

Democritus - Dalton

The first person to suggest the idea of atoms is credited to a Greek philosopher named Democritus. More than 2400 years ago, 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.

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 the Atomic Theory of Matter. It changed little in regard to the development of the model of the atom, but it took physics and chemistry beyond just philosophy and into the realm of true scientific endeavor. He identified for the first time elements by atomic mass.

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. Today these particles are known as electrons. 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. His model often referred to as the plum pudding model.

Rutherford's Model

In 1908, a scientist from New Zealand named Ernest Rutherford performed an experiment to test Thomson's atomic model. Rutherford was Thomson's understudy and 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 did not, and most simply passed right through as though nothing were there at all. Occasionally some the alpha particles ricocheted wildly in one direction or another. He concluded that they must have struck a small dense central core. The nucleus had been discovered.

Bohr's Model

Rutherford's model of the atom did not explain the arrangement of electrons. In 1913, the Danish scientist Neils Bohr, working under Rutherford proposed that electrons in an atom are found in discrete energy levels. Each energy level is at a certain 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?

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 stacked 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. During the period of debate that much of this was all being hashed out it was common to simply depict the electron as a cloud of sorts around a nucleus.

The Quantum Mechanics model

Uses complex shapes of orbitals (sometimes called electron clouds) 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 atoms increase in atomic number & number of electrons, all sorts of bizarre geometric patterns around the nucleus start to arise.

