Atomic Theory

- Over the 2000 years there have been many ideas and models postulated to describe what we now know as the atom.

1.) Democritus – 5th century B.C. he suggested that atoms might exist as "tiny, uniform and uncuttable particles".

2.) Aristotle – 4th century B.C. rejected Democritus' idea and postulated that earth, air, fire and water are the fundamentals of existence.

3.) Various scientists – middle ages many scientists shared discoveries and built upon each other's work, accumulation much knowledge through experimentation.

4.) John Dalton – 1808 reintroduced the idea of the atom and supported his atomic theory on a firm experimental foundation.

Dalton's Atomic Theory

- elements are made up of extremely small particles called atoms.

- the atoms making up a particular element are all identical, and different types of atoms have different properties.

- each chemical compound is unique and consists of a particular combination of specific types of atoms put together in a distinctive way.

- chemical reactions involve the reshuffling of the atoms in a compound to make new compounds. The new compounds are made from the exact same atoms which were present in the original compound.

- Dalton's ideas supported three fundamental laws of chemistry:

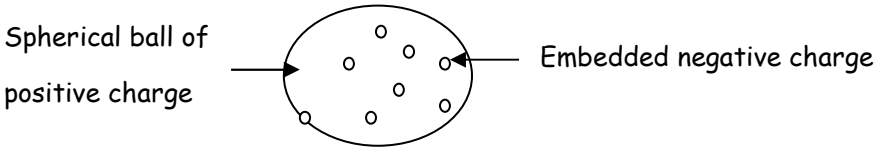
1.) The law of definite proportions or law of constant composition – every pure sample of a particular compound always contains the same proportion by mass of the elements in the compound.

2.) The law of multiple proportions – when elements combine, they do so in the ratio of small whole numbers (assuming they have the same type of chemical bonds).

Ex. – carbon and oxygen react to form CO or CO_2, but not $CO_{1.8}$. Or $1.00\ g$ copper reacts with different amounts of oxygen. Copper could react with $0.126\ g$ of oxygen or it could react with $0.252\ g$ of oxygen. The ratio of these two amounts is a small whole number. $\frac{0.252}{0.126} = 2$

3.) The law of conservation of mass – the mass of the reactants must equal the mass of the products.

- J.J. Thomson – 1897 he discovered atoms contain negatively charged particles (later named electrons). Later he found positive charges that he had hypothesized because atoms are electrically neutral, atoms must possess both positive and negative charges. He poised a model called the "plum pudding model". This said that the atom was a ball of positive charge with negative charges distributed throughout the ball. This sounds like a bowl of pudding with raisins spread about the pudding.



- Sir Ernest Rutherford – 1899 he made many discoveries that contributed to our understanding of the atom. He was awarded a Nobel Prize in chemistry 1908. He shot alpha (α) particles at gold atoms and most flew right by but the odd one shot straight back. This gave him the idea that most of the mass of an atom must be concentrated in the middle. He called this area the nucleus and this is where the protons are found. He predicted the existence of neutrons (a neutral charged particle).

- Rutherford's model of the atom had a small, positively charged nucleus surrounded by a cloud of negatively charged electrons. The nucleus contains almost all the mass and is composed of protons and neutrons. The number of electrons equals the number of protons so the two opposite charges cancel each other out.

- J. Chadwick – 1932 discovers the neutron.

Table of Standard Subatomic Particles

Particle	Symbol	Charge	Mass	Location
electron	e-	-1	0.000549	outside nucleus
proton	p	+1	1.007825	inside nucleus
neutron	n	0	1.008665	inside nucleus

- Niels Bohr – 1913 proposed the electrons in an atom are restricted to having certain specific energies and are restricted to following specific paths called "orbits" at a fixed distance from the nucleus.

Practice – Worksheet – Atomic Structure Atomic Structure - Answers