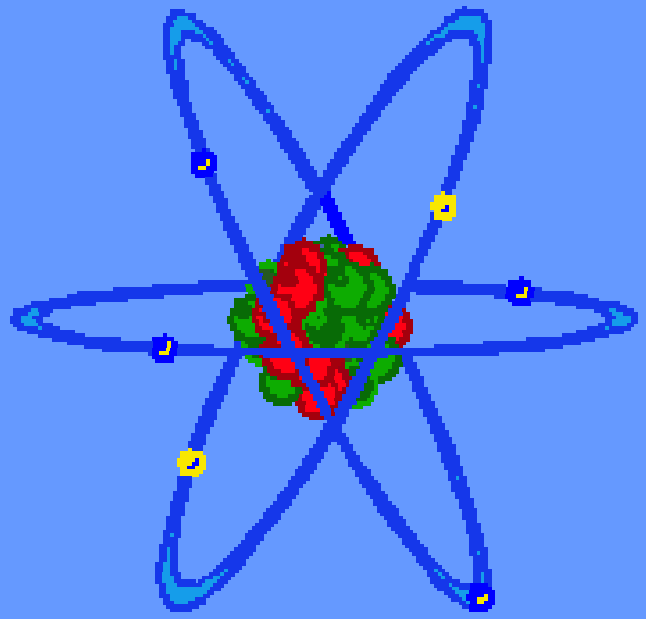
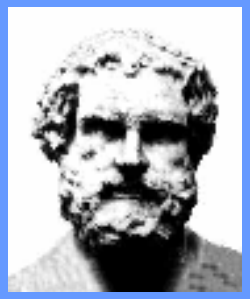
The Atom and Elements

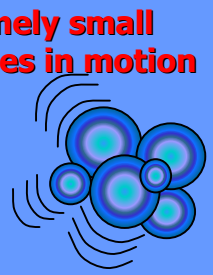


Development of Atomic Theory:



Democritus (460-370 BC)

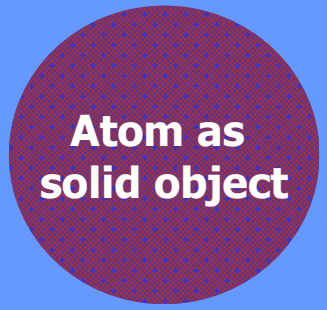
Proposed that matter was made of small particles he called **atoms**. In Greek this means indivisible or cannot be divided. He believed different atoms would vary in size and in constant motion.



John Dalton (1766-1844)

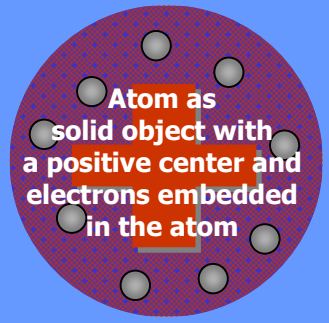
Published the atomic theory:

1. Elements were composed of atoms.
2. Atoms of a given element are identical
3. Atoms of different elements have different properties
4. Atoms don't change, but can be combined and rearranged with other atoms
5. Compounds are formed when atoms of more than one element combine

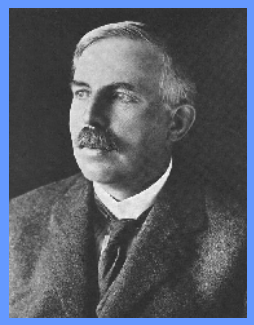


Joseph John Thomson (1856-1940)

Identified the electron, which carries a negative charge. He thought that electrons were embedded in the atom like raisins in raisin bread.



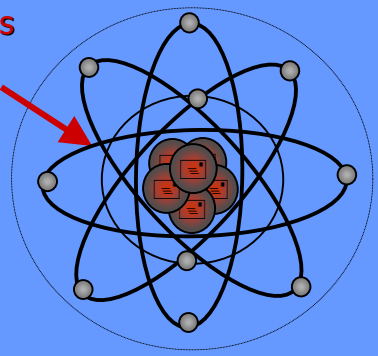
Development of Atomic Theory:



Ernest Rutherford (1871-1937)

Used high speed lightweight atoms called alpha particles to bombard very thin gold foil. Most of these alpha particles passed through the gold foil. The fact that these particles went through the foil lead to his theory that atoms have mostly empty space.

