General Chemistry
Mr. MacGillivray
Quiz #19:
Empirical and Molecular Formulas

1. Calculate the % composition by mass of Na_3PO_4. Show all work. Report answers to three significant figures.

% Na = _____ % P = _____ % O = _____

2. Calculate the empirical formula of a compound for which the % composition by mass is 69.9% Fe and 30.1% O. Show all work.

3. Calculate the molecular formula of a compound (molar mass = 150. g/mol) for which the empirical formula is CH_2O.

Assume 1.00 mol Na_3PO_4

∴ 3.00 mol Na × $\frac{23\ g}{1\ mol}$ = 69 g Na

1.00 mol P × $\frac{31\ g}{1\ mol}$ = 31 g P

4.00 mol O × $\frac{16\ g}{1\ mol}$ = 64 g O

total = 164 g

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% Na = 42.1 % % P = 18.9 % % O = 39.0 %

Na = $\frac{69}{164} \times 100 = 42.1\ \%$

% O = $\frac{64}{164} \times 100$

% P = $\frac{31}{164} \times 100 = 18.9\ \%$

2. Calculate the empirical formula of a compound for which the % composition by mass is 69.9% Fe and 30.1% O. Show all work.

Assume 100 g ∴ 69.9 g Fe and 30.1 g O

69.9 g Fe × $\frac{1\ mol\ Fe}{55.85\ g\ Fe}$ = 1.25 mol Fe

30.1 g O × $\frac{mol\ O}{16.0\ g\ O}$ = 1.88 mol O

→ $Fe_{1.25}O_{1.88}$

$\frac{1.88}{1.25} = 1.50 = \frac{3}{2} = \frac{O}{Fe}$

Fe_2O_3

3. Calculate the molecular formula of a compound (molar mass = 150. g/mol) for which the empirical formula is CH_2O.

CH_2O

C = 12.0 = 12
H = 2 × 1.01 = 2
O = 16 = 16
30 g/mol

$\frac{150\ g/mol}{30\ g/mol} = 5$

$C_5H_{10}O_5$