Empirical(/molecular) formula problem

What's it look like

"Unknown substance", ***percentages or grams of each element*** in the substance.
Giveaway question like "What is the empirical formula of...?" or "What are the empirical and molecular formulas of...?"

Ex: Mass spectrometry of an unknown substance (molar mass: 152.0 g/mol) shows it to be composed of 36.85 % nitrogen and 63.15 % oxygen.. What is the molecular formula of this substance?

Concept behind it

Given the relative amounts of the elements in a compound (by mass or percent), you find the lowest mole ratios (subscripts in the empirical formula) or the actual mole ratios of those elements to each other (subscripts in the molecular formula) in that compound.

How to tackle it

Convert percentages or masses to mole amounts, normalize/equalize all moles to lowest amount.

Detailed steps

1) If you're given percentages, change these to grams. You can do this by assuming you have a 100 g sample. If given grams instead, just skip to step 2.
2) Convert grams of each element to moles (divide the grams of each element by its atomic mass)
3) Find the smallest number of moles and divide all the mole amounts by this number. After dividing, if the number is ***very*** close to a whole integer, change it to that integer. If it's very close to a common fraction (a quarter, third, half), then change it to that fraction. *Ex: 3.74998 would be 3.75 whereas 14.9986 would be 15.*
4) If any numbers are common fractions, multiply all numbers by a factor to turn all numbers into even integers. Many times this step is unnecessary as the numbers are already integers.
5) Use these integers as your subscripts in your empirical formula.
6) If a molecular formula is required, divide the molar mass (or molecular weight) given to you by the mass of your empirical formula. Then multiply all the subscripts in your empirical formula by that integer.

Example (continued from above):

Assuming a 100 g sample and converting to moles:

$N\text{: } 36.85\text{ g} \cdot \frac{1\text{ mol}}{14.007\text{ g}} = 2.630827443\text{ mol N}$

$O\text{: } 63.15\text{ g} \cdot \frac{1\text{ mol}}{16.00\text{ g}} = 3.946875\text{ mol O}$

Normalizing to smallest mole amount:
2.630827443 mol N / 2.630827443 = 1 mol N
3.946875 mol O / 2.630827443 = 1.5 mol O

Multiply to bring up to whole number mole amounts (if needed):
1 mol N · 2 = 2 mol N *1.5 mol O · 2 = 3 mol O*
Empirical formula: N_2O_3
Empirical mass = 76.014

152.0 g/mol (from molar mass given above) / 76.014 g/mol = 2 (multiply subscripts by this number for molecular formula)

Molecular formula: N_4O_6