1.INVESTIGATION ON THE CONCEPT OF PHOTOELECTRIC EFFECT :-

When a material absorbs electromagnetic radiation it will release from or within electrically charged particles which is known as **photoelectric effect or photo emission.** Such effect is also known **photoelectron** when there is ejection of electrons due to light falls on a metal, in which each particle of light is called a photon collides with an electron and uses some of its energy to remove the electron. The rest of the photon's energy transfers to the free negative charge. In short, it is form of interaction of X-ray or gamma photon where a low energy interacts with the electron in the atom and removes it from its shell. This effect is widely used to convert a light signal into an electric current. [1]

X-RAY PRODUCTION BY PHOTOELECTRIC INTERACTION :-

When frequently moving electrons accelerate through a potential difference and strike a metal target than X-rays are produced. When x-ray beam or gamma radiation passes through an object, three possible fates await each photon :- **1. It attenuate without interacting**.**2. It interact and absorb by depositing its energy.** and **3. It scattered or deflect from its original direction.**

The photons deposit their energy by two kinds of interactions, both are with electrons. For 1st type of interaction the photon loses all its energy and another will loses a portion of its energy, and the remaining energy is scattered. In the photoelectric interaction, a photon shifts all its energy to an electron situated in the atomic shells. The electron is discharged from the atom by energy and start to pass through the vicinity. The electron quickly loses its energy and swift only a short distance from its real location. There is a two-step process in energy transfer. The photon transfers its energy to the electron is the first step in photoelectric interaction. The second step is depositing of the energy in the surrounding matter by the electron.

When electrons that are firmly bound to the atom with high binding energy it results in photoelectric interactions. They are predictable when the electron binding energy is less than the energy of the photon. By the interaction, photon's energy is divided into two parts. To overcome the electron's binding energy and to remove it from the atom a part of the energy is used. The remaining energy is transferred to the electron as kinetic energy and is deposited near the interaction site. The interaction produces a vacancy in one of the electron shells like K or L, which results an electron moves down to fill in. A characteristic x-ray photon is produced by drop in energy for filling electron. [2]

**2.THE CONCEPT BREMSSTRAHLUNG RADIATION :-**

**Bremsstrahlung radiation**: when an electron due to its acceleration caused by an electric field of an atomic nucleus this radiation is obtained. In this process, **a highly speed electron traveling in a material is slowed or stopped by the forces when it encounters to any atom**. It will interact with the negative force from the electrons of the atom and it may be slowed or completely stopped when a high speed electron approaches an atom. It will exit the material with less energy if electrons is slowed down. **The energy which is used to slow down the electron is immoderate to the atom and this energy will be radiated as x-radiation of equal energy.**

If the electron is blocked by the strong positive force of the nucleus, the radiated x-ray energy will be equal to the total kinetic energy of the electron. This type of action results with very huge and heavy nuclei materials. The liberated electrons and new x-rays will interact with same fashion to produce more radiation at lower energy levels. Therefore**,** whenever a charged particle is accelerate or decelerate it must radiate energy. [3]

BREMSSTRAHLUNG RADIATION vs PROTON BOMBARDMENT:-

X-ray spectrographic technique like Proton Induced X-ray Emission (PIXE) is used for deciding whether element made up of material or sample. The orbiting electrons of an atom must occupy discrete energy levels in order to be stable. **Ion accelerator will produce bombardment of protons (MeV) with sufficient energy which results inner shell ionization of atoms in a specimen. Outer shell electrons drop down to replace inner shell vacancies, however only certain transitions are allowed. X-rays of a characteristic energy of the element are emitted** while in Bremsstrahlung radiation, electrons from electric field of atomic nucleus will be deflected from their corresponding path when it encounters to atom and energy which used to slow down electron will cause X-ray photons production. [4]

3.DIFFERENCE BETWEEN X-RAYS AND GAMMA RAYS:-

X-rays and gamma rays are forms of high-frequency ionizing radiation which clears that they have enough energy to eliminate an electron from an atom or molecule. They are both part of the electromagnetic spectrum.

**X-rays** are produced by collision of a high-energy electron beam with a metal outside the nucleus, and **gamma rays** are emitted by the excited nucleus itself. The rapid deceleration of the electrons causes high-energy photons to be emitted while Gamma rays have the photons with the highest energy in the electromagnetic spectrum **X-rays** frequencies vary from 30 petahertz to 30 exahertz, and **Gamma rays** are above 10^19Hz. The **gamma rays** wavelength is smaller than that of the **X-rays**. Due to short wavelength **Gamma rays** have more energy to pass through matter than **X-rays**. As they pass through matter, they are scattered and absorbed and the degree of penetration depends on the kind of matter and the energy of the rays. In the EMR spectrum Gamma-ray photons have the highest energy but have the shortest wavelength. **Gamma rays** are a lot **more dangerous and hazardous to human health than X-rays.** Moreover, gamma rays are the highly penetrating and highly energetic ionizing radiation. X rays are used in hospitals for taking X-rays and are used to map the interior of the human body using the diffraction of X-rays while gamma rays are widely used in observational astronomy Since gamma rays have very high energies, these are capable of breaking bonds of several molecules thus creating a biological hazard. [5]

4. DIFFERENCE BETWEEN HARD X-RAYS AND SOFT X-RAYS :-

X-rays having wavelength of 4 or above with lesser frequency and hence lesser energy. They are called **Soft X-rays** due to their low penetrating power. They are produced at comparatively low potential difference and by fast moving electrons. **Soft X-rays are used** in radiography to take pictures of bones and internal organs. Due to their lower energy, they do not cause much damage to tissues, unless they are repeated too often.

X-rays having low wavelength of the order of 1 with have high frequency and hence high energy. Their penetrating power is high therefore they are called **Hard X-rays**. They are produced at high potential difference and by slow moving electrons. **Hard X-rays are used** in radiotherapy and a treatment for cancer. They are used to see the inside of the human body. Due to their higher energy, they destroy molecules within specific cells and destroying tissue. Another use for these X-rays is in airport security scanners to examine baggage.

**Soft X-rays are often damaging to humans** because they omit a lot of radiation frequency. Thus soft X-rays cause radiation damage by releasing photoelectrons on high absorption cross sections of C, N and O K-shells, the main organic matter constituents. A radiation dose of 104 Jkg-1 can kill a living cell and 107 Jkg-1 for can cause severe morphological damage. [6]

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