CHEM 101 Day 8

What is the final concentration if 75.0 mL of a 3.50 M glucose solution is diluted to a volume of 400 mL?

(3.50 M)(75.0 mL) = (M_2)(400 mL), M_2 = ((3.50 M)(75 mL)/(44 mL) = 0.656 M

Titration

Analytical method used to determine the concentration of an unknown solution. Allowed to react with a carefully measured amount of a known solution.

MUST know the balanced reaction.

Reaction must go to completion.

Need a way to detect when the reaction is over.

Equivalence point = stoichiometric completion point

End point = point at which we detect the reaction to be over

A 25.0 mL sample of vinegr ($CH_3COOH_{(aq)}$) is titrated with 94.7 mL of a 0.200 M NaOH solution. What is the molarity of the vinegar?

$CH_3COOH + NaOH \rightarrow H_2O + NaCH_3COO$

(x/0.0947 L) = 0.200 M, x = 0.0189 moles NaOH

0.0189 mol NaOH x (1 mol CH_3COOH/1 mol NaOH) = 0.0189 mol CH_3COOH

(0.0189 mol CH_3COOH/0.0250 L) = 0.756 M CH_3COOH

Percent composition

% of A = (mass of A/ total mass) x 100

What is the percent of oxygen in H_2O?

%O = (16.0 g/18.02 g) = 88.8%

%H = (2.02 g/18.02 g) = 11.1%

Diborane has the following analysis: 21.86% H and 78.14% B. What is the empirical formula?

Assume a 100 g sample: **21.86% H = 21.86 g H and 78.14% B = 78.14 g B**

21.86 g H x (1 mol/1.01 g H) = 21.64 mol H

78.14 g B x(I mol B/10.81 g B) = 7.228 mol B

Divide by the smallest: **21.64 mol H/7.228 = 3.001 and 7.228 mol B/7.228 = 1**

BH_3

An unknown white solid has the following composition: 43.6% P and 56.4% O

43.6 g P and 56.4 g O

43.6 g P x (1 mol/30.97 g P) = 1.4078 mol P/1.4078 = 1 x 2 = 2

56.4 g O (1 mol/16 g O) = 3.525 mol O/1.4078 = 2.504 x 2 = 5

P_2O_5

Need Molar Mass to get the molecular formula

Mass Spectrometry

P_2O_5 = empirical formula

By mass spectrometry we find the MM to be 284 g/mole

MM_{P2O5} = 142g/mole

(284/142) = 2

$P_2 \times 2 = P_4$, $O_5 \times 2 = O_{10}$; P_4O_{10}

What is the empirical formula for a compound with: 75.69% C, 15.51% O, 8.8% H

75.69 g C, 15.51 g O, 8.8 g H

75.69 g C x (1 mol/12.01 g C) = 6.30225/0.96938 = 6.501 x 2 = 13

15.51 g O x (1 mol/16 g O) = 0.96938/0.96938 = 1 x 2 = 2

8.8 g H x (1 mol/1.01 g H) = 8.71287/0.96938 = 8.988 x 2 = 18

$C_{13}H_{18}O_2$