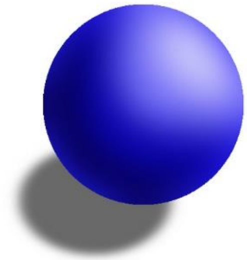
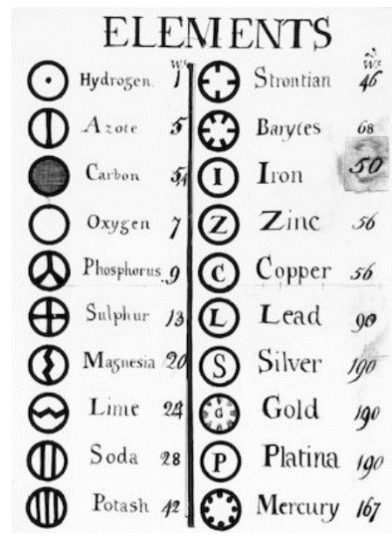
1. **Democritus**

The first person to suggest the idea of atoms is credited to a Greek philosopher named Democritus. More than 2400 years age, Democritus asked whether it is possible to divide a sample of matter forever into smaller and smaller pieces. After much thought, he concluded that it was not. At some point, a smallest piece would be reached. In fact, the word "atom" comes from the Greek word *atomos*, meaning "cannot be divided." Democritus and his students did not know what scientists today know about atoms. However, they hypothesized that atoms were small, hard particles that were all made out of the same material. They also believed them to be infinite in number and that they were always moving and could be joined together. They weren't far off.

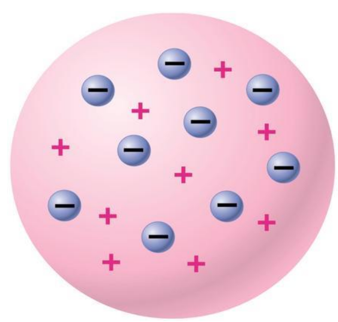


Dalton - In the early 1800s a man **John Dalton**, an English chemist, weather observer and discoverer of colorblindness among other things, did some careful experiments involving matter and mass. Based on his observations he came up with an Atomic Theory of Matter. Much of his theory was correct. Scientist for the first time started accurately identifying atoms as various elements and compounds. His Atomic Theory changed little regarding the development of the model of the atom, but it took it beyond just philosophy. Dalton order each of the known elements and gave them symbols 1808.



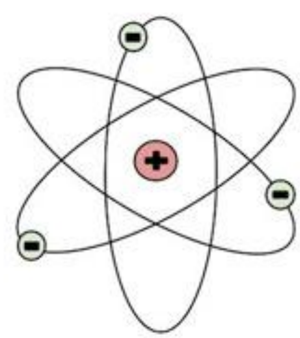
2. **Thomson's Model**

The first scientist to suggest that atoms contain smaller particles was J.J. Thomson of England. In 1897, Thomson passed an electric current through a gas. He found that the gas gave off rays made of negatively charged particles. He had discovered the electron. Because the electrons were negative and atoms were known to be neutral, Thomson reasoned that there must also be some positive charge holding the atom together. Thomson hypothesized that an atom is made up of mostly positively charged material with electrons scattered evenly throughout.



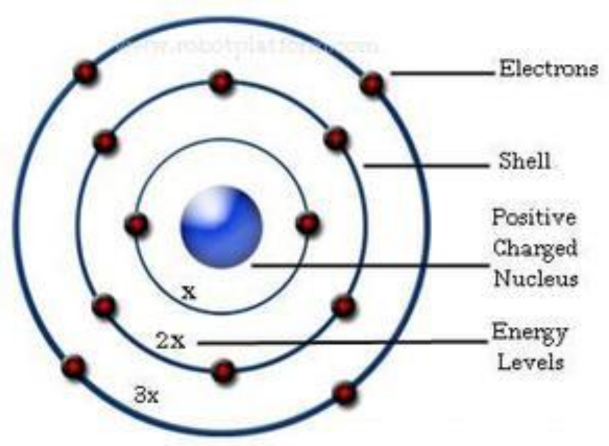
3. **Rutherford's Model**

In 1908, a scientist from New Zealand named Ernest Rutherford having studied under Thomson performed an experiment to test Thomson's atomic model. Rutherford discovered that an atom is mostly empty space. He did this by firing alpha particles at thin sheets of gold foil. If the nature of the atom were solid, the particles should bounce back. They typically did not and most simply passed right through as though nothing were there at all. He released the atom was mostly "empty space." On occasion a few alpha particles would bounce back or be deflected. Rutherford had discovered the dense mass packed core of an atom. He called it the nucleus.



