**Molecular and Empirical Formulas**

**Molecular Formulas: are the actual symbols and subscripts of the compound.**

**Example: Hydrogen Peroxide’s Molecular formula is H2O2.**

**Empirical Formulas: are lowest possible whole number ratios of the compound.**

**Example: Hydrogen Peroxide’s Empirical formula is HO (simply by dividing each of the subscripts of H2O2 by 2).**

**If you are given the molar mass and the percent composition of all of the elements in a compound you can calculate the molecular mass.**

**Example: If Caffiene’s (and assuming you have 100 g of Caffeine) Molar Mass is 194.2 and the % composition is:**

**C: 49.458%**

**H: 5.15%**

**N: 28.87%**

**O: 16.49%**

**What is Caffeine’s Molecular Formula?**

**1st: Convert each percentage to moles.**

**Carbon:**

**.4948 moles Caff. x 194.2 = 96.09 g C**

1. **1 Mole of Caff.**

**96.09 g C x 1 mole C = 8.0008 moles C**

**1 12.01 g C**

**Hydrogen:**

**.0515 moles Caff. X 194.2 = 10.0013 g H**

**1 1 Mole Caff.**

**10.0013 g H x 1 mole H = 9.92 g H**

**1 1.008 g H**

**Nitrogen:**

**.2887 Moles Caff. X 194.2 = 56.07 g N**

**1 1 Mole Caff.**

**56.07 g N x 1 mole N = 4.0029 moles N**

**1 14.007**

**Oxygen:**

**.1649 moles Caff. X 194.2 = 32.02 g O**

**1 1 mole Caff.**

**32.02 g O x 1 mole O = 2.0013 moles O**

**1 15.999 g O**

**Finally: round off each of the mole conversions and they become the subscripts of the molecular formula.**

**Caffeine’s Molecular formula:**

**C8H10N4O2**

**Empirical Formula:**

**C4H5N2O**