

Chapter 3 Part 2

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Molecular vs. Empirical formulas

Molecular Formulas

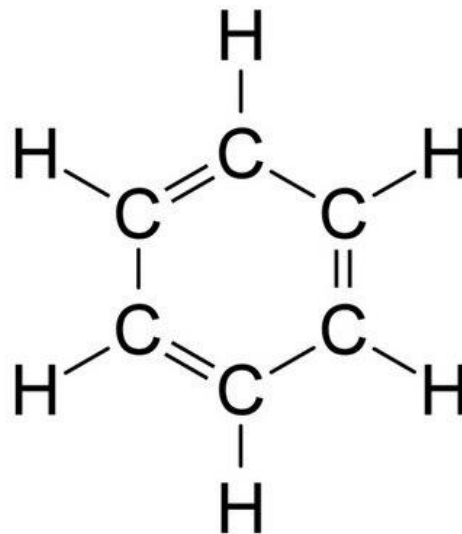
- Shows the actual number of atoms of each element in the molecule

Empirical Formulas

- Shows the simplest whole-number ratio of atoms of each elements in a molecule

Molecular vs. Empirical formulas

Give the molecular and empirical formula for the compound below.



Formulas

Is $\text{C}_6\text{H}_{12}\text{O}_6$ an empirical formula?

Empirical Formulas

A generic compound contains 1.0 mol A and 2.5 mol B. What is its empirical formula?

- A. AB_2
- B. AB_3
- C. AB_5
- D. A_2B_3
- E. A_2B_5

Empirical Formulas

A compound has a percent composition of 44.77% C, 7.52% H, and 47.71% O? Determine the empirical formula of this compound.

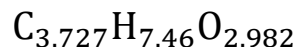
Finding Empirical Formulas

1. Find moles of each element

$$44.77 \text{ g C} \left(\frac{1 \text{ mol C}}{12.011 \text{ g C}} \right) = 3.727 \text{ mol C} \quad 7.52 \text{ g H} \left(\frac{1 \text{ mol H}}{1.008 \text{ g H}} \right) = 7.46 \text{ mol H}$$

$$47.71 \text{ g O} \left(\frac{1 \text{ mol O}}{15.999 \text{ g O}} \right) = 2.982 \text{ mol O}$$

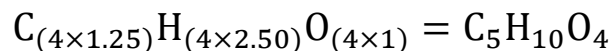
2. Write tentative formula based on the number of moles of just determined



3. Divide subscripts by lowest number of moles to determine whole numbers

$$\frac{\text{C}_{3.727}}{2.982} \frac{\text{H}_{7.46}}{2.982} \frac{\text{O}_{2.982}}{2.982} = \text{C}_{1.25}\text{H}_{2.50}\text{O}$$

4. If necessary multiply by a small whole number



Empirical Formulas

A sample was found to have 10.0 grams of carbon and 2.52 grams of hydrogen. What is the empirical formula of the compound?

Molecular Formulas

A compound has an empirical formula of CH_3 (15.04 g/mol). The molecular formula of the same compound has a molar mass of 30.08 (g/mol)? What is the molecular formula of this compound?

Molecular Formulas

A compound with empirical formula CH_2 (formula mass = 14 amu) has a molar mass of 28 g/mol. What is the molecular formula?

- A. CH_2
- B. C_2H_2
- C. C_2H_4
- D. C_3H_6
- E. C_4H_6

Molecular Formulas

Determine the empirical and molecular formulas for a compound with a molar mass of 180 amu and the elemental composition 40.0% C, 6.72% H, and 53.3% O.

Molecular Formulas

Lactic acid contains 40.0% C, 6.72% H, and 53.3% O (same percent composition as last example). If 45.05 grams of lactic acid contains 0.500 moles of lactic acid, what is the molecular formula of lactic acid?