Calculating Molecular Mass

This is a figure showing the locations of hydrogen (H), oxygen (O), carbon (C), nitrogen (N) and phosphorus (P) atoms in one molecule of adefovir dipivoxil, which is a drug designed to treat hepatitis B.

**Problem 1** - How many atoms of each element are present in one molecule of tannic acid?

**Problem 2** - Write the molecular formula of this molecule by filling-in the blanks with the number of counted atoms in the following:

\[
C__H__ N__O__P__
\]

**Problem 3** – The mass of each element is given in terms of Atomic Mass Units (AMUs). If the masses of the atoms in adefovir dipivoxil are H = 1 AMU, C=12 AMU, N= 14 AMU, O=16 AMU, and P = 31 AMU, what is the total mass of a single molecule in AMUs?

**Problem 4** - If 1 AMU equals \(1.7 \times 10^{-27}\) kilograms, how many molecules are present in a sample with a mass of 1 microgram?
Problem 1 - How many atoms of each element are present in one molecule of tannic acid?

Answer: Carbon (C) = 20  
Oxygen (O) = 8  
Hydrogen (H) = 32  
Nitrogen (N) = 5  
Phosphorus (P) = 1

Problem 2 - Write the molecular formula of this molecule by filling-in the blanks with the number of counted atoms in the following:

C\textsubscript{20} H\textsubscript{32} N\textsubscript{5} O\textsubscript{8} P

Problem 3 – The mass of each element is given in terms of Atomic Mass Units (AMUs). If the masses of the atoms in adeovir dipivoxil are H = 1 AMU, C=12 AMU, N= 14 AMU, O=16 AMU, and P = 31 AMU, what is the total mass of a single molecule in AMUs?

Answer: \[ M = 20(12) + 32(1) + 5(14) + 8(16) + 1(31) = 501 \text{ AMU}. \]

Problem 4 - If 1 AMU equals $1.7 \times 10^{-27}$ kilograms, how many molecules are present in a sample with a mass of 1 microgram?

Answer: One molecule has a mass of 501 AMU x (1.7x10\textsuperscript{-27} km/1 AMU) = 8.5 x 10\textsuperscript{-25} kg. The sample has a total mass of 1.0x10\textsuperscript{-6} grams which equals 1.0x10\textsuperscript{-9} kilograms. So the number of molecules is \[ N = 1.0x10^{-9} / 8.5x10^{-25} = 1.2 \times 10^{15} \text{ molecules}. \]