq}) + \text{SO}_4^{-2}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{NO}_3^-(\text{aq}) + 2\text{Na}^+(\text{aq})$