

# Chapter 17

## *Chemical Reactions*



# Changes in Matter

- *Physical Changes* – A change in the state or appearance of a substance with no chemical change.
  - Example:  $\text{H}_2\text{O}$  as a solid, liquid, or gas.



# Changes in Matter

- Chemical Changes – A change in matter that produces a new substance
  - Example: The same word printed in a different order...

STAMPEDES = MADE + STEPS

# Evidence of A Chemical Reaction

- What forms of evidence show that a chemical reaction took place?
  - Color Change.
  - Precipitation.
  - Gas Production.
  - Changes in Temperature.
  - Changes in Properties.

# Are They Chemical or Physical Reactions?

- Ice cream melting
- Sugar dissolving in water.
- Gasoline burning.
- Milk turning sour.
- Physical.
- Physical.
- Chemical
- Chemical

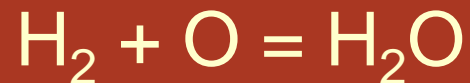
# Conservation of Mass

- During a chemical reaction, matter is not created or destroyed.
- But what about burning a piece of wood. Burnt ash does not equal the mass of the log before it was burned?
  - Much of the mass is lost as carbon dioxide.

# Describing Chemical Reactions

- Writing Chemical Equations
  - Hydrogen molecules react with Oxygen molecules to form water molecules.

--OR--



# Chemical Formulas

- Water =  $\text{H}_2\text{O}$
- Carbon Dioxide =  $\text{CO}_2$
- Carbon Monoxide =  $\text{CO}$
- Methane =  $\text{CH}_4$
- Propane =  $\text{C}_3\text{H}_6$
- Table Salt =  $\text{NaCl}$



# Structure of an Equation

- Reactant + Reactant = Product
- $\text{H}_2 + \text{O}_2 = \text{H}_2\text{O}_2$

# Balancing Chemical Equations

- $3 \text{ H}_2\text{O}$
- Multiply 3 by each atom's subscript.
- $3 \times \text{H}_2 = 6 \text{ H's}$
- $3 \times \text{O}_1 = 3 \text{ O's}$

# Balancing Chemical Equations

- How many atoms are present in each compound?
  - 2 H<sub>2</sub>SO<sub>4</sub>
  - 4 Fe<sub>2</sub>O<sub>3</sub>
  - 6 NaCl
  - NO<sub>2</sub>
  - 2 CO<sub>2</sub>H (carboxylic acid).

# Balancing Equations

Balance the equation



	Reactants	Products
Element	# of Atoms	# of Atoms
H	4	4
O	2	2

# Types of Chemical Reactions

- Synthesis
- Decomposition
- Replacement

# Synthesis Reactions

- When two or more substances combine to make a more complex substance.
- Example:  $2 \text{H}_2 + \text{O}_2 = 2 \text{H}_2\text{O}$ .

# Decomposition Reactions

- The breaking down of compounds into simpler products.
- Example:  $2 \text{H}_2\text{O}_2 = 2 \text{H}_2\text{O} + \text{O}_2$

# Replacement Reactions

- One element replaces another.
- Example:  $2 \text{CuO} + \text{C} = 2 \text{Cu} + \text{CO}_2$ 
  - Copper oxide in the presence of charcoal. The carbon of the charcoal takes the place of the copper in the copper oxide.



# Reaction Energy

- Exothermic Reactions:
  - A reaction that releases energy.
    - Example: Car engine (combustion).
    - Reactants = products + energy.
- Endothermic Reactions:
  - A reaction that absorbs energy.
    - Example: The formation of ice.
    - Reactants + energy = products

# Rates of reactions

- Concentration
- Surface Area
- Temperature
- Catalyst (enzymes)
- Inhibitor

MAKE CHART OF  
INCREASING AND  
DECREASING EACH  
VARIABLE WITH  
EXPECTED  
OUTCOME

# Fire and Fire Safety

