



Classifying Chemical Reactions

Chapter 9



Chemical Reaction

- - A process in which the physical and chemical properties of the original substances change as new substances with different physical and chemical properties are formed.
- Reactant(s) – starting substance(s)
- Product(s) – ending substance(s)



Reasons for chemical reactions:

- atoms can obtain a complete set of valence electrons (by losing, gaining, or sharing)
- atoms can become more stable



Evidence of a Chemical Reaction:

- Precipitate – solid that falls out of a liquid
- Bubbles (gas formed)
- production of heat/light...ENERGY
- color change



Chemical Equation

- shorthand way to represent a chemical reaction
- word equation – uses words (names) of reactants and products
- Formula equation – uses symbols and formulas for reactants and products.

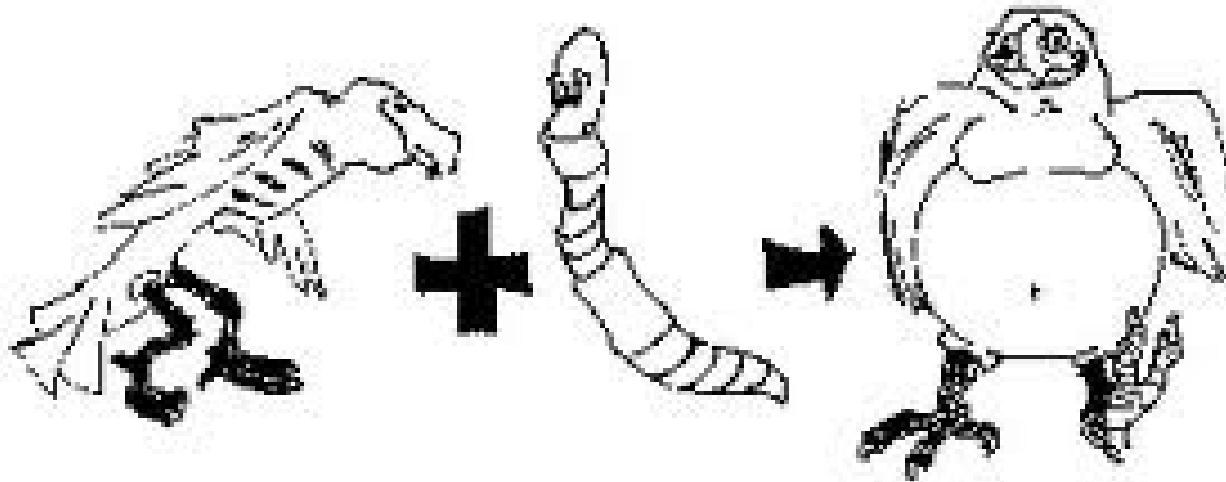
Writing Chemical Equations:

- put reactants on left side
- put products on right side
- “ \rightarrow ” means yields or produces
- Must use the correct formulas and/or symbols
- Diatomic molecules H, O, N, Cl, Br, I and F (*BOFINCH*)
- states of matter – (s), (l), (g) or (aq)
- balance equation. Use coefficients to follow the Law of Conservation of Matter.

To Balance an Equation:

- Write correct symbols and formulas for reactants and products
- count the # of atoms on both sides of the equation (separately)
- balance using coefficients (lowest ratio)
- recount the # of atoms as a check.
- Hint: begin with the element which appears only once on each side.

