

ATOMIC AND NUCLEAR PHYSICS

The Atom

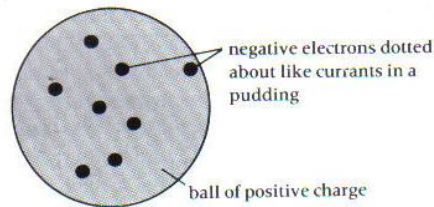
Scientists such as Rutherford, Geiger, Thomson, Mardsen, Bohr and Chadwick helped established modern views of the atom.

Before 1897

Atoms were thought to be small invisible particles

1902 -Thomson

Thomson showed that negative charges called electrons existed within matter. He suggested that the atom resembled a plum pudding where the electrons were represented by the seeds and the body of the plum pudding was the positive charge.



a) 1902: Thomson's 'plum pudding' atom

1906 - Rutherford

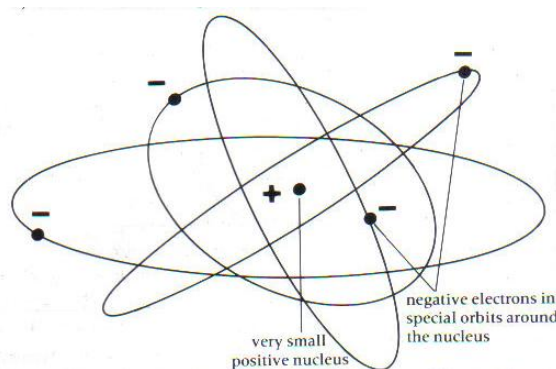
During this time Rutherford observed that alpha particles passing through a thin sheet of mica without making holes in it.

1911- Geiger and Marsden

They fired alpha particles at a gold foil and found that some of the alpha particles went straight through, a few were deviated and a small number were reflected.

1913 - Rutherford and Bohr

These two scientists came up with a new model that suggested that the atom had a dense central core, which was positive, and a very small negative part compared to the rest of the atom. They suggested that the most of the volume occupied by the atom was an empty space and negative electrons orbited around the nucleus



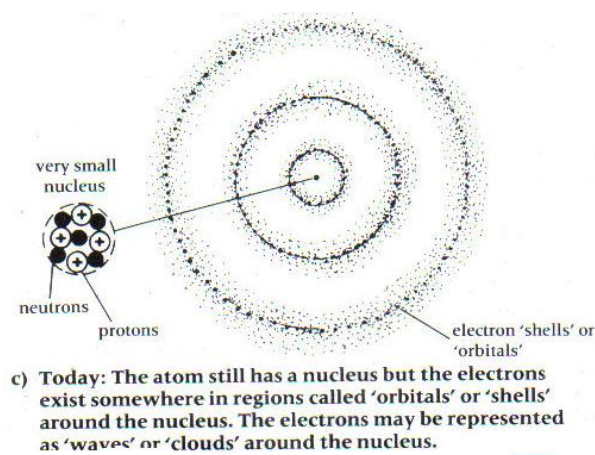
b) 1913: Rutherford-Bohr model – electrons orbit a nucleus like planets orbiting the sun

1932 - Chadwick

Chadwick identified the neutron as a neutral particle found within the nucleus of the atom. Chadwick's experiment supported the new model proposed by Rutherford and Bohr.

Today

We still picture the atom today to have a very small and dense nucleus that consists of protons and neutrons, surrounded by a cloud of negative electrons. The electrons cannot be pinpointed since it is thought to behave as a wave and a particle.



Atomic Structure

Atoms are composed of neutrons, protons and electrons

PARTICLE	CHARGE	MASS
PROTON	+ 1	1
ELECTRON	- 1	1/ 1840
NEUTRON	None	1

Standard Notation



where X is the element symbol
 Z is the atomic number (proton number)
 A is the mass number (nucleon number)

Atomic Number (Z)

The atomic number of an element is the number of protons found in the nucleus of that element.

E.g. Carbon has an atomic number of 6; hence there are 6 protons in its nucleus.

Mass Number (A)

The mass number of an element is the number of protons plus the number of neutrons.

$$(A = Z + N)$$

Atoms are neutral particles and have the same number of protons as electrons.

E.g. Sodium has 11 protons; therefore it must also have 11 electrons.

PARTICLE	NO. OF PROTONS	NO. OF NEUTRONS	ATOMIC NO.	MASS NO.
${}_{11}^{23}\text{Na}$				
${}_{17}^{35}\text{Cl}$				
${}_{6}^{12}\text{C}$				
${}_{30}^{65}\text{Zn}$				
${}_{34}^{79}\text{Sc}$				

Isotopes

Isotopes are different atoms of the same element. They have the same atomic number but different mass numbers. Isotopes of the same elements have the same number of protons and electrons but different neutrons.

Examples