

# Topic IV-3 Study Guide

## Chemical Reactions

### 4 Signs Chemical Reaction:

- Formation of precipitate
- Permanent change in color
- Heat/light given off
- Formation of a gas (bubbles)

Reactants → products

### Symbols

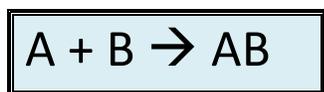
+	added
→	yield or produces
↔	reversible
(s)	solid
(l)	liquid
(aq)	aqueous (dissolved in H <sub>2</sub> O)
(ppt)	precipitate (only in product side)



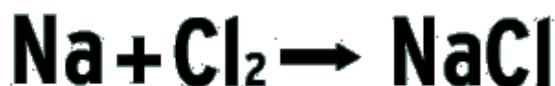
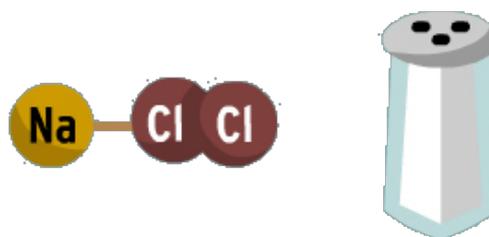
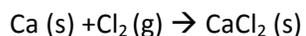
### 5 chemical reactions:

1. Synthesis
2. Decomposition
3. Combustion
4. Single replacement
5. Double replacement
  - a. Formation of Precipitate
  - b. Formation of gas
  - c. Production of H<sub>2</sub>O (Neutralization)

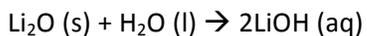
### 1. Synthesis reaction



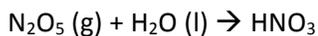
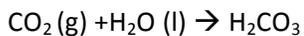
a) Metal + nonmetal → salt



b) Metal oxide + H<sub>2</sub>O → metal hydroxide

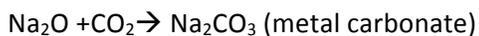


c) Nonmetallic oxide + H<sub>2</sub>O → acid



\*Oxidation numbers for C,N,P,... are the same on both sides\*

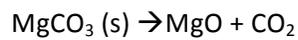
d) Metallic oxide + nonmetallic oxide → salt



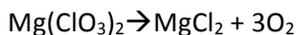
## 2. Decomposition



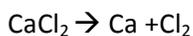
a) Metal carbonate → metal oxide + nonmetal oxide



b) Metal chlorate → metal chloride + oxygen



c) Salt → into components



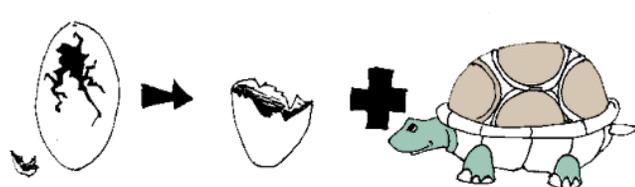
d)  $(\text{NH}_4)_2\text{CO}_3 \rightarrow 2\text{NH}_3 + \text{CO}_2 + \text{H}_2\text{O}$

e)  $\text{H}_2\text{SO}_3 \rightarrow \text{H}_2\text{O} + \text{SO}_2$

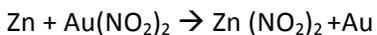
f)  $\text{H}_2\text{CO}_3 \rightarrow \text{H}_2\text{O} + \text{CO}_2$

g)  $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$

h)  $\text{NH}_4\text{OH} \rightarrow \text{NH}_3 + \text{H}_2\text{O}$

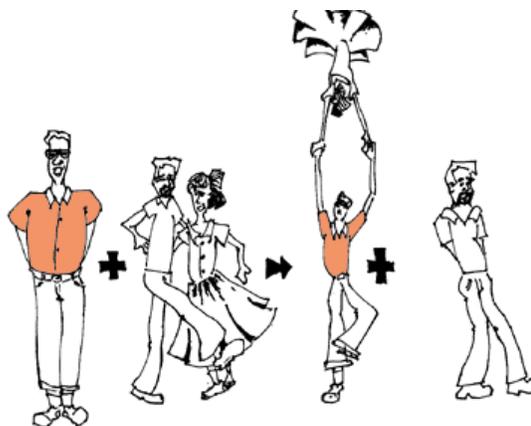
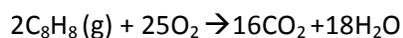
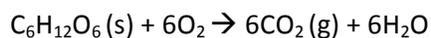
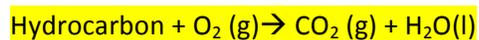


### 3. Single replacement



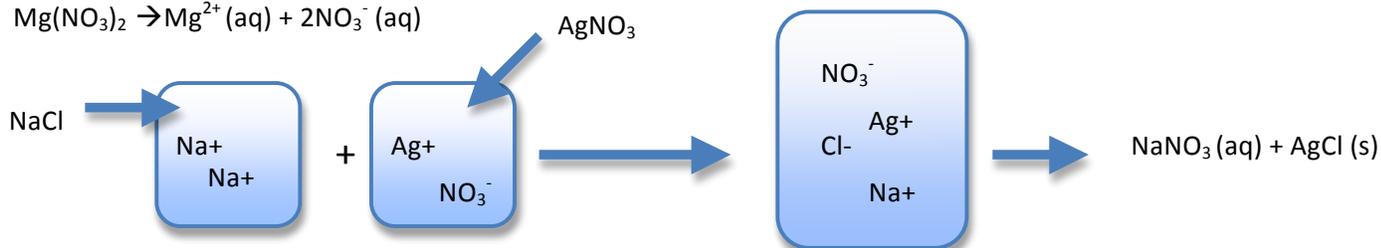
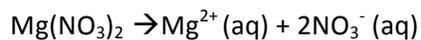
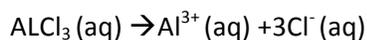
### 3. Combustion

Burning in oxygen

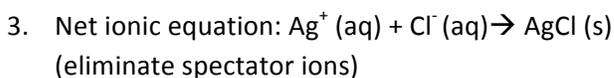
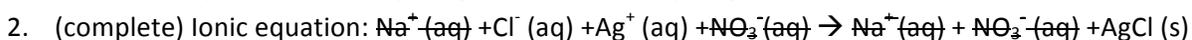
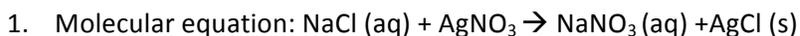


### 4. Double Replacement Reaction

- Precipitate
- Gas
- H<sub>2</sub>O (neutralization)

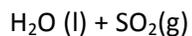
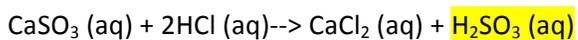


\*See notes\*

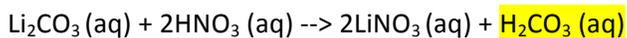


## Gas Formation

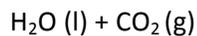
1. Sulfite + acid → salt + water + sulfur dioxide



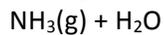
2. Carbonate + acid → salt + water + carbon dioxide



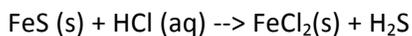
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3. Ammonium salt + strong hydroxide → salt + water + ammonia gas



4. Sulfide + acid → Salt + hydrogen sulfide



Neutralization (→ salt + H<sub>2</sub>O)/Acid-Base/ H<sub>2</sub>O forming

Acids (strong): HClO<sub>4</sub>, HClO<sub>3</sub>, HCl, HBr, HI, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>

Bases (strong): Group 1 Hydroxides

