Characteristics of Geiger Muller Counter

Objective:

1- Plotting the characteristic curve of the GM counter.
2- Determination of:
    a. Starting voltage V_s of the GM counter.
    b. Threshold voltage $V_{th.}$ (or V_1) of the GM counter.
    c. Plateau length of the GM counter.
    d. Operating voltage V_0 of the GM counter.
3- Calculation of the percentage gradient of the GM detector.

Theory:

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

- *Starting voltage (V_s)* : It is the minimum voltage applied 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.
$$\text{Plateau length} = V_2 - V_1 .$$
- *Operating voltage (or working voltage) (V_0)* : It is the voltage corresponding to the midpoint of the plateau region.

$$V_O = \frac{V_1 + V_2}{2}$$

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

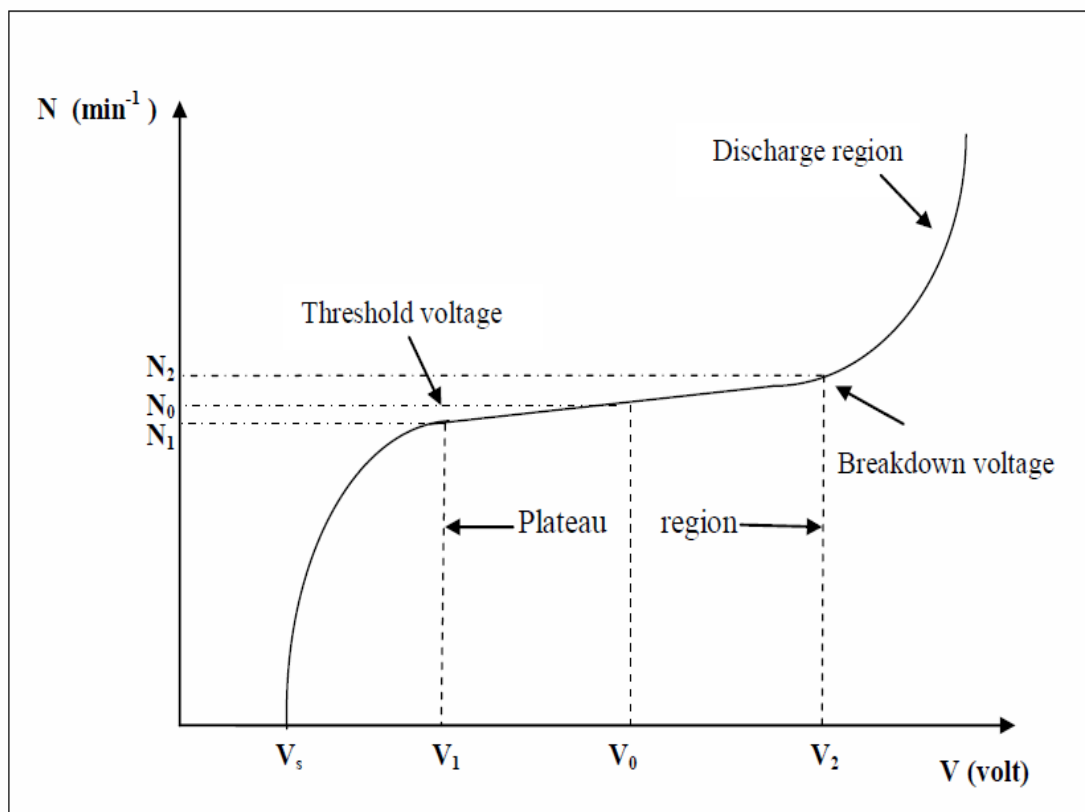$$PERCENTAGE\ GRADIANT = \frac{N_2 - N_1}{N_o(V_2 - V_1)} \times 100\%$$

Fig.1

Apparatus:

Source of radiation.   Geiger detector.   HV power supply.

Procedure:

1. Connect the plugs of the electric mains.
2. Set the timer to 60 s and the HV to 280 Volt.
3. Record the count rate per one minute for the back ground ($N_{B.G}$).
4. Put the source in front of the Gieger tube on the second shelf from top .
5. Set the high voltage to 220 V and start counting. Increase the applied voltage in steps of 20 V until the detector begins to operate, this is the starting voltage (V_s).
6. Increase the applied voltage and record the count rate per one minute (N_1) for each voltage. Take two readings for each voltage and take their average.
7. Plot the counting rate (N) versus the applied voltage (V) deduce the threshold voltage, the plateau length, the operating voltage and the percentage gradient of the detector.

Data Sheet

Experiment 1: Characteristics of Geiger Muller Counter

Source description

Element	Activity (A_o) (…….)	Half life (……)	Date of calibration

bagk

Background radiation: $N_{B.G} = (……. + …….)/2 = ………$ (………).

Data:

Voltage (…...)	N_1 (…….....)	N_2 (…….....)	N_{av} (…….....)	$N = N_{av} - N_{B.G.}$ (…….....)
220				
240				
260				
800				

Calculations and results:

- $V_s = $ ....   (.........)

- $V_1 = $ ....   (.........)   - $N_1 = $ .... (.........).

- $V_2 = $ ....   (.........)   - $N_2 = $ .... (.........)

- $V_0 = $

    $= $ ....   (.........)   - $N_0 = $ .... (.........).

- Plateau length $= $

    $= $ .... (........)

- Percentage gradient $= $

    $= $ .... %   (.........)