



### Single Replacement

- Sodium is added to water
- Whenever water is added to an element visualize it as HOH (make sure you re write it as H<sub>2</sub>O)

### Single Replacement

- Chlorine gas is bubbled into a solution of potassium fluoride

### Double Replacement

- **Double Replacement** – a reaction involving the exchange of ions between 2 compounds
- Of the form:  $AX + BY \rightarrow BX + AY$

### Double Replacement

- In order for a double replacement reaction to take place, one of 3 things must be formed:
- Precipitate (solid)
- Gas
- Weak electrolyte

## Solubility Rules!!!

### SOLUBILITY RULES

#### Always soluble:

alkali metal ions ( $\text{Li}^+$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Rb}^+$ ,  $\text{Cs}^+$ ),  $\text{NH}_4^+$ ,  
 $\text{NO}_3^-$ ,  $\text{ClO}_3^-$ ,  $\text{ClO}_4^-$ ,  $\text{C}_2\text{H}_3\text{O}_2^-$

#### Generally soluble:

$\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$  Soluble except  $\text{Ag}^+$ ,  $\text{Pb}^{2+}$ ,  $\text{Hg}_2^{2+}$  (AP/H)

$\text{F}^-$  Soluble except  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Mg}^{2+}$

$\text{SO}_4^{2-}$  Soluble except  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Pb}^{2+}$  (CBS-PM)

#### Generally insoluble:

$\text{O}^{2-}$ ,  $\text{OH}^-$  Insoluble except alkali metals, and  $\text{NH}_4^+$   
 $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$  (CBS) somewhat soluble

$\text{CO}_3^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{C}_2\text{O}_4^{2-}$ ,  $\text{CrO}_4^{2-}$   
Insoluble except alkali metals and  $\text{NH}_4^+$

## Double Replacement # 1 (Precipitate)

1. Precipitate (must know solubility rules)...the precipitate will stay together
- A saturated solution of barium hydroxide is mixed with a solution of iron (III) sulfate

## Double Replacement # 2 (Formation of a gas)

2. Formation of a gas (acid + sulfide, sulfite, carbonate, or bicarbonate... or ammonium salt + a strong base  $\rightarrow$   $\text{NH}_3(\text{g})$ ,  $\text{H}_2\text{O}$ , and a salt)
- Hydrobromic acid is added to a solution of potassium bicarbonate

## Double Replacement # 3

3. Metal hydride + water  $\rightarrow$   $\text{H}_2$  + strong base (IONS)
- Sodium hydride is placed into water

### Double Replacement #4 (Acid Base neutralization)

- Acid + base  $\rightarrow$  salt + water
- Hydrogen sulfide gas is bubbled through excess potassium hydroxide solution

### Combustion

1. Hydrocarbon +  $O_2 \rightarrow CO_2 + H_2O$  (No ions)
- Combustion of methane