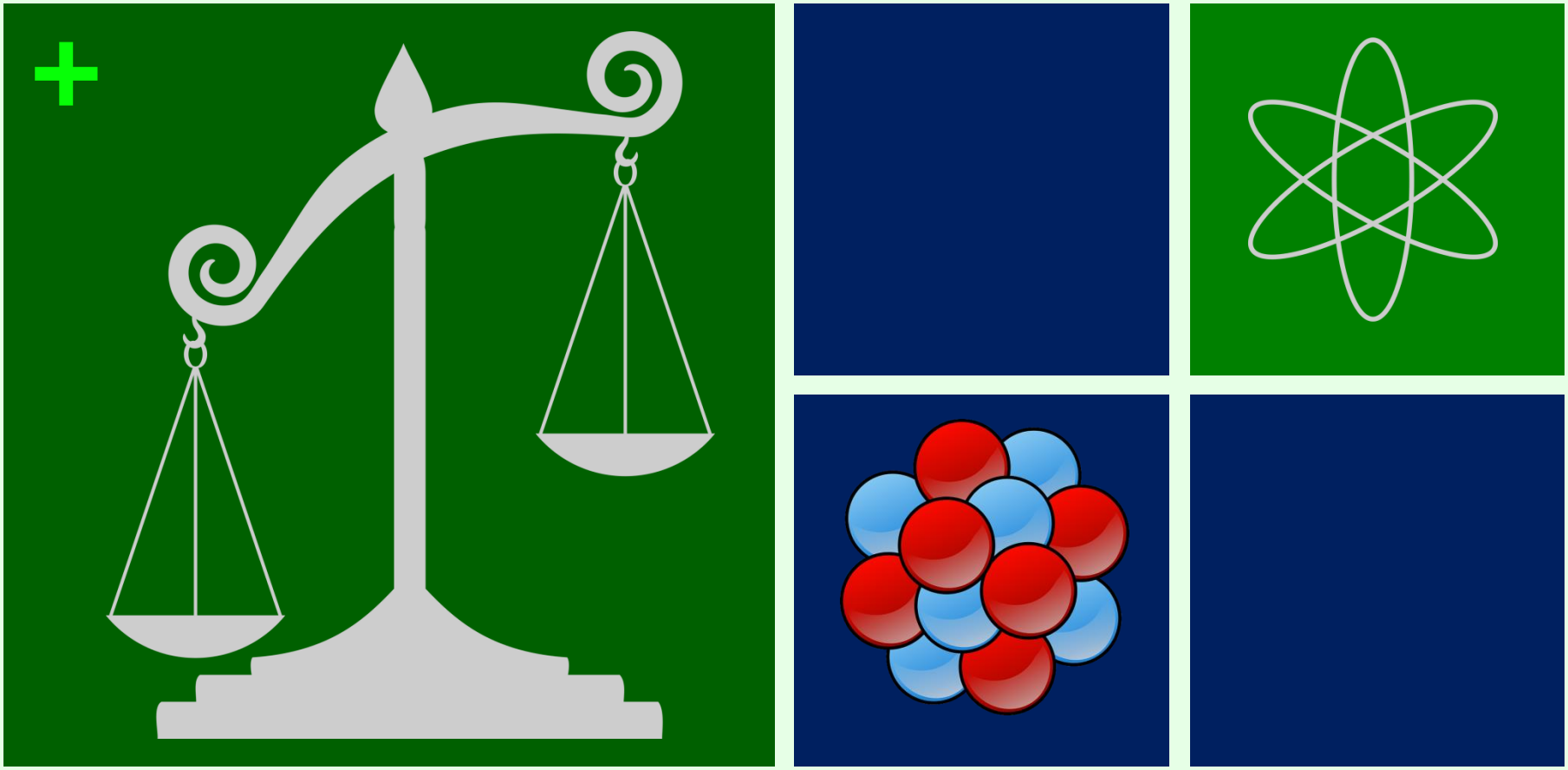


# Section 4.3 Balancing Chemical Equations

Pages 203 to 211

# Chemical Reactions



- Result in chemical changes
- New substances are created
- No new matter is created or destroyed; atoms are just rearranged.
- Reactants → Products

