WKS 3-10 – Chem Honors **NAME** _____
Molecular Formula **Period** _____ **Date** _____

Empirical Formula: The simplest formula for a compound-- simplest whole number ratio. (fully reduced.)

For example: NaCl, CH_2, H_2O, NH_3

Molecular Formula: Actual formula for the molecule.

- Sometimes the molecular formula and the empirical formula of a compound are the same.
  Ex: A water molecule is H_2O. Water's empirical formula is also H_2O (fully reduced.)
- However, sometimes the molecular formula of a compound is a multiple of its empirical formula.
  Ex: The molecular formula of ethane gas is C_2H_6, but its empirical formula is CH_3
  Ex: The molecular formula of benzene is C_6H_6, but its empirical formula is CH.

Practice Problems:

1) A compound has an empirical formula of CH_2. The molar mass of the compound is 56.1 g/mole. What is the compound's molecular formula?
   HINT: **Step 1**: What is the molar mass of just the empirical formula?_____

   Step 2: Find out what multiple the molecular formula is to the empirical formula. To do so, plug in:

   $$\text{multiple} = \frac{\text{molar mass of molecular formula}}{\text{molar mass of empirical formula}} =$$

   Step 3: multiply the empirical formula by this multiple. Write molecular formula.

2) Glucose, a natural sugar found in fruit, has the empirical formula CH_2O and its molar mass is 180.2 g/mol. What is the molecular formula of glucose?

3) The compound diethyl maleate, used as an additive and intermediate for plastics, pigments, pharmaceuticals, and agricultural products, has the empirical formula of C_2H_3O and molar mass 172 g/mole. What is its molecular formula?

4) It is experimentally determined that a sample of the stimulant caffeine contains 49.5% C, 5.15% H, 28.9% N, and 16.5% O.
   a) What is the empirical formula of caffeine?

   b) The molar mass of caffeine is 195 g/mole. What is caffeine's molecular formula?

Answers: 1) 14.03 g/mol, 4, C_4H_8; 2) $C_6H_{12}O_6$; 3) $C_8H_{12}O_4$; 4a) $C_4H_5N_2O$; 4b) $C_8H_{10}N_4O_2$