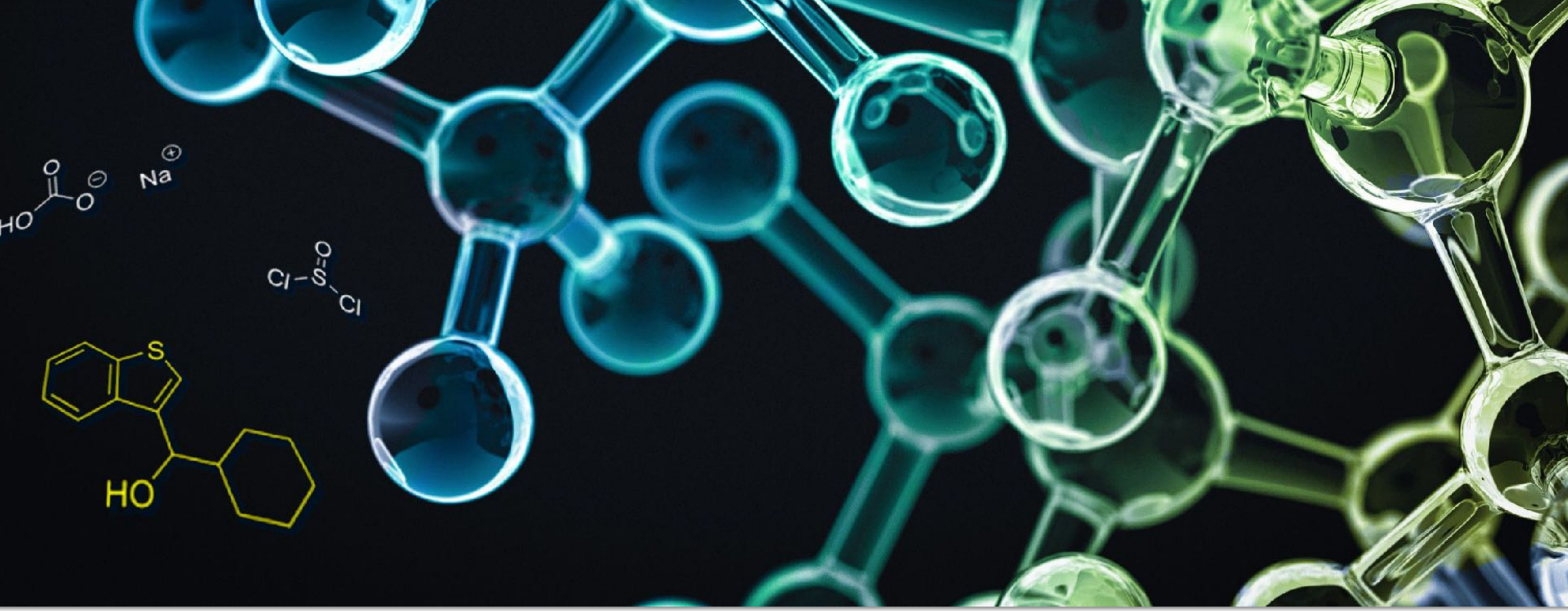


Unit 4

Chemical Reactions

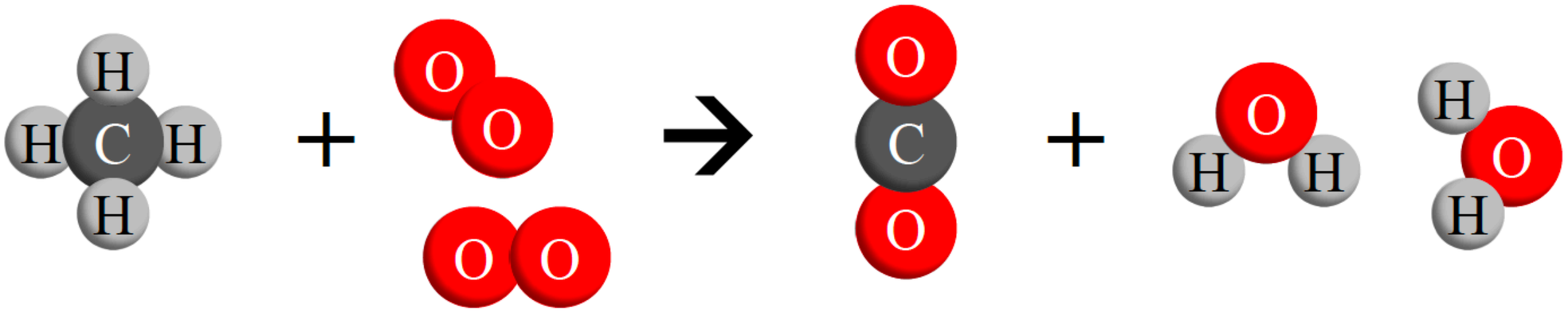
4.1 Introduction to Reactions
4.2 Net Ionic Equations
4.3 Representations of Reactions
4.4 Physical and Chemical Changes