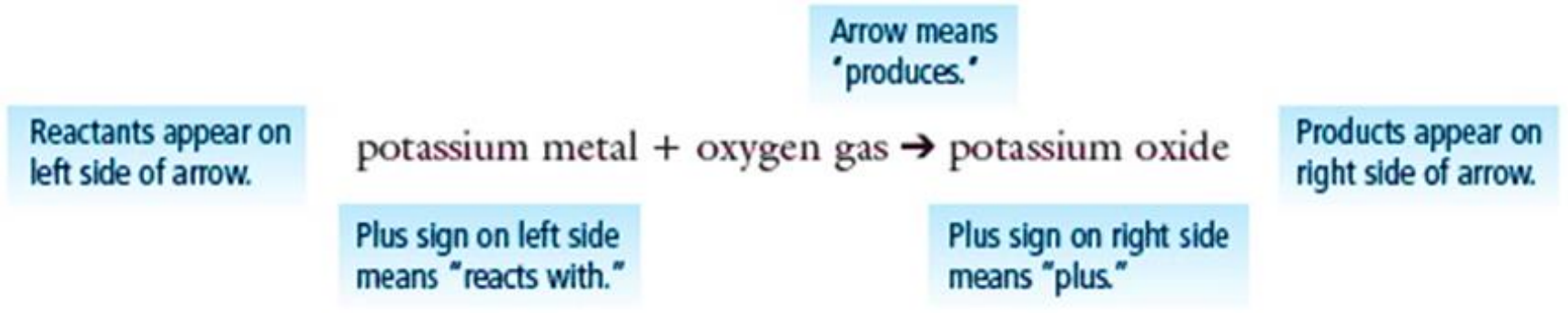
# The law of conservation of mass:

- In chemical reactions, atoms are neither created nor destroyed.
- Mass of reactants = mass of products
- This is why the equation for every chemical reaction needs to be balanced

# How are Chemical Reactions Written



- A word equation:
- The simplest form of a chemical equation
  - Examples:
    - Nitrogen monoxide + oxygen → nitrogen dioxide
    - Potassium metal + oxygen gas → potassium oxide

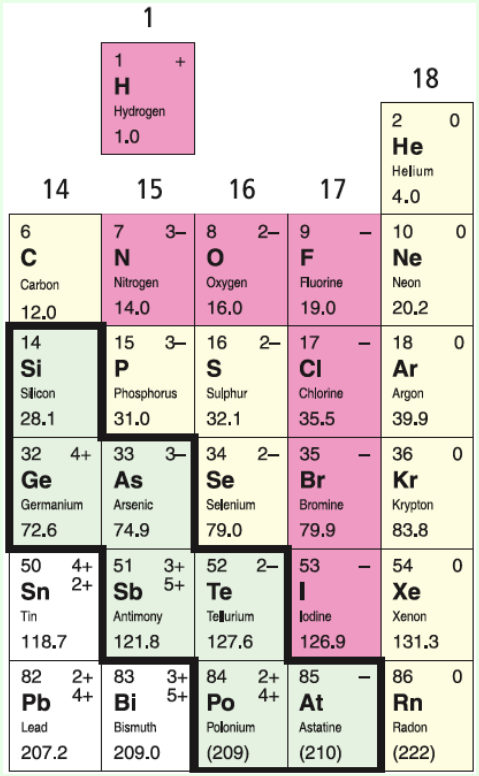


# + Word Equations Continued



- Require careful examination
  - Be careful of polyatomic elements
    - For Example: $P_4$ and $S_8$
  - Be careful of diatomic elements (“special seven”)
    - $H_2$, $O_2$, $F_2$, $Br_2$, $I_2$, $N_2$, $Cl_2$
    - Acronym: HOFBrINCl

- **Common names for molecules containing hydrogen**
  - **Examples**
    - **methane = $CH_4$**
    - **glucose = $C_6H_{12}O_6$**
    - **ethane = $C_2H_6$**
    - **ammonia = $NH_3$**



# How are Chemical Reactions Written

- A symbolic equation:
  - Example
    - $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$

*Coefficients*

- *Indicate the ratio of compounds in the reaction.*

*State of matter*

*(aq) = aqueous/dissolved in water*

*(s) = solid*

*( ℓ ) = liquid*

*(g) = gas*

# Symbolic Equations Continued

- **<u>Skeleton equation</u>**
  - shows the formulas of the elements/compounds, but not quantities
  - Example:
    - $K + O_2 \rightarrow K_2O$

# Symbolic Equations Continued

- **<u>Balanced chemical equation</u>**
  - shows the formulas of the elements/compounds including quantities
  - Always use the smallest whole-number ratio.
  - Example:
    - $4K + O_2 \rightarrow 2K_2O$

# Steps for Balancing Chemical Equation

1. Count the number of atoms for the reactants and products
2. Balance compounds first and elements last.
3. Balance one compound at a time.
4. Only add coefficients; NEVER change subscripts.
5. If H and O appear in more than one place, attempt to balance them LAST.
6. Polyatomic ions (such as $SO_4^{2-}$) can often be balanced as a whole group.
7. Always double-check after you think you are finished.

# Practice Problems

- $Fe + Br_2 \rightarrow FeBr_3$
- $Sn(NO_2)_4 + K_3PO_4 \rightarrow KNO_2 + Sn_3 (PO_4)_4$
- $C_2H6 + O_2 \rightarrow CO_2 + H_2O$