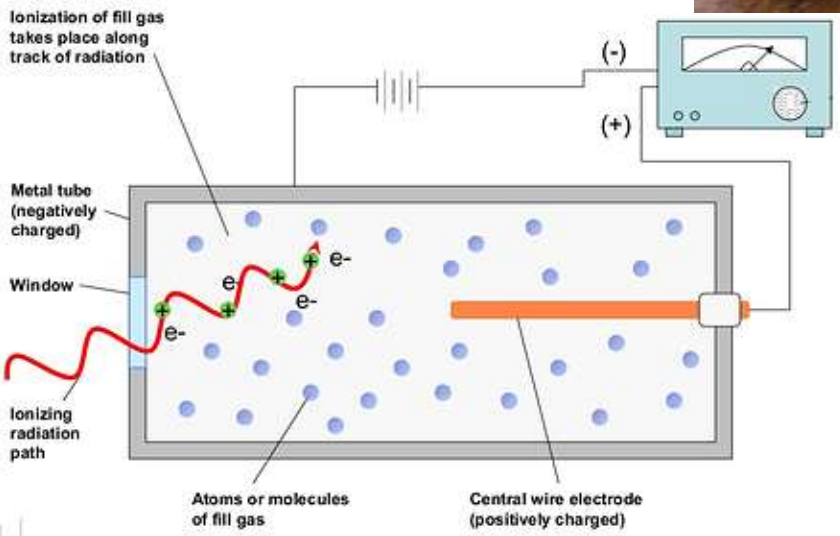

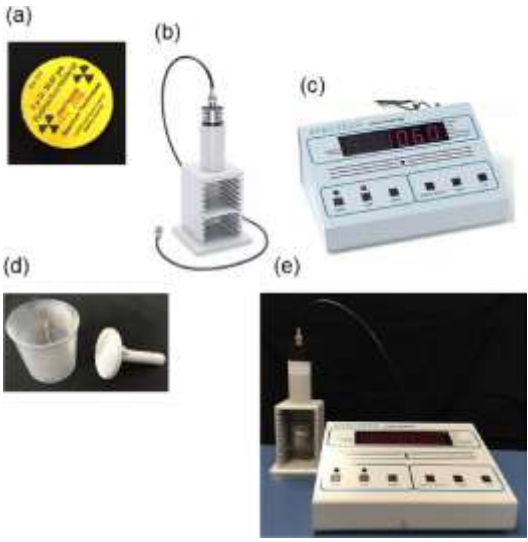

Radiation Detection and Measurement

First Experiment (1)

First semester / Second year

By

By Assist. Lec. ASAL AHMED

Radiation Detection and Measurement

Gaseous ionization detectors: are radiation detection instruments used to detect the presence of ionizing particles and measure ionizing radiation. They use the ionizing effect of radiation on a gas-filled sensor. If a particle has enough energy to ionize a gas atom or molecule, the resulting electrons and ions cause a current flow, which can be measured.

Geiger–Müller Counter:

Characteristics of Operation Curve for Geiger–Müller Tube:

Objectives:

To investigate the characteristics of the Geiger-Müller tube.

Apparatus:

Source of radiation, Geiger detector and HV power supply.

The Theoretical Part:

A Geiger-Müller Counter is an instrument that can detect and measure radioactivity. It detects ionizing radiation such as alpha, beta particles, and gamma rays using the ionization effect produced in a Geiger-Müeller tube, which gives its name to the instrument. It is widely used in applications such as radiation dosimetry, radiological protection, experimental physics, and the nuclear industry. Figure 1 shows the Geiger-Müller Counter.

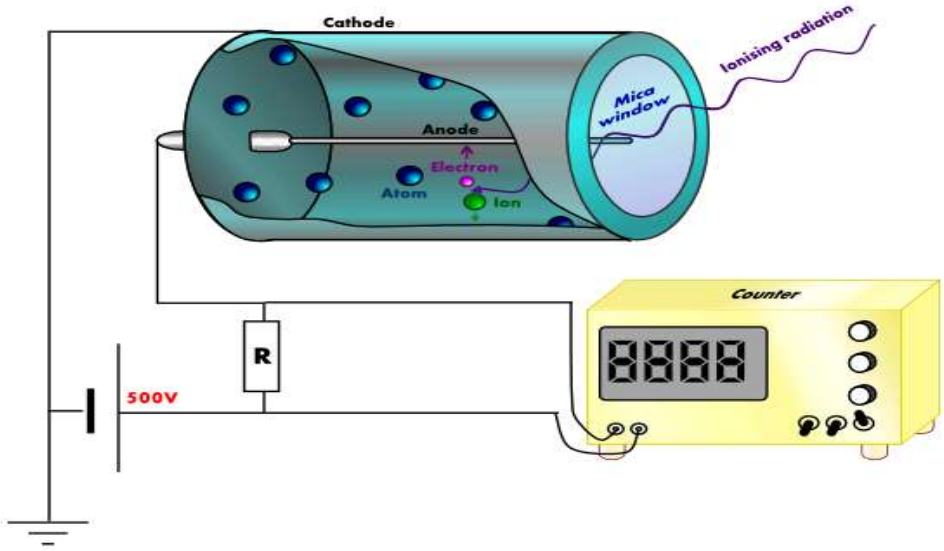

Figure (1): Shows Geiger-Müller Counter.