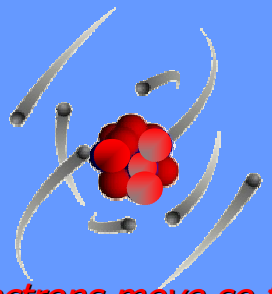
Alpha particles went through spaces.



Neils Bohr (1885-1962)

Described the electrons moving around the nucleus in fixed orbits. Each orbit has a set amount of energy. We still use his model of an atom to better understand the structure of the atom.

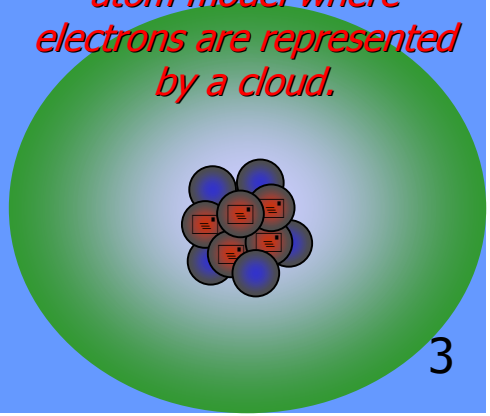
Later experiments have shown that electrons move around the nucleus in waves rather than an elliptical orbit. They are represented as an "electron cloud."



Electrons move so fast that scientists prefer the atom model where electrons are represented by a cloud.

James Chadwick (1891-1974)

Solved the problem of "missing mass" in the atom by discovering the neutron.



Basic Structure of an Atom

Proton

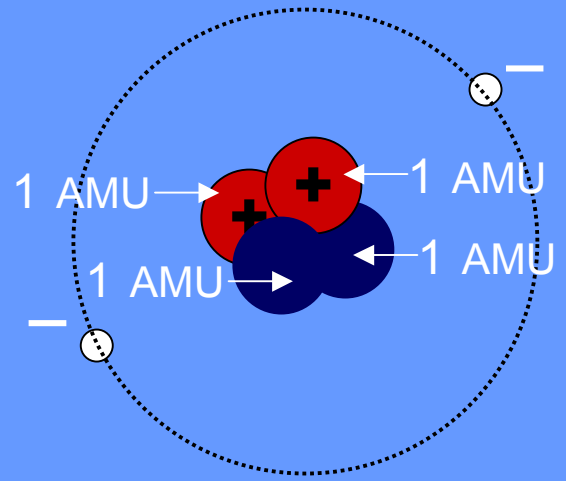
Positive Charge

Neutron

No Charge

Electron

Negative Charge

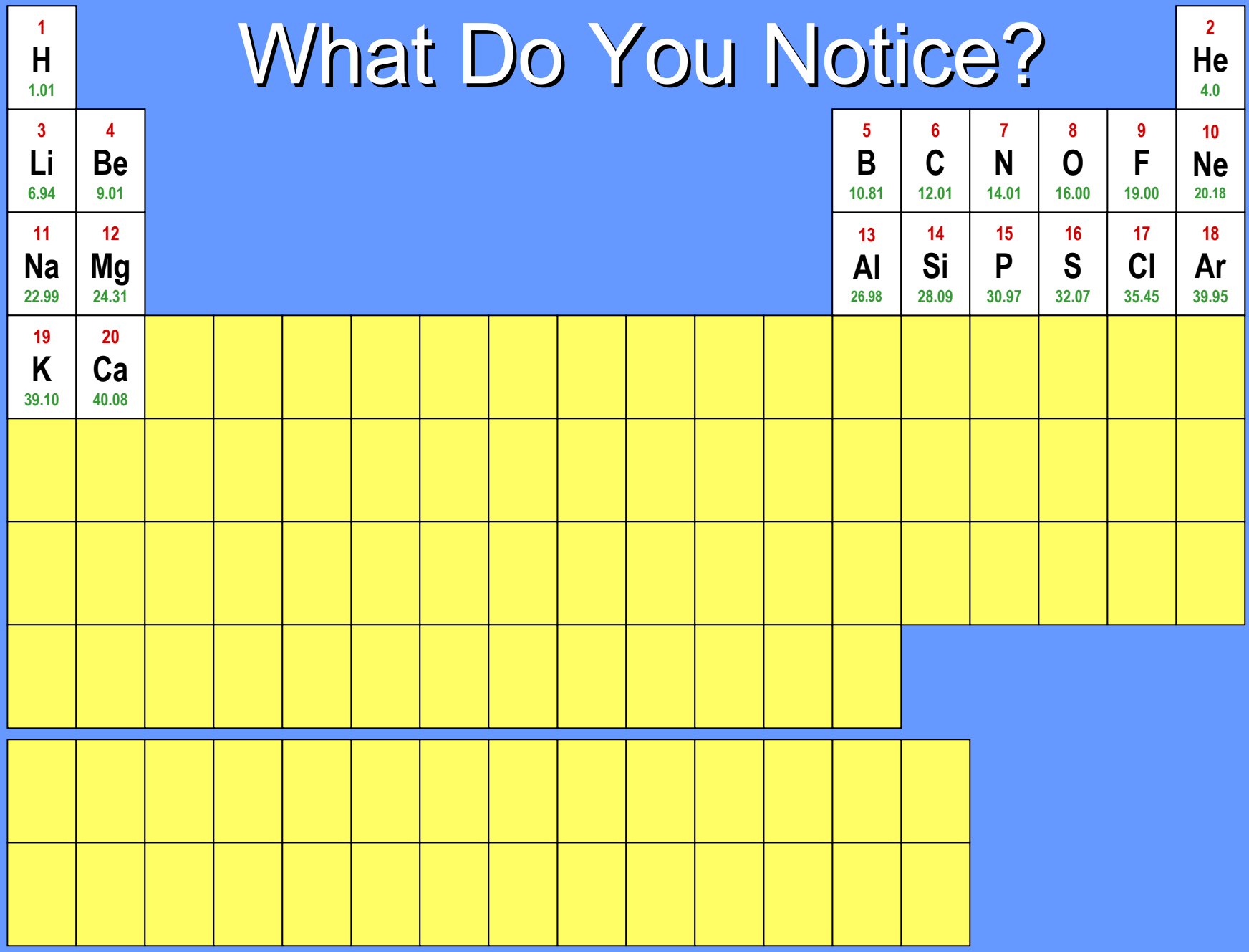


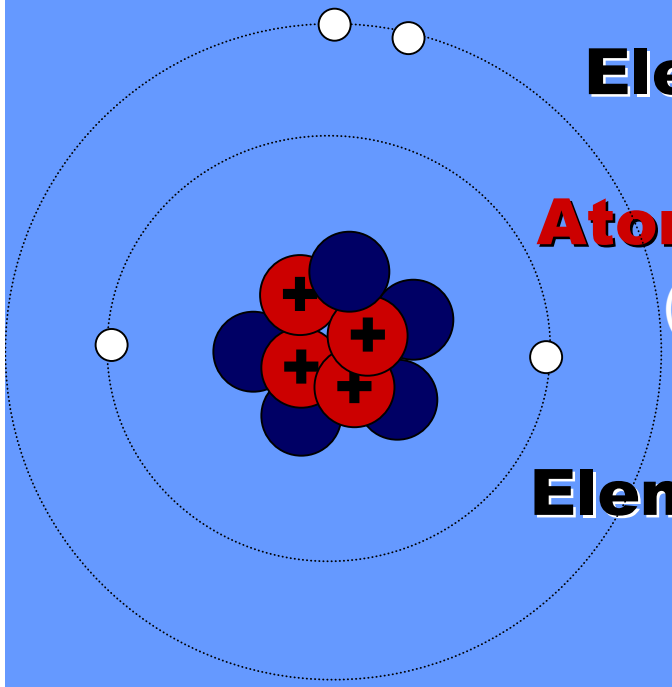
AMU is an atomic mass unit

Electrons don't have much mass compared to protons and neutrons

Notice the Pattern of the Periodic Table

What Do You Notice?





Element Name → *Beryllium*

Atomic Number → 4

(Tell us the # of protons and electrons)

Element Symbol → Be

Atomic Mass → 9.01

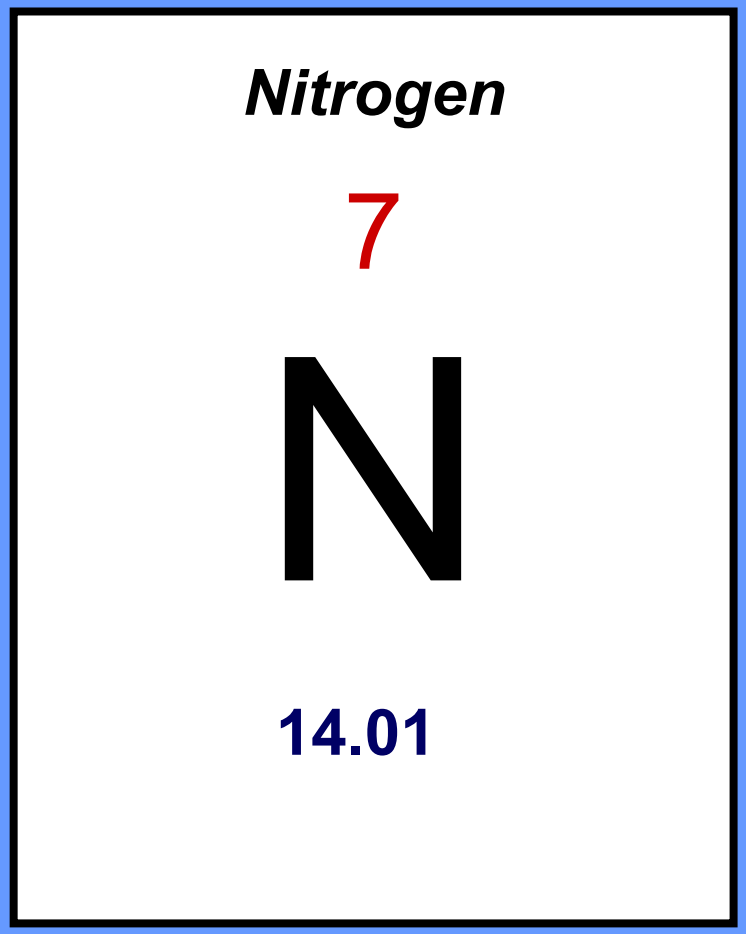
(Tell us how to calculate the # of neutrons)

Atomic Mass - Atomic Number = # of neutrons

9 - 4 = 5

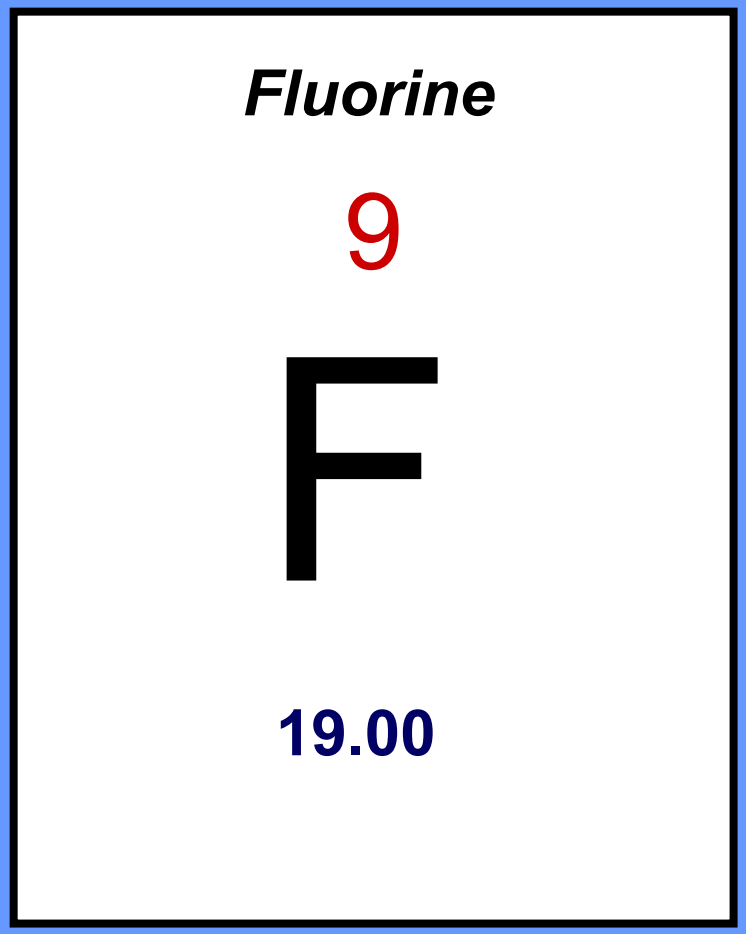
5 Neutrons

What are the numbers of Protons, Electrons and Neutrons?



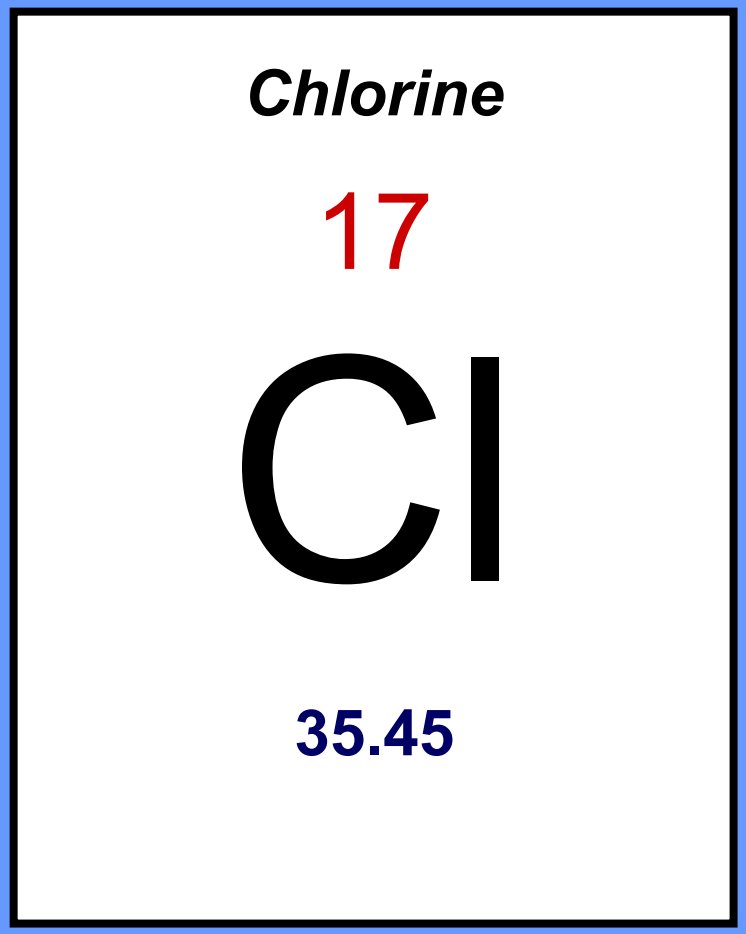
P = 7
E = 7
N = 7

What are the numbers of Protons, Electrons and Neutrons?



P = 9
E = 9
N = 10

What are the numbers of Protons, Electrons and Neutrons?



P = 17
E = 17
N = 18

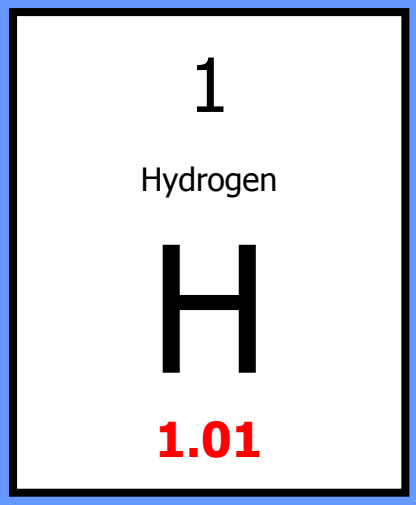
Isotopes

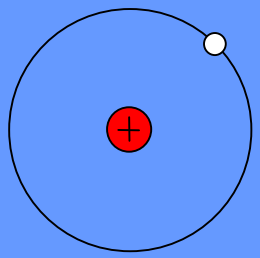
Elements usually have differing amount of neutrons.
These different forms are called **Isotopes**.

Let's take hydrogen as an example:

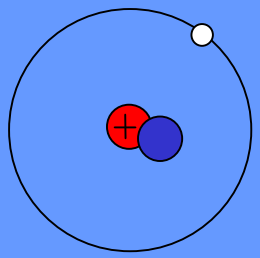
As you can see from the atomic mass (1.01) the most naturally abundant form of hydrogen does not have a neutron.

