

# Double Replacement Reactions

# The Basics!

- This type of reaction has a positive ion and a negative ion switching places
  - $A^+B^- + C^+D^- \rightarrow A^+D^- + C^+B^-$
- A Double Replacement Reaction will usually produce:
  - A gas
  - A precipitate
  - A molecular compound
    - (like water)
- If the Products are 2 aqueous solutions, no chemical rxn has occurred
  - Ex.  $BaCl_2 + MgSO_4 \rightarrow BaSO_4 + MgCl_2$

# Solubility Chart

Ions That Form Soluble Compounds	Exceptions
Group 1 ions (Li <sup>+</sup> , Na <sup>+</sup> , etc.)	
ammonium (NH <sub>4</sub> <sup>+</sup> )	
nitrate (NO <sub>3</sub> <sup>-</sup> )	
acetate (C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> <sup>-</sup> or CH <sub>3</sub> COO <sup>-</sup> )	
hydrogen carbonate (HCO <sub>3</sub> <sup>-</sup> )	
chlorate (ClO <sub>3</sub> <sup>-</sup> )	
halides (Cl <sup>-</sup> , Br <sup>-</sup> , I <sup>-</sup> )	when combined with Ag <sup>+</sup> , Pb <sup>2+</sup> , or Hg <sub>2</sub> <sup>2+</sup>
sulfates (SO <sub>4</sub> <sup>2-</sup> )	when combined with Ag <sup>+</sup> , Ca <sup>2+</sup> , Sr <sup>2+</sup> , Ba <sup>2+</sup> , or Pb <sup>2+</sup>

Ions That Form Insoluble Compounds*	Exceptions
carbonate (CO <sub>3</sub> <sup>2-</sup> )	when combined with Group 1 ions or ammonium (NH <sub>4</sub> <sup>+</sup> )
chromate (CrO <sub>4</sub> <sup>2-</sup> )	when combined with Group 1 ions, Ca <sup>2+</sup> , Mg <sup>2+</sup> , or ammonium (NH <sub>4</sub> <sup>+</sup> )
phosphate (PO <sub>4</sub> <sup>3-</sup> )	when combined with Group 1 ions or ammonium (NH <sub>4</sub> <sup>+</sup> )
sulfide (S <sup>2-</sup> )	when combined with Group 1 ions or ammonium (NH <sub>4</sub> <sup>+</sup> )
hydroxide (OH <sup>-</sup> )	when combined with Group 1 ions, Ca <sup>2+</sup> , Ba <sup>2+</sup> , Sr <sup>2+</sup> , or ammonium (NH <sub>4</sub> <sup>+</sup> )

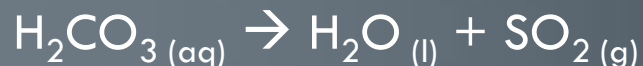
\*compounds having very low solubility in H<sub>2</sub>O

# Predicting the Products of a Double Replacement Reaction

1. Given the reactants, write the name of the **products by switching the LAST names**
  - Do not use acid names; use FULL NAME  
ex: Don't use Nitrous Acid; use Hydrogen Nitrite
2. Check the Table of Solubility Rules
  - If something is insoluble → it will form a precipitate (s) during the rxn  
**RXN WILL OCCUR**
  - If a liquid/ gas has formed  
**RXN WILL OCCUR**
  - If something is soluble → it will form an aqueous (aq) product  
(If you finish with 2 soluble (aq) reactants)  
**NO RXN (stop there)**

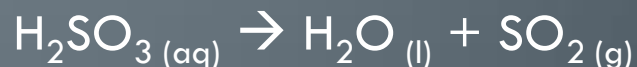
# The Exceptions!

- 5 things that may seem soluble, but will actually produce a liquid or a gas → a reaction WILL occur
  - If any of these are a product, there will be a rxn
- Hydrogen Carbonate → breaks into water and Carbon Dioxide



if you make Hydrogen Carbonate, the CO<sub>2</sub> bubbles (gas) produced = rxn

- Hydrogen Sulfite → breaks into water and Sulfur Dioxide



- Ammonium Nitrate → breaks into water and Ammonia



# Exceptions (cont.)

- Hydrogen Sulfide -  $\text{H}_2\text{S}$ 
  - Odor produced (rotten eggs)
- Hydrogen Hydroxide – HOH
  - Water  $\text{H}_2\text{O}_{(l)}$  (which is a rxn)