The chamber is filled with an inert gas *(helium, neon, or argon)* at low pressure. A high voltage is applied to this chamber. The metallic chamber will conduct electricity. When radiation enters the chamber through the window, the photons in the radiation will ionize the inert gas inside the chamber. This will make the gas conductive. The electrons produced due to ionization are accelerated due to the potential that we applied, and these electrons cause even more ionization. The ionized electrons travel towards the anode. The anode is connected to a counter. The counter counts the electrons reaching the anode. This is how we measure radiation.

Methods:

1. Configure the device to operate at the lowest voltage.
2. Place the radioactive source in front of the device (choose an appropriate distance) and record the meter reading for 100 sec.
3. Start by recording the count and gradually changing the voltage to 520 volts.

Readings:

Draw the graphic relationship between the change of count (N) and voltage (V) and find the following:

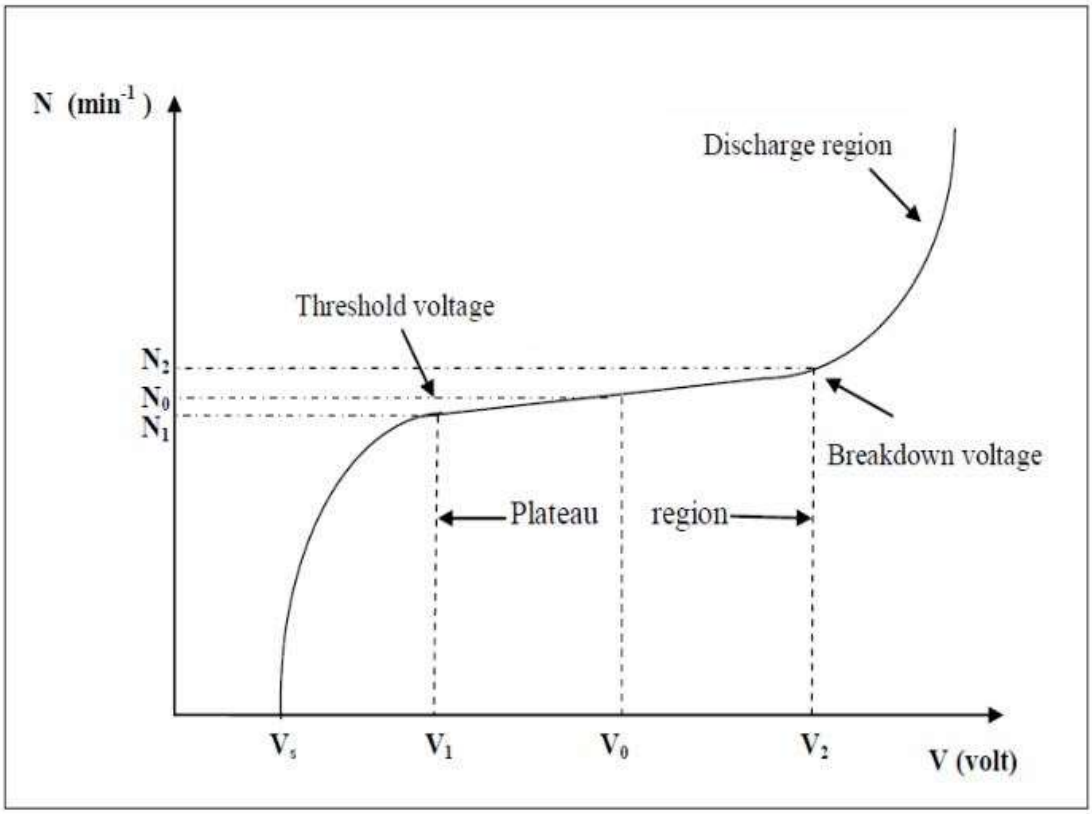

Figure (2): Shows the Characteristic of Geiger-Muller counter.

V (volt)	N1 (Count/ 100 sec)	N2 (Count/ 100 sec)	N average = (N1+N2)/2	N = N average -N_B
300				
320				
340				
380				
400				
440				
480				
520				

Where N_B is the Background radiation:

N_{B1} = 36, N_{B2} = 53

$N_{B.G}$ = (N_{B1}+ N_{B2})/2 = (36+53)/2 = 89/2 = 44.5.

Calculations:

The relation between the counting rate and the voltage applied to the counter is called the ***"Characteristic Curve ",*** from which we deduce the following characteristics:

- Starting voltage (Vs): This is the minimum voltage applied to the detector in order for it to operate.
- Plateau length (or operating plateau region): The range voltage corresponding to the flat part of the characteristic curve.

$$\textbf{Plateau length} = V_2 - V_1.$$

- Operating voltage (or working voltage) (V_{op}): It is the voltage corresponding to the midpoint of the plateau region.

$$V_{op} = \frac{V1+V2}{2}$$

- Percentage gradient: It is the percentage change in counting rate per volt.

$$PERCENTAGE\ GRADIANT = \frac{N2-N1}{NO\ (V2-V1)} * 100\ \%$$

Questions:

1- Define: G-M Counter and Radioactivity?
2- List five physical effects that can be used to measure radiation?
3- What happened if the person exposure for radiation?
4- What is the unit used to measure radiation exposure?
5- What are the **advantages** and **disadvantages** of G-M Counter?