Math Diversion Problem 901

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I think that mathematics can benefit by acknowledging that
the creation of good models is just as important
as proving deep theorems.
— David Mumford

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Source: http://msmorrischemistry.weebly.com/uploads/3/8/9/5/38951057
        /stoichiometry__ap_mc_.pdf
 Title:  Empirical formula oxide of nitrogen, Prob. 25
  Presenter: Patrick
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Definitions:

FW = Formula weight = molar mass
ppt = precipitate
At wt = atomic weight

1 Problem

The simplest formula for an oxide of nitrogen that is 36.8 percent nitrogen by weight is . . .

(A) N_2O (B) NO (C) NO_2
(D) N_2O_3 (E) N_2O_5

Ans: (D).

2 Solution

Step 1.

To begin with, we'll denote our mystery compound as N_xO_y, and set its mass to 100.0 grams. Hence, we set the mass of the nitrogen to 36.8 grams and the mass of the oxygen to 63.2 grams.

Step 2. Next, a diagram:

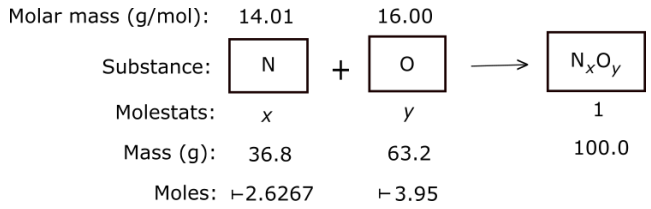

Figure 1. This figure depicts a pseudo-chemical reaction. Since we are only given the percentage of nitrogen in the mystery compound, we are free to pick the mass of the unknown compound as any convenient value we like, so I chose it to be 100.0 grams.

Step 3. Apply the stoichiometric proportion

All we need is the ratio of x to y, and we can use our stoichiometric proportion to get that:

$$\frac{x}{y} = \frac{2.6267}{3.95} = 0.665 \approx 2/3\,, \tag{1}$$

Therefore, the empirical formula of the compound is N_2O_3.