Atomic Mass & Mass Number

- Remember from yesterday that an atom's mass is the result of the sum of protons & neutrons in it's nucleus (electrons have negligable mass - $\frac{1}{1840}$ AMU each).
- This mass is unique to each atom of an element
- It is also unique to each Isotope of each element because there is not only 1 version of an element.

ex) Carbon has 3 Isotopes - C-12, C-13, & C-14

* Using the symbol of the element & mass number of the element is known as the Nuclide Notation. ex) C-13

As we have mentioned, the atomic mass of every element on the Periodic table is an average of the masses of each isotope of the element

ex) Carbon = 12.011 AMU

. The weird decimal is a result of the average (or weighted average) of the masses of C-12, C-13, & C-14, along with their relative abundances

Here are the abundance of each carbon isotope

C-12 = 98.9%
C-13 = 1.0%
C-14 = 0.1%

To determine the weighted average mass (aka Atomic Mass) of an element use the following formula:

I = istope A, B, C = version of isotope

$$(\text{mass } I_A \times \%\text{ Abund}) + (\text{mass } I_B \times \%\text{ Abund}) + \dots$$

* % must be in decimal form (frequency) before putting into formula - use parenthesis!

ex) C-12 = 98.9% Abund
C-13 = 1% Abund
C-14 = 0.1% Abund

$(12 \times 0.989) + (13 \times 0.01) + (14 \times 0.001)$
$= 12.012$ AMU

To determine % relative abundance of isotopes use following:

$$(\text{Mass } I_B)x + (1.0 - x)(\text{Mass } I_A) = \text{Avg. Mass}$$

x = unknown value

Plug & Chug → Answer = % of I_B

1 − Answer = % of I_A

ex) Cu-63 mass = 62.9296 ← I_A
Cu-65 mass = 64.9278 ← I_B
> Avg = 63.546 (as appears on PT)

$$(64.9278)x + (1.0 - x)(62.9296) = 63.546$$

$$1.9982x = 0.6164$$

$x = I_B = 0.3085$ or 30.85% Abundance

$I_A = 1 - 0.3085 = 0.6916$ or 69.16% Abundance

The mass number of an element is the rounded whole number version of the weighted average (atomic mass) of each element and its isotopes.

* Ignores the small decimals in mass

ex) Carbon = 12.011, the mass number = (12)

ex) Bromine = 79.904, the mass number = (80)

- makes for easier determination of protons & neutrons in atoms.