However in rare instances isotopes form. Below are the isotopes of hydrogen:

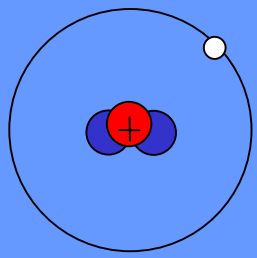




Protium

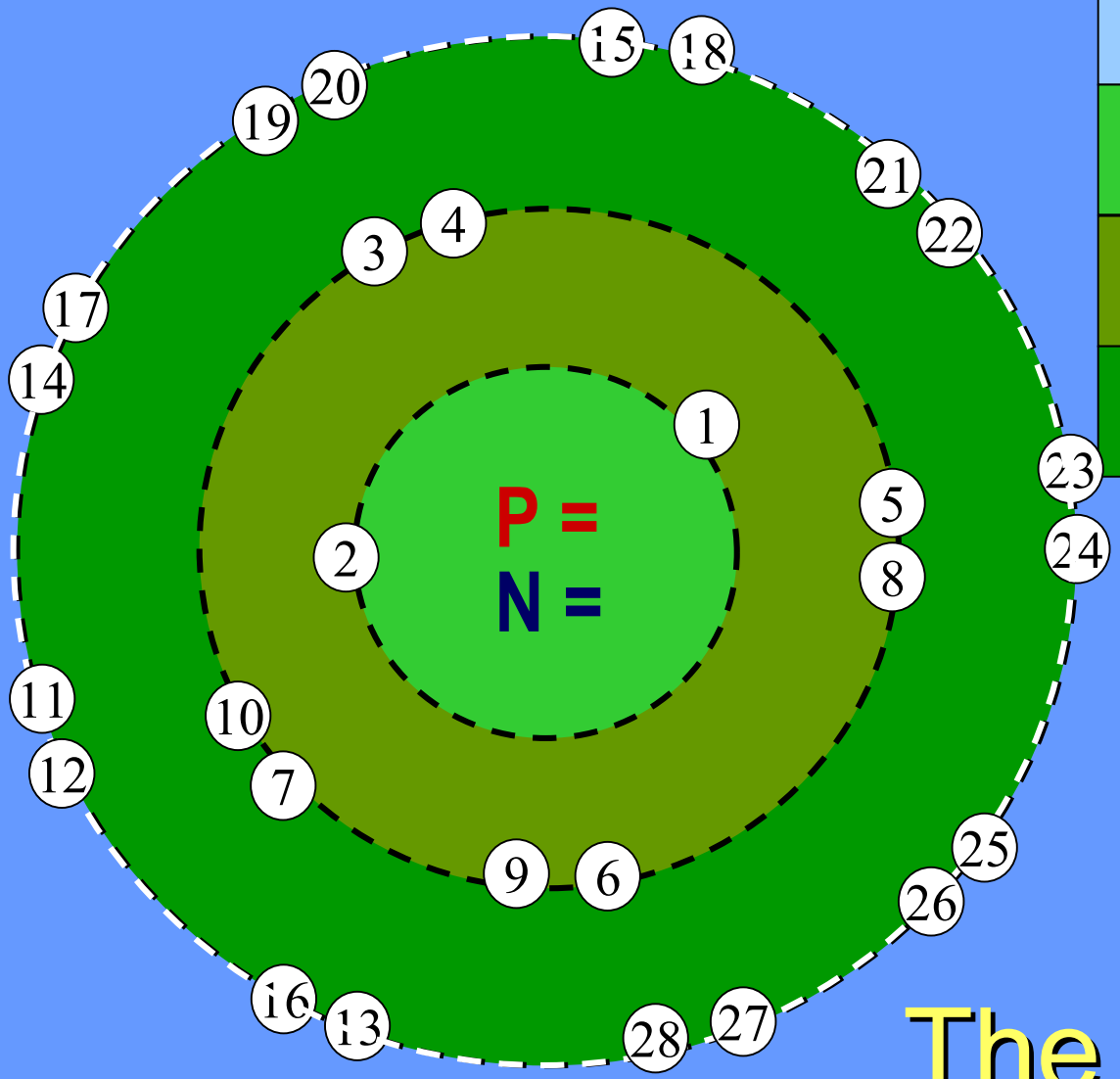


Deuterium



Tritium

…. are isotopes of hydrogen.



Energy Level	Max # of Electrons
1	2
2	8
3	18

The Bohr Model

Valence Electrons – The electrons on the outer shell