MODEL OF THE ATOM

Many Scientists gave various postulations about the model of the atom.
1. Ernest Rutherford
2. Niel Bohr: This scientist discovered that electrons are found in shells and they occupy different energy levels. He discovered that the most stable stated is called the Ground State. This is where an electron can be found (with normal physical properties remaining constant)

When an element is heated, electrons become excited hence they are promoted from lower energy levels (the levels on which they are) to the higher energy levels. The energy required for this process is called the Excitation Energy

$\Delta E = hf$

$E_2 - E_1 = hf$

h is a constant called the planck's constant
f is the frequency of the photon
E is the excitation energy or the energy associated witht the emitted photon.

The energy level of a particular state E_n can be expressed as

$E_n = \frac{E_o}{n^2}$

E_o is the ground state energy

STRUCTURE OF THE ATOM

The atom can therefore be described as having a center called the nucleus (which is positively charged because it contains positive protons and neutral neutrons) surrounded by shells containing electrons.

There are twelve fundamental particles which are the basic building blocks of everything in the universe. Six of the particles are quarks and the remaining six are leptons.

PARTICLES FOUND IN AN ATOM

1. Protons
2. Neutrons
3. Electrons
4. Nucleon number
5. Positron
6. Neutrinos
7. Quarks
8. Leptons

POSITRONS

A positron also called an antielectron is the antiparticle equivalent of an electron. It has the same mass of an electron and a spin of ½ (same as the electron). It however has a charge of +1. They are formed when a proton sheds its positive charge and becomes a neutron. When a positron collides with an electron, annihilation occurs and gamma radiation is given off. It was theorized by Paul Dirac (1928) and was discovered by Carl D. Anderson (1932)
Positrons are produced, together with neutrinos naturally in Beta decays

QUARKS

An atom is made up of nuclei and electrons, bounded by electromagnetic force. The mass of electrons is small compared to that of nuclei and it is negatively charge. Nuclei consist of neutrons and protons. The protons consist of point-like particles known as “up” and “down” quarks.

When you deal with nuclear physics, we usually come across matter that is made up of particles such as protons, neutrons and electrons. These particles are made up of subatomic particles called Quarks
A quark is a fundamental consituent of matter and is defined as an elementary particle. Quarks combine to produce composite particles called **hadrons**, the most stable of which are neutrons and protons which are the components of atomic nuclei. There are 6 types of quarks (up, down,strange, charm, bottom, and top). It has a spin of ½. It was theorized by George Zweig(1964) and Murray Gell-Mann(1964)

EXAMPLES OF QUARKS

Protons consist of two up quarks and one down quark
Neutrons consist of two down quarks and one up quark.
Quarks cannot exist independently but as a consituent part of matter. Its standard theoretical model is based on the conceptual framework which. It describes all the known elementary particles. Also, it describes unobserved particles.

TYPES OF QUARKS

There are 6 types of quarks (up, down,strange, charm, bottom, and top) of which three are the primary quark types.
1. Up
2. Down
3. Strange

The antiparticles that correspond to every flavour of quarks are known as Antiquarks. Antiquarks have the same mass, same mean lifetime, and same spin corresponding to quarks, but other properties like electric charge and other charges have opposite signs.

Quark and leptons are distinguished based on flavours. The six types are namely up, down, top, bottom, strange, and charm

UP QUARKS

1.Up quarks are the lightest among all the quarks.
2. They have maximum stability due to the lowest mass
3. Its symbol is u, and its antiparticle is denoted by u
4. The mass of the up quark ranges from $1.7-3.1\frac{MeV}{c^2}$
5. Its charge is $\frac{+2}{3}e$

DOWN QUARKS

1. The down quark comes next to up quarks regarding its light mass.
2. Therefore, it also has high stability.
3. Down quark is denoted by d, and its antipartcle is denoted by d with line under
4. The mass of the down quark ranges from $4.1-5.7\frac{MeV}{c^2}$.
5. Its electric charge is $-\frac{1}{3}e$

STRANGE QUARKS

1. The strange quark comes under the third lightest among all
2. Strange quark is denoted by s, and its antiparticle is s with a line under
3. Its electric charge is $-\frac{1}{3}e$

CHARM QUARKS

1. The meson which is called a J/Psi particle is an example of the charm quark
2. Charm quark is denoted by C, and its antiparticle denoted by C with line under
3. The electric charge of a charm quark is $\frac{+2}{3}e$

TOP QUARKS

1. The top quark is denoted by t and its antiparticle is denoted by t
2. The mass of the top quark is $172.9-1.5\,GeV/c^2$
3. Its electric charge is $\frac{+2}{3}e$

BOTTOM QUARKS

1. The bottom quark is symbolized by b and its antiparticle is denoted by b with line under
2. The mass of the bottom quark is $4.1\frac{GeV}{c^2}$
3. Its electric charge is $-\frac{1}{3}e$

LEPTONS

A lepton id an elementary half-integer spin particle that does not get involved in strong interactions. There are six leptons, three of them have an electrical charge and three do not. They appear like point-like particles that don’t have internal structures. The electron is an example of the leptons.

The charged leptons could be seen as charged electrons but have more mass. The other three leptons are called neutrinos (denoted by the letter v). They have very little mass, no electrical charge, and are very hard to find.

Quarks usually live together to form bigger structures wile leptons are individual particles.

TYPES OF LEPTONS

1. Electrons (e): The electron is directly tied to almost all the atoms of its chemical properties. It is very stable and the smallest charged particle we know. The positron which is the electron’s antiparticle is similar in mass and with a positive charge.
2. Tauon (τ). The name of that symbol is Tau.
3. Muon (μ). The name of that symbol is Mu.
4. Electron neutrinos (ve)
5. Tauon neutrino$(v\tau)$
6. Muon neutrino$(v\mu)$

The first three are charged leptons while the last three are **neutrinos**.

There is also an associated antiparticle for each lepton, having the same mass but charge oppositely. An example is the positron being an antiparticle of the electron and therefore also called an antielectron.