CH 115 - Mass & Calculations

Tuesday, September 1, 2020 8:11 PM

Percent Abundance of an Isotope Example
The average atomic weight of oxygen (O) is 15.9994 amu. It has three naturally occurring isotopes, ^{16}O, ^{17}O and ^{18}O, and 0.037 percent of oxygen is made up of ^{17}O. If the atomic weights are ^{16}O = 15.995 amu, ^{17}O = 16.999 amu and ^{18}O = 17.999 amu, what are the abundances of the other two isotopes?

Known:

Molecule	Mass (amu)	Percent (%)
O	15.999	100%
^{16}O	15.995	x
^{17}O	16.999	0.037
^{18}O	17.999	x

Find: Percent abundance for ^{16}O and ^{18}O?

Steps:

1) **Define a Variable**
   Set one of the unknown abundances: ^{16}O = x
   Subtract Known Percentages: O -^{17}O = 100 - 0.037 = 99.963 /100 = 0.99963
   The other unknown abundance ^{18}O = y = 0.99963 - x.

   ^{16}O + ^{17}O +^{18}O = O
   X + 0.037 + y = 100
   x+y = 100-0.037
   x+y = 0.9
   x=0.9-x

2) **Set up an Equation**
   (atomic weight of ^{16}O) • (fractional abundance of ^{16}O) + (atomic weight of ^{17}O) • (fractional abundance of ^{17}O) + (atomic weight of ^{18}O) • (fractional abundance of ^{18}O) = 15.9994

   (15.995) • (x) + (16.999) • (0.0037) + (17.999) • (0.99963 - x) = 15.9994

3) **Solve for X**
   15.995x - 17.999x = 15.9994 - (16.999) • (0.00037) - (17.999) (0.99963)
   X = 0.9976
   ^{16}O= 0.9976 * 100% = 99.76%

4) **Solve for Other Variable**
   ^{18}O = 0.99963 - x
   X = 0.9976
   ^{18}O = 0.99963 - 0.9976 = 0.00203
   ^{18}O = 0.00203 * 100% = 0.203%

Answer:
^{16}O = 99.76%
^{17}O = 0.037%
^{18}O = 0.203%

Source: https://sciencing.com/calculate-percent-abundances-8267267.html