AVERAGE ATOMIC MASS CALCULATIONS

N6

AVERAGE ATOMIC MASSES

The average of all the naturally occurring isotopes of that element.

Isotope	Symbol	Composition of the nucleus	% in nature
Carbon-12	^{12}C	6 protons 6 neutrons	98.89%
Carbon-13	^{13}C	6 protons 7 neutrons	1.11%
Carbon-14	^{14}C	6 protons 8 neutrons	<0.01%

Carbon = 12.011

WEIGHTED AVERAGE

We want to take into account how much of each isotope there is so we get an accurate picture of what we are likely to "scoop up"

Carbon = 12.011

WEIGHTED AVERAGE

Average should give you a clue as to what the most common isotope is:

Average mass of Carbon = 12.011

Which is the most common isotope of carbon?

Carbon-12 **Carbon-13** **Carbon-14**

CALCULATING AVERAGE MASS

$$\text{Avg. Mass} = \left(\begin{array}{l} (\text{Mass}_{\text{Isotope1}} \times \%_{\text{abundance1}}) \\ + (\text{Mass}_{\text{Isotope2}} \times \%_{\text{abundance2}}) \\ + (\text{Mass}_{\text{Isotope3}} \times \%_{\text{abundance3}}) \\ \text{etc...} \end{array} \right)$$

TIP - Put your percentages in decimal form. Don't put 30%, put 0.30 in your work/calculator. We see fewer mistakes that way!

AVERAGE ATOMIC MASSES

Isotope	Real Mass	% *(as a decimal)*	=
Mg-24	23.99 X	78.99% → 0.7899	18.9497
Mg-25	24.99 X	10.00% → 0.1000	2.499
Mg-26	25.99 X	11.01% → 0.1101	2.861499

+

= 24.31

If not given the *real* mass of an isotope, just use the mass number given as part of the name…close enough!

FINDING % ABUNDANCE

Same equation, just solving for a different variable!

We can use (x) to represent the $\%_{abundance1}$

We can use (1- x) to represent the $\%_{abundance2}$

BECAUSE:

The total has to add up to 100% right?!

100% is the same as 1 to make the math faster

FINDING % ABUNDANCE

Boron has two naturally occurring isotopes:

B-10 = 10.013amu

B-11 = 11.009amu

Calculate $\%_{abundance}$ for each isotope if the average atomic mass of boron is 10.81amu

$$\text{Avg Mass} = (\text{Mass}_1)(\%_{\text{abundance1}}) + (\text{Mass}_2)(\%_{\text{abundance2}})$$

$$10.81 = (10.013)(x) + (11.009)(1-x)$$ *solve for x*

B-10 → x = 0.1998 → *100 = **19.98%**

B-11 → 1-x = 1 - 0.1998 = 0.8002 → *100 = **80.02%**