

## Single-Replacement Reactions

### 1) Metal reacting with water:

#### A) The Six Active Metals: $\text{Li} > \text{K} > \text{Ba} > \text{Sr} > \text{Ca} > \text{Na}$



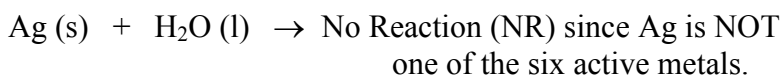
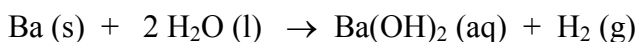
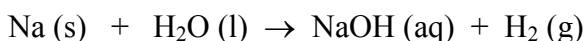
The solid or liquid metal (uncombined, all by itself) is reacted with water to produce the metal hydroxide plus hydrogen gas.

The metal, M, must be one of the six active metals;  $\text{Li} > \text{K} > \text{Ba} > \text{Sr} > \text{Ca} > \text{Na}$

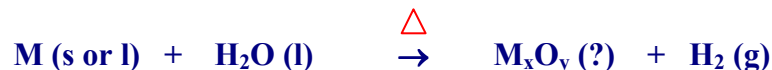
To correctly write the formula for the metal hydroxide, take into account the charge for the metal once it becomes an ion and combine it with  $\text{OH}^-$ . Once you determine the formula, look at the solubility table to see if it is soluble or insoluble.

Recall: soluble = (aq) insoluble = (s) as the physical state

Examples:



#### B) All Other Metals in the Activity Series



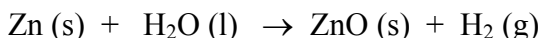
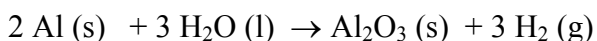
The solid or liquid metal (uncombined, all by itself) is reacted with water to produce the metal oxide plus hydrogen gas. Typically these reactions need to be heated,  $\Delta$ , in order to produce the metal oxide. The x and y represent the subscripts for the formula unit of the metal oxide.

The metal, M, must be greater than H and *not* on of the six active metals on the activity series:



To correctly write the formula for the metal oxide, take into account the charge for the metal once it becomes an ion and combine it with  $\text{O}^{2-}$  (oxide ion). Clues will be given as to the solubility of the metal oxide.

Examples:



## 2) Metal reacting with an acid:



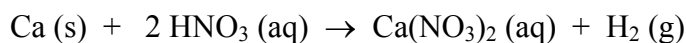
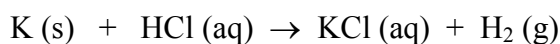
The solid or liquid metal (uncombined, all by itself) is reacted with an acid to produce an ionic compound plus hydrogen gas.

The metal, M, must be greater than H on the activity series:  $M > (H)$

To correctly write the formula for the ionic compound, take into account the charge for the metal once it becomes an ion and combine it with the anion, X. Once you determine the formula, look at the solubility table to see if it is soluble or insoluble.

X can be a monatomic anion ( $Cl^-$ ,  $Br^-$ , etc.) or it can be a polyatomic ion ( $NO_3^-$ ,  $SO_4^{2-}$ , etc.)

Examples:



## 3) Metal reacting with an ionic compound in an aqueous solution:



The solid or liquid metal,  $M_A$  (uncombined, all by itself) is reacted with an ionic compound in an aqueous solution to produce an ionic compound plus a solid metal,  $M_B$ .

The metal  $M_A$  must be greater than the metal  $M_B$  on the activity series:  $M_A > M_B$

To correctly write the formula for the ionic compound, take into account the charge for the metal once it becomes an ion and combine it with the anion, X. Once you determine the formula, look at the solubility table to see if it is soluble or insoluble.

X can be a monatomic anion ( $Cl^-$ ,  $Br^-$ , etc.) or it can be a polyatomic ion ( $NO_3^-$ ,  $SO_4^{2-}$ , etc.)

Examples:

