

# Solubility Rules

## Chem Worksheet 15-1

Name \_\_\_\_\_

Many ionic compounds will dissolve in water so we say they are **soluble**. Sodium chloride (NaCl), and potassium nitrate (KNO<sub>3</sub>) are two examples of soluble compounds. When these compounds are mixed with water they dissolve, and we describe them as aqueous (aq). There are many ionic compounds that do not dissolve in water, though. These are described as **insoluble**. An insoluble substance simply remains in the solid state (s) when added to water. The chart below can be used to predict whether the compounds are soluble or insoluble.

**Solubility Table**

		Anions						
		Acetate C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> <sup>-</sup>	Carbonate CO <sub>3</sub> <sup>2-</sup>	Chloride Cl <sup>-</sup>	Hydroxide OH <sup>-</sup>	Iodide I <sup>-</sup>	Nitrate NO <sub>3</sub> <sup>-</sup>	Sulfate SO <sub>4</sub> <sup>2-</sup>
Cations	Aluminum Al <sup>3+</sup>	S	I	S	I	S	S	S
	Ammonium NH <sub>4</sub> <sup>+</sup>	S	S	S	S	S	S	S
	Barium Ba <sup>2+</sup>	S	I	S	S	S	S	I
	Copper (II) Cu <sup>2+</sup>	S	I	S	I	I	S	S
	Lead (II) Pb <sup>2+</sup>	S	I	S	I	I	S	I
	Silver Ag <sup>+</sup>	I	I	I	I	I	S	I
	Sodium Na <sup>+</sup>	S	S	S	S	S	S	S
	Zinc Zn <sup>2+</sup>	S	I	S	I	S	S	S

S - soluble

I - insoluble

Use the chart above to answer the following questions about solubility.

- Which of the following compounds are soluble? Which are insoluble?
  - Sodium iodide
  - Silver nitrate
  - Lead (II) chloride
  - Ammonium chloride
  - Copper (II) hydroxide
  - Aluminum hydroxide
- The following reactions take place in water. Rewrite each equation and specify whether each substance would be aqueous (aq) or solid (s).
  - $\text{Pb}(\text{NO}_3)_2 ( ) + \text{BaI}_2 ( ) \rightarrow \text{PbI}_2 ( ) + \text{Ba}(\text{NO}_3)_2 ( )$
  - $\text{Ba}(\text{C}_2\text{H}_3\text{O}_2)_2 ( ) + \text{CuSO}_4 ( ) \rightarrow \text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2 ( ) + \text{BaSO}_4 ( )$
  - $\text{ZnSO}_4 ( ) + 2\text{AgNO}_3 ( ) \rightarrow \text{Zn}(\text{NO}_3)_2 ( ) + \text{Ag}_2\text{SO}_4 ( )$
  - $\text{Cu}(\text{NO}_3)_2 ( ) + 2\text{NaOH} ( ) \rightarrow \text{Cu}(\text{OH})_2 ( ) + 2\text{NaNO}_3 ( )$
  - Silver nitrate and sodium carbonate react to form silver carbonate and sodium nitrate .
- Which three anions form the most soluble compounds?
- Which two cations form the most soluble compounds?
- It is helpful to create a general rule for solubility of compounds? Fill in the following blank to describe the solubility of some ionic compounds.
  - Compounds containing the ion sodium (Na<sup>+</sup>) are always \_\_\_\_\_.
  - Compounds containing the anion nitrate (NO<sub>3</sub><sup>-</sup>) are always \_\_\_\_\_.
  - Compounds containing the ion carbonate are usually \_\_\_\_\_. Exceptions include \_\_\_\_\_ and \_\_\_\_\_.