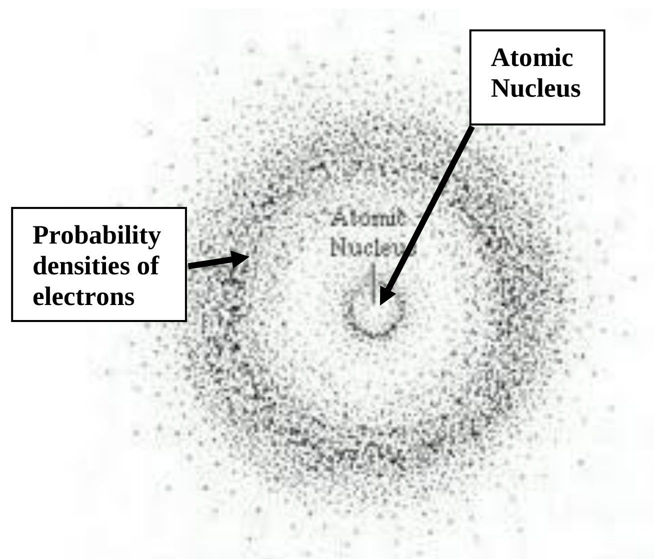
4. Bohr's Model

Rutherford's model of the atom did not explain the arrangement of electrons. In 1913, the Danish scientist Neils Bohr proposed that electrons in an atom are found in discrete energy levels. Each energy level is at a certain set distance from the nucleus. Electrons in different energy levels move around the nucleus in different *orbits*, much as the planets move in orbits around the sun. Bohr was drawn to this conclusion after careful observations and consideration. His theory had strong opposition however, at the time and opponents of it often pointed to the fact that electrons were known to be negative and the nucleus positive. Why do electrons not spiral down into the nucleus? Shouldn't oppositely charged particles be attracted to one another? Bohr's idea was radical but ultimately proved correct.



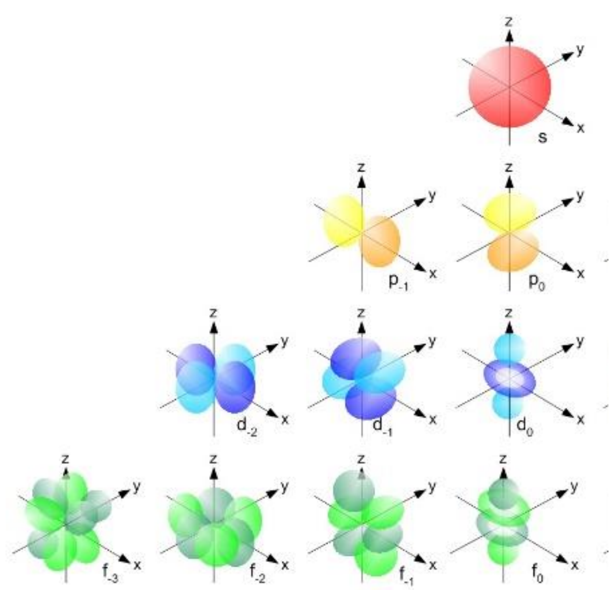
5. Cloud Model

Scientists now know that the exact location of an electron cannot be predicted. Instead, energy levels are used to predict the place where an electron is most likely to be found outside the nucleus. This area is often called the electron cloud. Within this cloud are distinct shells in which electrons reside. The heavier the atom, like Uranium, the more shells it has. Like layers of an onion, one shell staked on top of another. The shells are typically modeled as spherical and each spherical shell has subshells. As an atom gains energy, electrons climb higher through the cloud layers or shells. Models often portray electrons as particles for the sake of conceptual ease. Sometimes this approach is correct for instance when calculating velocity of an electron. Other times it is best to think of electron as an energy wave that occupies a given shape, space and volume around an atom's nucleus. Quantum Mechanics, which Bohr helped to pave the way for tries to rectify this dual nature of electrons as both wave or particle. The reality is perhaps far more complex. They are both and neither.



6. The Quantum Mechanics Model

Uses complex shapes of orbitals (sometimes called electron clouds or quanta) which occupy distinct volumes of space in which there is likely to be an electron.
This model is based on probability rather than certainty. Scientists now believe that as we move up the Periodic Table and the atom increases in atomic number (protons) & number of electrons, all sorts of bizarre geometric patterns around the nucleus start to arise. The evolution of Bohr's idea of quantum energy levels turns about to very complex. Here you see electrons forming all sorts of complex geometric patterns around the nucleus of their atom in 3 dimensional space.



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