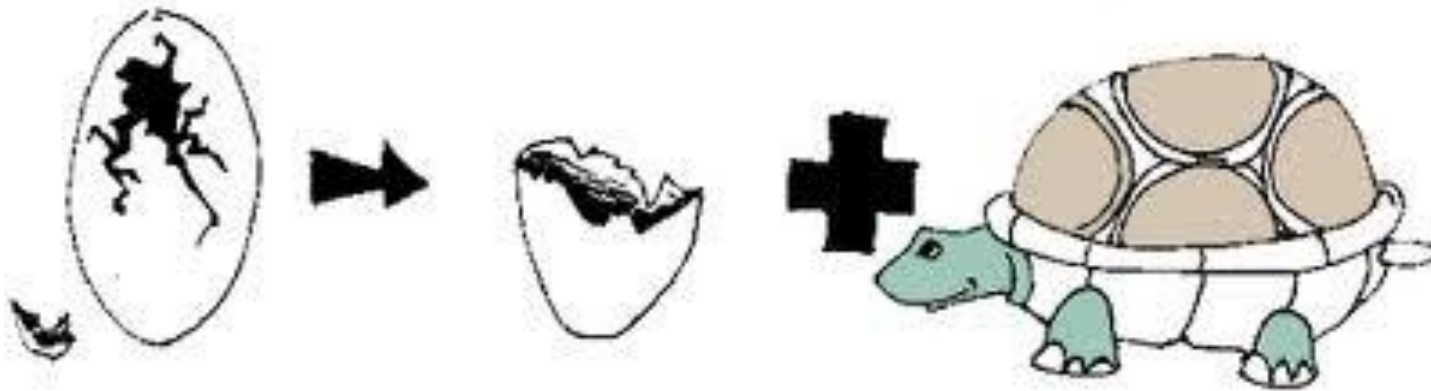
Type 1: Direct Combination or Synthesis



Type 1: Direct Combination or Synthesis

- 2 or more lone elements or compounds combine to form one compound.
- $A + B \rightarrow AB$
- $2 \text{Na} + \text{Cl}_2 \rightarrow 2 \text{NaCl}$
- $\text{S} + \text{O}_2 \rightarrow \text{SO}_2$
- $4 \text{Fe} + 3 \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3$
- $\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2 \text{NaOH}$

Type 2: Decomposition

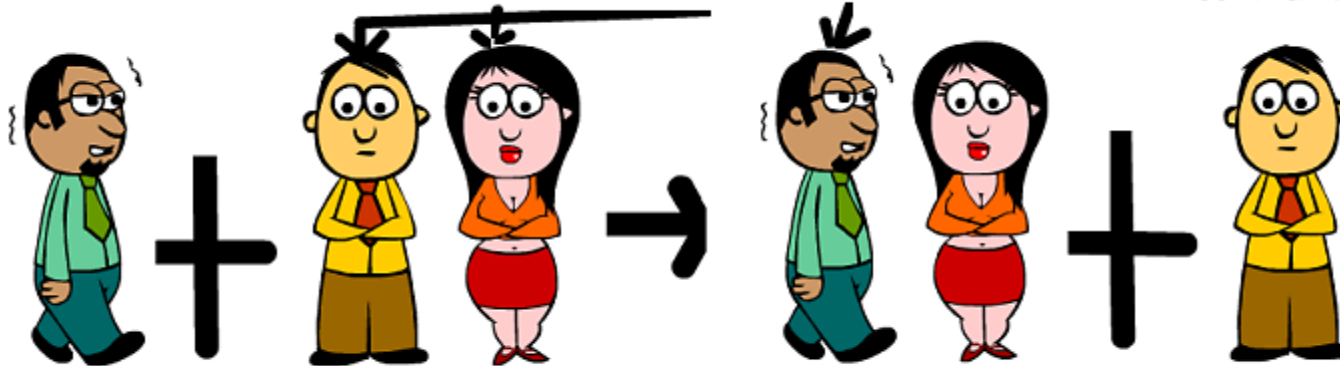


Type 2: Decomposition

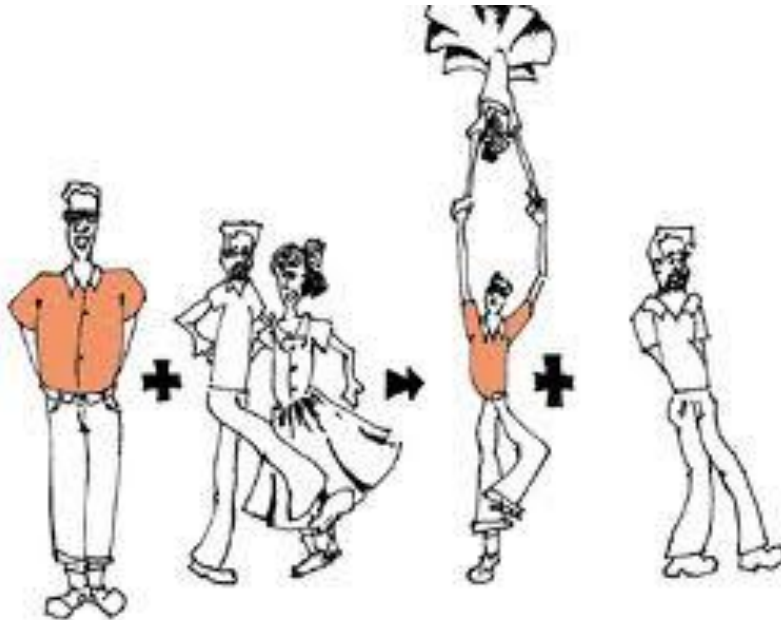
- Single compound is broken down into 2 or more smaller compounds or elements.
- $AB \rightarrow A + B$
- $\text{CaCl}_2 \rightarrow \text{Ca} + \text{Cl}_2$

Type 3: Single Replacement

In a single-replacement reaction this girl leaves her guy for Joe.



