Chemistry 111

EMPIRICAL FORMULA-

MOLECULAR FORMULA-

DETERMINING THE EMPIRICAL FORMULA OF A COMPOUND

1. A compound is analyzed and found to contain 25.9 % nitrogen and 74.1 % oxygen. What is the empirical formula of the compound?

Assume you have 100. grams of the substance. ∴ 25.9 g N, 74.1 g O

$n = \frac{m}{M} = \frac{25.9\,g}{14.01\,g/mol} = 1.85\,mol$

$O - \frac{74.1\,g}{16.00\,g/mol} = 4.63\,mol$

The mole ratio is 1.85 : 4.63

The empirical formula must have whole number subscripts, therefore divide by the smallest number of moles:

n_N = 1.85 mol ÷ 1.85 mol = 1

n_O = 4.63 mol ÷ 1.85 mol = 2.5

$NO_{2.5}$

The mole ratio is 1 : 2.5 ×2

The empirical formula must have whole number subscripts, therefore multiply both subscripts by the smallest whole number that will convert the subscripts to whole numbers:

∴ N_2O_5

The empirical formula is _____ ✓

DETERMINING THE MOLECULAR FORMULA OF A COMPOUND

1. A chemical analysis of phosgene, a poisonous gas used in World War I, gave the following evidence. 12.1% Carbon, 16.2% Oxygen, 71.7% Chlorine and a molar mass of 98.8. Determine the molecular formula.

Start with emp formula....

12.1 g C ÷ 12.01 = 1.00

16.2 g O ÷ 16.00 = 1.01

71.7 g Cl ÷ 35.45 = 2.0

∴ $COCl_2$ $\frac{MM}{EM} = \frac{98.8}{96.92} \sim 1.0$

∴ MF = $COCl_2$