Reaction Types

Synthesis Reaction

- General form:
- A + B → AB
- key: only one product
- ex: $SO_3 + H_2O \rightarrow H_2SO_4$

Decomposition Reaction

- General form:
- AB → A + B
- key: only one reactant
- ex: $C_6H_{12}O_6$ → C + H_2O

“special” elements

- Some elements occur in nature as combinations rather than individual atoms
- Diatomics: H_2, N_2, O_2, F_2, Cl_2, Br_2, I_2
- Others: P_4, S_8
- Note – this is only when they are *free elements* (not in a compound)

Examples in reactions…

- sulfur + oxygen yields sulfur dioxide
- $S_8 + O_2 \rightarrow SO_2$ …is this balanced?
- $S_8 + 8\ O_2 \rightarrow 8\ SO_2$

- How about… diphosphorus pentoxide decomposes into phosphorus and oxygen?
- $P_2O_5 \rightarrow P_4 + O_2$
- $2\ P_2O_5 \rightarrow P_4 + 5\ O_2$

Predicting results

- Predict the result of: $HClO_4 \rightarrow$

  This is a **<u>decomposition reaction</u>**

1. Write every element in the compound as a "free element" on the product side
2. Watch out for the "special" elements
3. Balance the equation

- $HClO_4 \rightarrow H_2 + Cl_2 + O_2$
- $2\ HClO_4 \rightarrow H_2 + Cl_2 + 4\ O_2$

Predicting results

- Predict the result of: $Ca + P_4 \rightarrow$

  This is a **<u>synthesis reaction</u>**

1. There will be a single *ionic* product
2. Write the ion symbols & balance charges
3. Balance the equation

- $Ca + P_4 \rightarrow Ca^{2+}\ P^{3-}$
- $Ca + P_4 \rightarrow Ca_3P_2$
- $6\ Ca + P_4 \rightarrow 2\ Ca_3P_2$

Predicting results: 2 more…

Nonmetal oxide + water yield an oxyacid

$$H_2O + SO_2 \rightarrow H_2SO_3$$

Write the product as a simple combination of the elements on the reactant side

Metal oxide + water yield a metal hydroxide

$Na_2O + H_2O \rightarrow Na^+ OH^-$

$Na_2O + H_2O \rightarrow NaOH$

$Na_2O + H_2O \rightarrow 2\ NaOH$