Types of Reactions

Aim

- group chemical changes into four basic types

Notes

- ★ Direct combination (synthesis)
  - ☆ General Pattern
    A + B → AB or **AB + D → AD + BD**
  - ☆ Examples
    - ✯ Haber Process

$$N_2(g) + 3H_2(g) \xrightarrow[\Delta]{catalyst} 2NH_3(g)$$

      - ✯ process for making ammonia
      - ✯ developed in 1913 by a German scientist Fritz Haber
      - ✯ Ammonia used for making fertilizer and explosives
    - ✯ Combustion
      $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O$
- ★ Decomposition
  - ☆ General Pattern
    AB → A + B
  - ☆ Example
    $2H_2O_2 \rightarrow 2H_2O + 2O_2$
- ★ Single Replacement (substitution)
  - ☆ General Pattern
    AB + C → CB + A or **AB + D → AD + B**
  - ☆ Examples
    - ✯ Replacement of a metal by a more active metal

Molecular equation	$CuSO_4(aq) + Mg(s) \rightarrow MgSO_4(aq) + Cu(s)$
Ionic equation	$Cu^{+2} + SO_4^{-2} + Mg \rightarrow Mg^{+2} + SO_4^{-2} + Cu$
Ionic equation omitting spectator ions	$Cu^{+2} + Mg \rightarrow Mg^{+2} + Cu$

    - ✯ Replacement of a nonmetal by a more active nonmetal
      $2NaI(aq) + Cl_2(g) \rightarrow 2NaCl(aq) + I_2(s)$
- ★ Double Replacement (Exchange of Ions)
  - ☆ General Pattern
    AB + CD → AD + CB
  - ☆ Example
    $AgNO_3(aq) + NaCl(aq) \rightarrow NaNO_3(aq) + AgCl(s)$
- ★ Reversible and end reactions
  - ☆ End reaction - reaction in which the products are not available to react to form the initial reactants because
    - ✯ A precipitate forms
    - ✯ A gas forms
    - ✯ A liquid forms
    - ✯ A product is removed
  - ☆ Reversible reaction - reaction in which the products remain available to react to form the initial reactants because
    - ✯ They remain aqueous

A + B ⇌ C + D

Answer the questions below by circling the number of the correct response

For each of the reactions described in questions 1-7, write the correct number to indicate whether the reaction type is (1) DECOMPOSITION, (2) DIRECT COMBINATION, (3) SINGLE REPLACEMENT, or (4) DOUBLE REPLACEMENT

1. A reaction occurs in which only one reactant is present.
2. A metal reacts with an acid. ($2Fe + 6HCl \rightarrow 2FeCl_3 + 3H_2$)
3. Magnesium burns.
4. Two salt solutions react with each other.
5. Two elements unite to form a compound.
6. A compound breaks down.
7. $HCl + NaOH \rightarrow NaCl + H_2O$

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8. Many sulfide ores are prepared for refinement by roasting. This reaction can BEST be described as (1) decomposition, (2) direct combination, (3) single displacement, (4) double displacement.
9. During smelting, oxide ores are reduced to pure metals by reacting with (1) oxygen, (2) hydrogen, () carbon, (4) nitrogen.