

Symbols in Chemical Equations

→ Yields; Results of rxn

⇌ Reversible rxn

(s) Solid state; also indicates precipitate

(l) liquid state

(g) gaseous state

(aq) Aqueous; Solution; Dissolved in H₂O

Δ → Reactants heated

atm → Pressure at which rxn is carried out

°C → Temp. at which rxn is carried out.

Formula → Catalyst used to alter rate of rxn.

Types of Chemical Reactions

Synthesis (Combination)



Decomposition



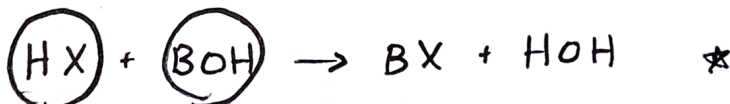
* Single Replacement



* Double Replacement



Neutralization



Combustion



Use **Activity Series** to predict if rxn occurs

Use **Solubility Rules** to predict state of products



*SR RXNS OCCUR?

Re

ACTIVITY SERIES

Highly reactive metals want to be part of a compound
(stable metals want to be left alone)

More
Reactive

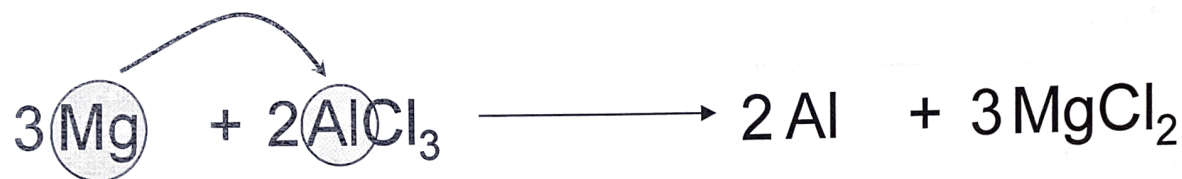
Metal Reactivity

| | |
|----------------|---------------------------|
| Li | |
| Rb | react with cold |
| K | water and |
| Ba | acids, replacing |
| Ca | hydrogen |
| Na | |
| <hr/> | |
| Mg | |
| Al | react with acids or |
| Mn | steam, but usually not |
| Zn | liquid water, to |
| Cr | replace hydrogen |
| Fe | |
| <hr/> | |
| Co | react with |
| Ni | acids, but not |
| Sn | water, to replace |
| Pb | hydrogen |
| <hr/> | |
| H ₂ | |
| Cu | react with O ₂ |
| Ag | to form oxides |
| Hg | |
| <hr/> | |
| Pt | mostly |
| Au | unreactive |

Halogen Reactivity

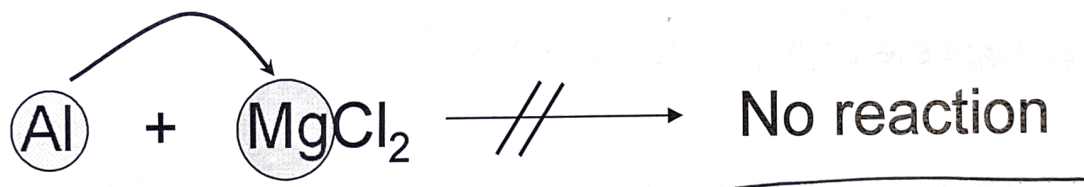
F₂most reactive
Cl₂
Br₂
I₂least reactive

Predict if these reactions will occur



Can magnesium replace aluminum? YES, magnesium is more reactive than aluminum.

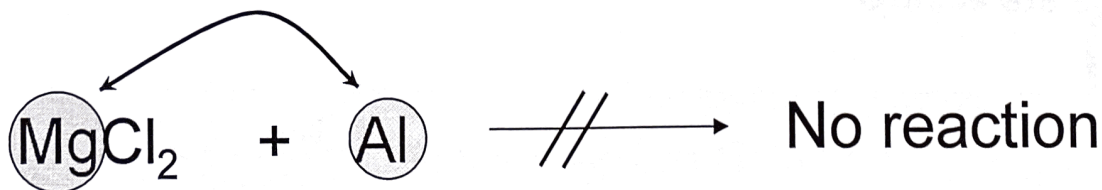
Activity Series



Can aluminum replace magnesium? NO, aluminum is less reactive than magnesium.

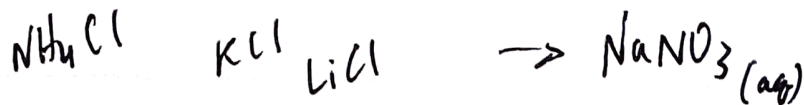
Activity Series

Therefore, *no reaction* will occur.



Order of reactants
DOES NOT
determine how
they react.

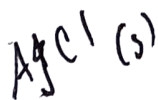
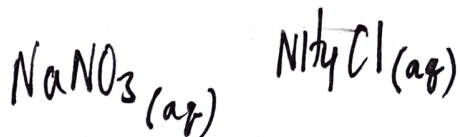
The question we must ask is can the single element replace its counterpart?
metal replaces metal or nonmetal replaces nonmetal.



Soluble = dissolves in H₂O
 Insoluble = solid

Solubility Rules = Aqueous

1. Most ^(NO₃⁻) nitrates are soluble.
2. Most salts containing ^(Na, K, Li) Group I ion and ammonium ion, NH₄⁺, are soluble.
3. Most chloride, bromide, and iodide salts are soluble, except Ag⁺, Pb²⁺ and Hg₂²⁺.
4. Most sulfate salts are soluble, except BaSO₄, PbSO₄, Hg₂SO₄, and CaSO₄.
5. Most hydroxides ^{OH⁻} except Group 1 and Ba(OH)₂, Sr(OH)₂, and Ca(OH)₂ are only [slightly soluble].
6. Most sulfides, carbonates, chromates, and phosphates are only slightly soluble.



Writing Chemical Equations

1. Identify reactants and products and place them in a word equation.
2. Convert the chemical names into chemical formulas and write the state symbols.
3. Balance the chemical equation.

Example:

Step 1: Aluminum + iron(III) oxide \Rightarrow aluminum oxide + iron

Step 2: $\text{Al}_{(s)}$ $\text{Fe}_2\text{O}_{3(s)}$ $\text{Al}_2\text{O}_{3(s)}$ $\text{Fe}_{(l)}$

Step 3: $2\text{Al}_{(s)} + \text{Fe}_2\text{O}_{3(s)} \Rightarrow \text{Al}_2\text{O}_{3(s)} + 2\text{Fe}_{(l)}$

PRACTICE!