**Molecular Formulas**

Finding the molecular formula of an unknown compound is an important technique in pharmaceutical research, environmental toxicology and forensics.

\* Remember that the empirical formula is just the molecular formula reduced.

Finding molecular formulas

**Molecular Multiplier = Molar Mass/ Empirical Mass**

\* We find the molar mass using a mass spectrometer (pg 281)

Ex 1. A compound with the empirical formula CH has a molar mass of 78.11 g/mol. What is the molecular formula?

MCH (empirical mass) = 12.011 + 1.008 = 13.019 g/mol

Molecular Multiplier = 78.11 g/mol (molar mass of true compound)  
 13.019 g/mol (empirical mass)  
 = 6

Empirical formula C1H1 x 6 (to each subscript)

Molecular formula C6H6

Ex 2. An unknown compound contains 55.4% C, 7.8 % H and 36.8 % O. Mass spec analysis concludes that the compound has a molar mass of 390.48 g/mol. Identify the compound.

Assume a 100 g sample

mC = mH= mO=

nC = nH= nO=

C : H : O

(these shouldn’t be nice numbers)

Now do the new step in example 1 with the empirical formula. Your final answer should be:

Empirical formula C6H10O3

Molecular formula C18H30O9