Write A Short Note On The Discovery of Electrons

Electrons were discovered through a series of experiments involving cathode ray discharge tubes. Relatively high voltages were supplied across the electrodes of these tubes, resulting in the flow of current through the tube. The current flowed from the cathode (the negative electrode) to the anode (the positive electrode). This flow is commonly known as a cathode ray. Despite being invisible, the behaviour of cathode rays could be observed with the use of phosphorescent or fluorescent materials. Cathode rays travelled in straight lines when they were not under the influence of any magnetic or electrical fields. Thomson proposed that the electrons were embedded in a uniform sphere that contained both the positive charge and most of the mass of the atom, much like raisins in the plum pudding or chocolate chips in a cookie

Rutherford showed unambiguously that Thomson's model of the atom was incorrect. Rutherford's results were not consistent with a model in which the mass and positive charge are distributed uniformly throughout the volume of an atom. He found there is a nucleus. The behaviour of cathode rays was observed to be similar to that of negatively charged particles. Therefore, it was inferred that cathode rays were made up of numerous negatively charged particles, which were later named electrons. The properties and characteristics of cathode rays were found to be independent of the materials used in the construction of the electrodes. The modern atomic theory establishes the concepts of atoms and how they compose matter.

Cathode Rays

Cathode rays (also called an electron beam or an e-beam) are streams of electrons observed in vacuum tubes. If an evacuated glass tube is equipped with two electrodes and a voltage is applied, the glass opposite the negative electrode is observed to glow from electrons emitted from the cathode. Electrons were first discovered as the constituents of cathode rays. The image in a classic television set is created by focused beam of electrons deflected by electric or magnetic fields in cathode ray tubes (CRTs).

Cathode rays are so named because they are emitted by the negative electrode, or cathode, in a vacuum tube. To release electrons into the tube, they must first be detached from the atoms of the cathode. The early cold cathode vacuum tubes, called Crookes tubes, used a high electrical potential between the anode and the cathode to ionize the residual gas in the tube. The electric field accelerated the ions and the ions released electrons when they collided with the cathode.

Modern vacuum tubes use thermionic emission, in which the cathode is made of a thin wire filament that is heated by a separate electric current passing through it. The increased random heat motion of the filament atoms knocks electrons out of the atoms at the surface of the filament and into the evacuated space of the tube. Since the electrons have a negative charge, they are repelled by the cathode and attracted to the anode. They travel in straight lines through the empty tube. The voltage applied between the electrodes accelerates these low mass particles to high velocities.

Cathode rays are invisible, but their presence was first detected in early vacuum tubes when they struck the glass wall of the tube, exciting the atoms of the glass and causing them to emit light—a glow called fluorescence. Researchers noticed that objects placed in the tube in front of the cathode could cast a shadow on the glowing wall, and realized that something must be traveling in straight lines from the cathode. After the electrons reach the anode, they travel through the anode wire to the power supply and back to the cathode, so cathode rays carry electric current through the tube.