Now Joe and Mary are together



Type 3: Single Replacement


- An uncombined element displaces an element that is part of a compound.
(activity series)
- Element + Compound \rightarrow element + compound
- $A + BC \rightarrow AC + B$
- $Zn + 2 HCl \rightarrow ZnCl_2 + H_2$
- $Cl_2 + 2 KI \rightarrow 2 KCl + I_2$



Type 3 continued

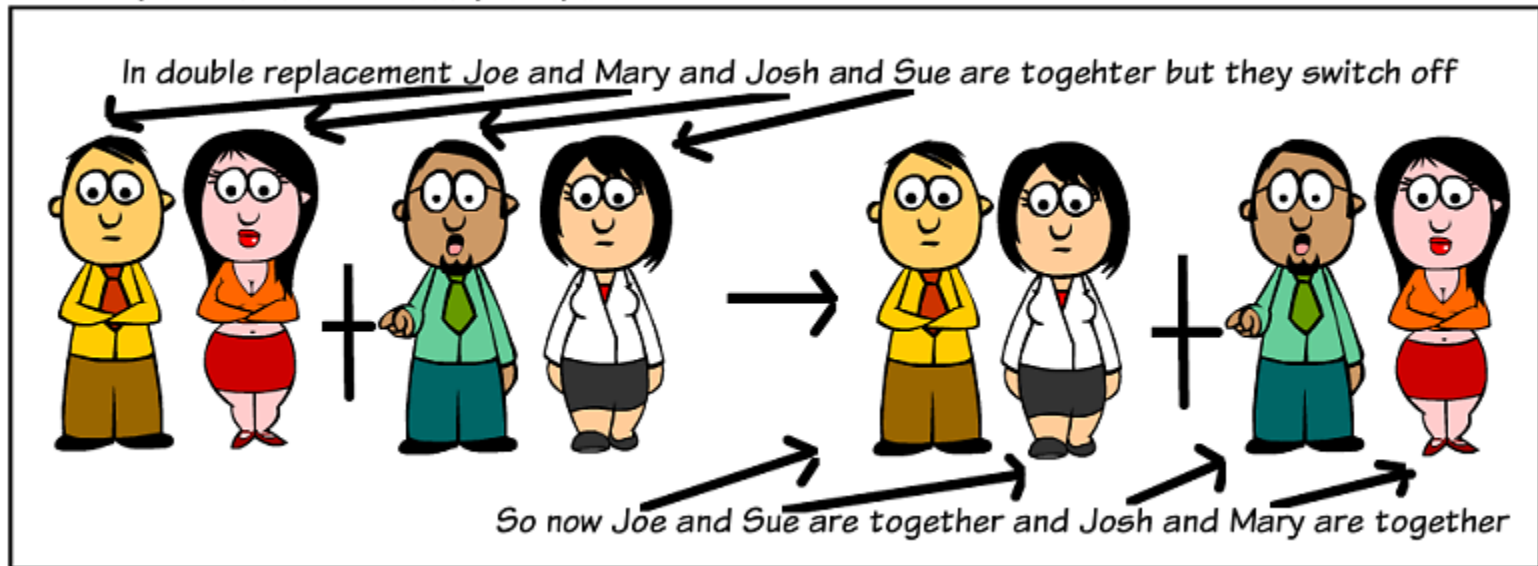
- Note: Metals replace metals, nonmetals replace nonmetals
- Note: In order to replace an element, the element must be more active than the one being replaced.

Activity Series

Two Activity Series		
Metals	Decreasing Activity	Halogens
lithium		fluorine
potassium		chlorine
calcium		bromine
sodium		iodine
magnesium		
aluminum		
zinc		
chromium		
iron		
nickel		
tin		
lead		
HYDROGEN*		
copper		
mercury		
silver		
platinum		
gold		

- Atoms can only replace atoms lower than themselves on the activity series.

Type 4: Double Replacement



+



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+



Type 4: Double Replacement

- Compound + Compound \rightarrow compound + compound
- $AB + CD \rightarrow AD + BC$
- Factors for double replacement reactions:
- Most will only occur if reactants are in solution. Compounds separate into ions in solution.
- will likely proceed if: one of the products is a molecular compound

Other Special Types of Reactions

- Complete Combustion of an Organic substance (C_xH_y or $C_xH_yO_z$)
 - Organic substance + $O_2 \rightarrow H_2O + CO_2$