**Chapter summary:**

We see how Rutherford proposed the first atomic model which resemble the solar system and successfully explained the structure of hydrogen and hydrogen like atoms. How Neil Bohr built upon this model and for the first time proposed the quantisation of energy states. With various discrete energy states inside an atom, came the concept of energy transfer to and from the atom by various means. In examining these various means of imparting or extracting energy from an atom we will come across the dual theory of matter and electromagnetic radiations. By an intelligent assertion given by Schrodinger, we are able to deduce the internal shapes in which the electrons revolve around the nucleus. This entire study being that of isolated atoms gets a little complicated when these isolated atoms begin to come closer and their interaction leads to the formation of electron bands. This paves the way to the study of three predominant type of materials in nature, conductors, semiconductors and insulators.

**Atomic structure:**

The entire story began with a dilemma about the structure of the atom. There was this initial apple pudding model proposed by thinkers of the time. Rutherford through his famous experiment negated this theory and proposed an alternate model which resembled something like our solar system. He proposed that just like the sun is the Centre of our solar system and the planets revolve around it in circular orbits, the atom primarily consists of two parts. The major mass of the atom is concentrated in a central entity called the nucleus which contains all the protons and the electrons revolve around it in orbits. But this model had a severe limitation put forth by the field of classical electromagnetics. In order to counter the electric forces exerted on the electrons by the nucleus, the electrons revolve around nucleus which causes centripetal acceleration. Charge when accelerated creates electromagnetic radiation and if it is radiating, the electron is basically losing energy. So the first thing to be observed is that there must be some radiation. The radiation is at the cost of the energy of the electron. Therefore the electron must be constantly losing energy. Consequently, the frequency of emitted radiation should continuously decrease. With reduced energy the radius of the orbit of the electron in a spiral fashion and eventually the electron must collide with the nucleus when it loses all its energy. But experiments showed that neither were there any energy radiations, nor any constant drop in their frequency. This model was faulty.

Neil Bohr used this model, and enhanced it to put forth three postulates.

1. The electrons revolve around the nucleus in fixed orbits and hence fixed energies. These orbits are stable and the electrons do not radiate energy when in these orbits. This is the quantisation of energy states.
2. A particular orbit is stable if it follows the following condition:

This essentially means that the angular momentum of the electron is also quantised.

1. The electron may jump from one orbit to another orbit by releasing or gaining energy. The energy needed/released is equal to the difference of energy of the initial and the final orbits.