- Physical & Chemical Changes
- Balancing Chemical Equations

Chemical vs. Physical Processes

- **Physical Processes**
  - Involve changes in intermolecular interactions.
  - Properties change but the composition remains the same (phase changes, formation of mixtures)
- **Chemical Processes**
  - Involve the breaking and/or formation of chemical bonds
    - *Temp changes, production of light, formation of a gas, formation of a precipitate, changes in color.*

Conservation of Atoms/Mass



$$CH_4 + 2\,O_2 \rightarrow CO_2 + 2\,H_2O$$

C: 12.01 amu	= 12.01 amu	
H: $4(1.01)$ amu	= 4.04 amu	
O: $4(16.00)$ amu	= 64.00 amu	
	80.05 amu	

C: 12.01 amu	= 12.01 amu	
H: $4(1.01)$ amu	= 4.04 amu	
O: $4(16.00)$ amu	= 64.00 amu	
	80.05 amu	

Balancing Chemical Equations

Write the balanced **net ionic equation** for the reaction that takes place when an aqueous solution of barium nitrate is added to an aqueous solution of sodium sulfate and a barium sulfate precipitate forms.

Net Ionic vs. Complete Ionic Equations

Net Ionic Equation

Only shows the reaction that actually took place.

$$Ba^{2+}_{(aq)} + SO_4^{2-}_{(aq)} \rightarrow BaSO_{4(s)}$$

Normally used when dealing with a problem that only involves the precipitation reaction.

Molecular Equation

Shows all of the species that are present.

$$Ba(NO_3)_{2(aq)} + Na_2SO_{4(aq)} \rightarrow 2\ NaNO_{3(aq)} + BaSO_{4(s)}$$

Normally used when it is necessary to identify all of the species in a system (reacting species and spectator ions.)

4.5 Stoichiometry

- Predicting the Mass of Products & Reactants
- Limiting Reactant
- % Yield

Predicting Mass of Products

- What mass of water is produced when 246.4 g of methane is burned in excess $O_2(g)$?

Predicting Mass of Products

- How many grams of CO_2 and Fe are produced when 114 g of carbon monoxide gas is added to a vessel containing excess hot iron (III) oxide?
  - Write a balanced chemical equation.
  - Find Masses of CO_2 and Fe

Predicting Mass of Reactants

- What mass of sodium bicarbonate is needed to produce 32 g of Na_2CO_3?

$$2\ NaHCO_{3(s)} \rightarrow Na_2CO_{3(s)} + H_2O_{(g)} + CO_{2(g)}$$

Limiting Reagent

If you have set quantities of two different reactants, one will get used up and some amount of the other will be leftover.

Limiting Reagent

- The reactant that is used up limits how far the reaction will proceed.

Excess Reactant

- The reactant that is leftover when the reaction is complete.

Limiting Reagent

- What is the limiting reactant when 28 g of glucose reacts with 14 g of oxygen gas?
- What mass of CO_2 is produced?

Percent Yield

- Find the percent yield if only 15 g of CO_2 were produced in the previous problem.

$$\%\text{Yield} = \frac{\text{Actual Yield}}{\text{Theoretical Yield}} \times 100$$

Reactions in Solution

- A 200.0 mL solution of 1.0 M $Pb(NO_3)_2$ is added to a 200.0 mL solution of 1.5 M NaI and a solid PbI_2 precipitate forms. Find the maximum mass of $PbI_2(s)$ that could be produced.

$$Pb^{2+}(aq) + 2I^{-}(aq) \rightarrow PbI_2(s)$$