Lesson 1: Atomic Structure

Atoms

https://www.youtube.com/watch?v=lP57gEWcisY

The atom is the smallest neutral representative particle of an element.

It is composed of several subatomic particles, the most important of which are:

- the proton - a positive (+ charge), mass = 1.0 a.m.u
- the neutron - a neutral (0 charge), mass = 1.0 a.m.u
- the electron - a negative (- charge) mass is insignificant ($1/1800^{th}$ amu)

- the **nucleus** of an atom is made up of protons and neutrons, while the electrons move freely around the nucleus

***Orally**: it is the number of protons that give an element its characteristics (i.e. if you change the number of protons in a nucleus, you have changed the element!!!)*

- unlike charges (i.e. "+" and "-" or p^+ and e^-) attract each other
- like charges (i.e. "+" and "+" or "-" and "-") repel each other

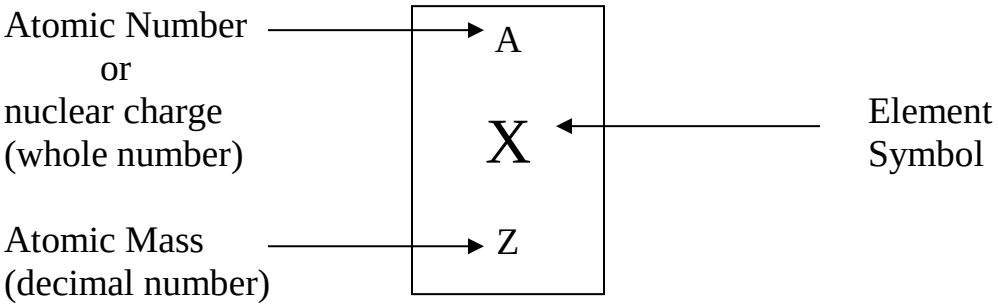
In a neutral atom: **number of electrons = number of protons**

The periodic table represents only neutral atoms.

Atomic Number and Atomic Mass

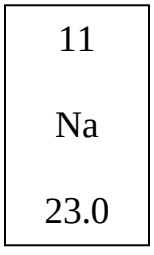
- the periodic table is a chart where all of the elements are organized by their **atomic number** (i.e., the number of protons.)

***Orally**: There are three pieces of information which usually are shown for each element on the periodic table.*



Note: If the information is not organized as in the above, then the smallest number of the two listed is the **atomic number.**

Example:



The atomic number of Na is 11. This means that the following is true:

- Na has 11 protons in its nucleus
- any atom containing exactly 11 protons is an atom of Na
- the charge on the nucleus of the Na atom is +11
- a **neutral** sodium atom has 11 electrons (-11)

Atomic Mass

***Orally**: protons and neutrons make-up the mass of an atom since electrons are too light to make any appreciable contribution to the mass of an atom.*

Atomic mass: - is the total number of protons and neutrons in an atom

Since **atomic number = # of protons**
and **atomic mass = # of protons + # of neutrons**
then

Number of neutrons = atomic mass – atomic number

Have students determine the number of neutrons in an atom of sodium.

Number of neutrons (n) = 23.0 – 11 = 12 n

Q: So what do I do if the atomic mass is a decimal and I'm asked to calculate the number of neutrons?
A: We will cheat here and round the mass to the nearest whole number.

e.g., the mass of calcium on your periodic table is 40.1 a.m.u. We will use 40 a.m.u to calculate the number of neutrons.

Do several examples to determine p+, n, and e- for elements

Ions

If the proton and electron counts differ, then the atom assumes an electrical charge and is no longer an atom but rather an **ion**.

Ion: - an atom or molecule which possess an electrical charge

Note: Electrons have a **NEGATIVE** charge so:

> **ADDING** a **Negative** charge produces a **NEGATIVE** ion, and
> **TAKING AWAY** a **Negative** charge produces a **POSITIVE** ion.

Metals tend to form positive ions by losing electrons and nonmetals tend to form negative ions by gaining electrons.

***Orally**: This exchange of electrons only occurs during a chemical reaction. So ions are a result of a chemical reaction that has already occurred. The periodic table lists elements that have not reacted yet.*

Do several examples including Ca+2, Fe+3, S-2 and F-1

Assign: Worksheet – 7.3 questions 1, 10-17.