

### Ch. 3: Stoichiometry

#### Avogadro's Number

- **Mole:** a measuring unit
  - 1 mole of atoms =  $6.022 \times 10^{23}$  atoms

#### Counting Atoms Using Moles

- A mole is the **exact number of atoms** present in a sample that weighs the element's atomic weight
  - Ex. 1 mole of Fe =  $6.022 \times 10^{23}$  atoms = 55.847 g
  - Ex. What is the mass in grams of 4.30 moles of Al?  
Molar mass of Al = 26.98 g/mol

$$4.3 \text{ mol Al} \times \frac{26.98 \text{ g}}{1 \text{ mol Al}} = 116 \text{ g of Al}$$

- The molar mass of a molecule is the **sum of the atomic weight** of all the atoms in a molecule
- **Molecular/formula weight:** molar mass of a compound
  - Ex. What is the molar mass of methane gas  $\text{CH}_4$ ?  
Molar mass of carbon = 12.01 g/mol  
Molar mass of hydrogen = 1.01 g/mol

$$\text{Methane} = 12.01 + 4(1.01) = 16.04 \text{ g/mol}$$

#### Percent Composition by Mass

- **Percent Composition:** the percent by mass, of each element in the compound
- **Formula:**
  - % composition of an element =  $\frac{(\# \text{ of atoms of the element}) \times (\text{molar mass of element})}{\text{Molar mass of the compound}} \times 100\%$
  - Ex. Calculate the percent composition by mass of  $\text{C}_3\text{H}_8$   
Molar mass of  $\text{C}_3\text{H}_8$  =  $3(12.01) + 8(1.01) = 44.11 \text{ g/mol}$

$$\% \text{ of C} = \frac{3(12.01)}{44.11} \times 100\% = 81.68\%$$

#### Empirical and Molecular Formula

- **Empirical Formula:** the simplest whole number ratio of element in a composition
  - Does NOT tell the number of atoms in a molecule

#### How to find the Empirical Formula from % mass

##### Part A: Determine Empirical Formula

1. Convert the data from % to grams for each element
2. Convert from grams to moles for each element by dividing atomic mass
3. Divide each value by the smallest of the values and round answers to the nearest whole number

# Chemistry 111 Lab Answers

**Rachel Sandford**



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