

Marwari college Darbhanga

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Topic--- Geiger Counter (Nuclear physics)

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Geiger Counter

Geiger counter is a device which is used to detect and measure particles in the ionized gases. It is widely used in applications like radiological protection, radiation dosimetry, and experimental physics. It is made up of the metallic tube, filled with gas and a high voltage range of multiples of 100V is applied to this gas. It detects alpha, beta, and gamma particles.

When radioactive isotopes are used in medical research work on humans, it is important to make sure that the

amount of radioactive material administered to human subjects is as little as possible. In order to achieve this, a very sensitive instrument is necessary to measure the radioactivity of materials. A 'particle detector' to measure the ionizing radiation was developed by Geiger and Muller in the year 1928 and they called it a 'Geiger Muller Counter' which in short is known as the 'GM counter.'



In the large and dominant use as a hand-held radiation survey instrument, it would be one of the planet's renowned radiation detection instruments.

Principle of Geiger Counter

The Geiger counter would contain Geiger-Müller tube, the element of sense that detects the radiation and the electronics that processes that would provide the result.

The Geiger-Müller tube is filled with a gas such as helium, neon, or argon at the pressure being the lowest, where

there is an application of high voltage. There would be the conduction of the electrical charge on the tube when a particle or photon of incident radiation would turn the gas conductive by the means of ionization.

Types of Geiger Counter

The Geiger counter is dictated entirely by the design of the tube, can be generally categorised into two types:

- **End Window**
- **Windowless**

End Window

This style of the tube would have a small window at one of its ends. This window would be helpful in ionizing particles that could travel easily.

Windowless

As the name suggests, this type of tube would not have any windows and the thickness would be in the range of one to two mm. This type of tube is used for detecting high penetrating radiations.

Geiger Counter Units

The measurement of particles would be in different units, the widely used one of them is the Counts Per Minute (CPM). The measurement of radioactivity would be in micro-($\mu\text{Sv/hr}$) – Sieverts per hour and (mR/hr) milli-Roentgens per hour.

Limitations

There are two main limitations of the Geiger counter. Because the output pulse from a Geiger–Müller tube is always of the same magnitude (regardless of the energy of the incident radiation), the tube cannot differentiate between radiation types. Secondly the inability to measure high radiation rates due to the "dead time" of the tube. This is an insensitive period after each ionization of the gas during which any further incident radiation will not result in a count, and the indicated rate is, therefore, lower than actual. Typically the dead time will reduce indicated count rates above about 10^4 to 10^5 counts per second depending on the characteristic of the tube being used. While some counters have circuitry which can compensate for this, for accurate measurements ion chamber instruments are preferred for high radiation rates.