Atomic Model #3: Discovering Electrons:

Thomson (1897): Experimented with Cathode Ray Tubes (CRTs)

A CRT is similar to your TV. It has an anode (A Negative electrode) and a cathode (A positive electrode). These are enclosed in an evacuated (air removed) glass container and when a charge is applied, the electrons flow from anode to cathode through the open space of the glass container.

As you watch the CRT, list your observations below. Are these qualitative or quantitative measurements?

1. e- are attracted to the POSITIVE plate
2. e- are deflected from N pole of magnet

7th grade: OPPOSITES ATTRACT (rule for charges & electricity)
Thomson observed these particles and determined that the particles:

- **Move at a very high speed** (about 10% the speed of light)
- Have a **negative charge**
- Have a **mass of about 1/2000 of a hydrogen atom** (hydrogen is the smallest atom)
- Were the same regardless of which gas was used in the container or the metal used as the electrode

**ALL e- are the same (from any element)**

The “plum pudding model” attempted to explain atomic structure once the electron (e- or e) had been discovered. An atom, according to this model, was a cluster of small positive and negative charges.

**SKETCH:** (Think of a choc. chip muffin)
Up to now...

• There are 3 types of **subatomic** particles – **protons, neutrons & electrons**

• The # of protons is called the **atomic #**

• # of **protons** (atomic #) **defines the element**

• **Neutral atoms** have the exact same number of **protons** as **electrons**

Nervous? – go to **classroom**
NOTES:
There are two different naturally occurring types of chlorine atoms, represented by Cl-35 and Cl-37.

What is the difference between these two?!

**Isotopes** = Same element with different numbers of neutrons!

So... What are three things that are the *same* between atoms that are isotopes?
1. Same # protons (same element!)
2. Same atomic number
3. Same # electrons

What are two things that are different?
1. # of neutrons
2. Mass number

Remember:
★ 1. The number of protons defines the *element*.
★ 2. The number of neutrons determines which *isotope* of a given element you have.
1. Atomic Mass: We are interested in "% natural abundance" - the weighted average of the mass of all isotopes of an element.

The Sum of # protons plus # neutrons is the Mass Number.

2. Look at a Periodic Table... Atomic mass is given to a number of decimal places. This is because, in most cases, there are a number of naturally occurring isotopes.

Mostly C-12
Some C-14

AVERAGE atomic mass
2. Look at a **Periodic Table**... Atomic mass is given to a number of decimal places. This is because, in most cases, there are a number of naturally occurring isotopes.

Example #1:
A natural sample of C (atomic mass = 12.011 amu) is a mixture of C-12 (98.89%) and C-14 (1.11%).

Carbon's atomic number is **6**, has an average atomic mass of **12.011** amu, and carbon's most common isotope has a mass number of **12** amu.

Therefore, the most common type of carbon atom has **6** protons, **6** neutrons and **6** electrons. Another naturally-occurring isotope of carbon is C-14, but it is rare in comparison to the amount of C-12 in nature.
Example #2:

A natural sample of N is a mixture of N-14 and N-15. Based on the atomic mass given on the periodic table, which isotope of nitrogen is more abundant?

\[ \text{Avg atomic mass} = 14.0067 \]

N-14   N-15

14 14 14 15 14 14 14 14 15 14 14 14 14

\textit{N-14 must be more abundant}
<table>
<thead>
<tr>
<th>Element Name</th>
<th>Atom (Isotope)</th>
<th>Atomic Number</th>
<th>Number of Protons</th>
<th>Number of Neutrons</th>
<th>Number of Electrons</th>
<th>Mass Number</th>
<th>Nuclear Charge</th>
<th>Overall Atomic Charge</th>
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1. QUIZ
2. Finish Assignment #7 – check with key
3. Atomic Goodies – get bag & sheets up front
4. Isotopes Tutorial – yellow sheet (link on classroom)
5. HW = #7 and #9 and yellow sheet