The changing of the atom

The idea of the atom as the basic building block of matter has been in existence for a very long time. In 600 BC, the philosopher, Acharya Kanad wrote, ??? Every object of creation is made of atoms which in turn connect with each other to form molecules??? (Lower, 2006). A couple of centuries later in 460? BCE, the Greek philosopher Democritus said the smallest particle of matter was the atom.

He came up with the idea that when you break a piece of matter over and over, you will eventually come to a point where the smallest piece simply can??™t be broken up any more. ??? Basic matter particles??? was his name for them. For roughly 2, 000 years no new ideas regarding the atom were developed. Then in 1804 John Dalton developed five qualities about the atom which could be scientifically tested (Carpi, 2003). From this point on, through much research and experimentation, the concept of the atom began to change. New thoughts, new ideas and many theories have arisen since then from several different scientists. Often small strides or slight changes in experimentation have led to a new or better understanding of the atom. One thing must be remembered, the current concept of the atom is also subject to change because the world of scientific discovery will continue.

New discoveries have led to the continual changing of the understanding of the atom, what makes up an atom, and how the parts interact within an atom and between atoms. The work of one scientist is used, added to and/or modified by another scientist. With improvements in technology come better, more in depth experiments which also adds to the discoveries that change understanding. Modern atomic theory began with Dalton (infoplease.

com, 2000-2010). * Dalton??™s work stated: * Chemical elements are composed of atoms. Atoms are indivisible and indestructible. * All atoms of a given element are identical in mass and properties.

* Compounds are formed by a combination of two or more different kinds of atoms. * A chemical reactions is a rearrangement of atoms.(De Leon, 2001) Dalton??™s theory of the atom is sometimes compared to a billiard ball. In 1897, J. J. Thomson, discovered atoms were not indivisible like a billiard ball, but contained positive and negative components. This discovery led to the understanding that the atom was made up of something smaller, or subatomic particles. His research led to a model known today as the ??? plum pudding??? model (Khan, 2008).

From 1906-1908, Ernest Rutherford put Thomson??™s pudding model to the test. He discovered the atom was mostly empty space and the positive charge was concentrated in a nucleus (Hyder, 2009). This was a great scientific achievement and is still the accepted view of the basic structure of the atom today. In 1913, Niels Bohr, had an amazing physics idea which went against accepted physics principles at the time. He believed electrons could travel through a ??? permitted??? path without losing energy (Khan, 2008). Bohr improved on the existing model of the day by using Rutherford??™s model and incorporating his own theory.

Colleagues of Thompson??™s had already determined that cathode rays carried a negative charge and their mass to charge ratio was over a thousand times smaller than the ratio for the smallest charged atom (American Institute of Physics, 1997). Using this information and conducting

some experiments of his own, Thompson suggested that cathode rays were actually made up of particles smaller than the smallest atom. These particles turned out to be electrons, although Thompson called them corpuscles. Based on the information that atoms were known to be electrically neutral and the electrons are negatively charged, Thompson developed a model of the atom that had electrons interspersed in a mass of positively charged material (Sharma, 2010). This is where the term, ??? plum pudding model??? came from.

The electrons represent the raisins and the positively charged material represents the pudding in plum pudding. Thompson??™s work advanced the atomic theory from the atom as the smallest building block of all matter to the atom being made up of smaller particles. Ernest Rutherford used gold foil and bombarded it with alpha particles. He observed that most of the particles passed right through the foil unaffected. A few particles passed through the foil and were deflected. A few were deflected back toward the source of the particles. From this he concluded that: * The gold atoms were made up of mostly empty space.

* The positive charge in an atom must be concentrated in a nucleus.(Carpi, 2003) Rutherford built on Thompson??™s idea that atoms are made up of smaller particles, but disproved Thompson??™s idea that the electrons are distributed throughout a positive mass. Instead he concluded that the positively charged particles were concentrated in the center of the atom, the nucleus, with the electrons surrounding the nucleus in a ring. The electrons are so small and spread out that most alpha particles he shot at the gold foil could pass right through.

The ones that did hit the nucleus were either deflected or bounced right back at the source of the particles. The atomic model that Rutherford proposed had a problem with how to explain specifically how the electrons behave. If they are stationary the positively charged nucleus would attract them.

Accepted physics principles of the day said that charged particles in motion gave off energy. If the electrons were in motion around the nucleus they would lose their energy, slowing as they did and be attracted to the nucleus. Niels Bohr suggested that there is a permitted orbit around the nucleus that electrons could travel without losing their energy (Pradesh-Hyderabad, 2006). These orbits were called electron shells. So his explanation directly contradicted the current theory. However, the model stood up to the experiments designed to test it.

As Bohr??™s principle became accepted, the model for the atom came to be known to contain a nucleus at the center containing the protons and neutrons, with the electrons rotating around the nucleus in defined orbits.