

## Supplemental Chemical Reactions 5-2

# Solubility Rules and Activity of Metals Reference Sheet

### Solubility Rules

The following general rules apply to most ionic compounds in water:

1. All inorganic acids and low-molecular weight organic acids are soluble.
2. All alkali metal (Li, Na, K, Rb, and Cs) and ammonium ( $\text{NH}_4^+$ ) compounds are soluble.
3. All acetate, perchlorate, chlorate, and nitrate compounds are soluble.
4. Silver, lead, mercury compounds are insoluble.
5. Chlorides, bromides, and iodides are soluble.
6. Carbonates, hydroxides\*, oxides, phosphates, silicates, sulfites, and sulfides\* are insoluble.
7. Sulfates are soluble except for calcium, strontium, lead, mercury, silver, and barium.
8. Chromates are insoluble, except for calcium and strontium.

\* Exception: Hydroxides and sulfides of Ca, Sr, and Ba are soluble.

These rules are applied in the order they are presented here; that is, a rule higher in the list takes precedence over one lower in the list.

*For example,  $\text{PbSO}_4$  is insoluble because rule 4 (which indicates that compounds of lead are insoluble) comes before rule 7 (which indicates that sulfates are soluble with the noted exceptions). Similarly,  $\text{AgCl}$  is insoluble because rule 4 takes precedence over rule 5.*

### Activity of Nonmetals

In single replacement reactions, a nonmetal in its **free state** (elemental, unbonded form) will replace any nonmetal below it on the activity series.

$\text{F}_2$   
 $\text{Cl}_2$   
 $\text{O}_2$   
 $\text{Br}_2$   
 $\text{I}_2$   
 $\text{S}_8$   
 $\text{P}_4$

### Activity Series of Metals

In single replacement reactions, a metal in its **free state** (elemental, unbonded form) will replace any metal below it on the activity series.

Name	Symbol	
Lithium	Li	} React with water to replace and release $\text{H}_2$ gas.
Potassium	K	
Barium	Ba	
Strontium	Sr	
Calcium	Ca	
Sodium	Na	
Magnesium	Mg	
Aluminum	Al	
Manganese	Mn	} Do not react with water unless water is in a gaseous state, in which case it will replace and release $\text{H}_2$ gas.
Zinc	Zn	
Chromium	Cr	
Iron	Fe	
Cadmium	Cd	
Cobalt	Co	
Nickel	Ni	
Tin	Sn	
Lead	Pb	} Do not react with water.
Hydrogen	H	
Copper	Cu	
Arsenic	As	
Bismuth	Bi	
Antimony	Sb	
Mercury	Hg	
Silver	Ag	
Platinum	Pt	} Do not react with any common acids.
Gold	Au	