Characteristics of operation curve for Geiger – Müller Tube (Counter)

The tools and equipment used:

Geiger counter and accompanying electronic equipment.

Objectives:

1. Finding the plateau area for a Geiger counter.
2. Determining the length and slope of the plateau.
3. Finding the operation voltage of the Geiger counter.

The theoretical part:

The Geiger counter consists of a metal cylinder representing the negative electrode and a thin wire in the middle representing the positive electrode, which is a wire of tungsten thickness (1 mm), (as shown in Figure 1), so that this installation is exactly the same as the installation of a wide Capacitor (cylindrical). The cylinder contains inert gas and a little alcohol under low pressure (100-50 Torr). When there is an appropriate potential difference between the two electrodes, the passage of any ionized particle through the window will result in to the occurrence of ionization of the gas in its path, and thus an electrical pulse occurs that can be received in the meter. that exist ethyl alcohol is for the purpose of suppressing the electric discharge by absorbing the photons released as a result of the union of ions positive with electrons inside the tube by decomposing alcohol into simpler compounds. The kicker counter cannot differentiate number of particles entered the detector during a period of time between the types of particles and is not used to calculate energies, but only tells that a number the work.

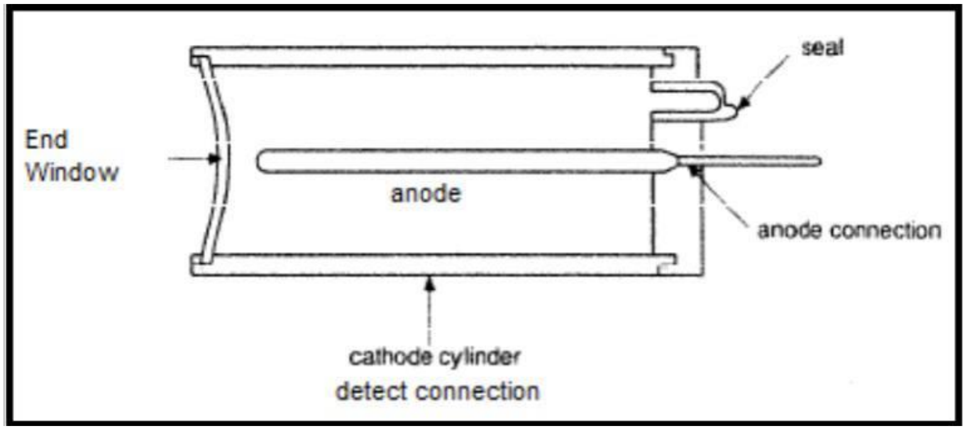


Figure (1) The main parts of a typical gicker-Miller tube.

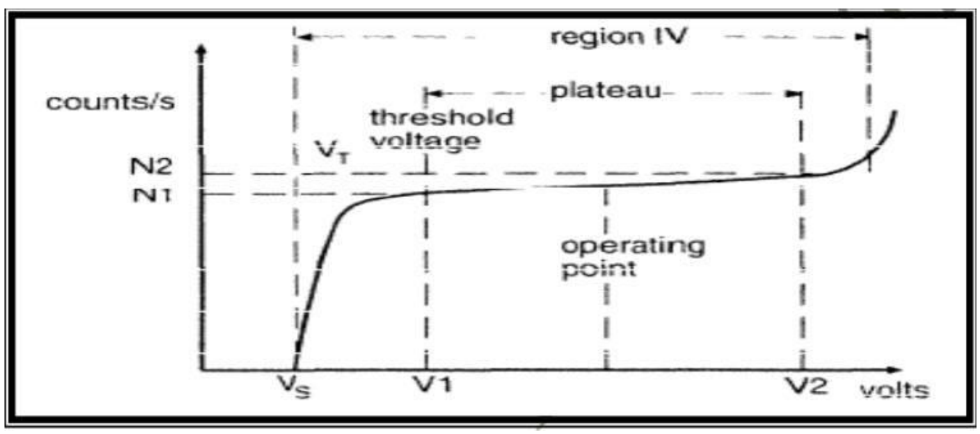


Figure (2) Characteristic run-of-the-geiger-miller counter.

Threshold voltage = V1, breakdown voltage = V2, primary ionization state = N1, secondary ionization state = N2

From Figure (2), there are a few distinct areas, which are:

1. Low applied voltage area (V < Vs): At very low operating voltages,

the counting is of no value, so the counter cannot work in this area.

2. Starting voltage (Vs): Which is the lowest value of the voltage applied to the tube, at which it can detects counting pulses in a specific and distinctive form.

3. Threshold voltages (VT > Vs): In which the count ratio increases rapidly between two voltage values (50-100V).

4. Plateau ($V1 < V < V2$): Is the voltage at which the change is small and it is a working area of the counter, the length of the region is about 100V, and the greater the length of this region, and the less its slope, the more this indicates the stability of the radiation intensity readings.

5. Continuous Discharge Zone: The continuous increase of voltage leads to a state of continuous discharging of the charge and can be leads to damage the tube and we should to turn off the device.

<u>practical part:</u>

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 a 100 sec.

3. Start by recording the count and gradually changing the voltage 300 volt.

4.

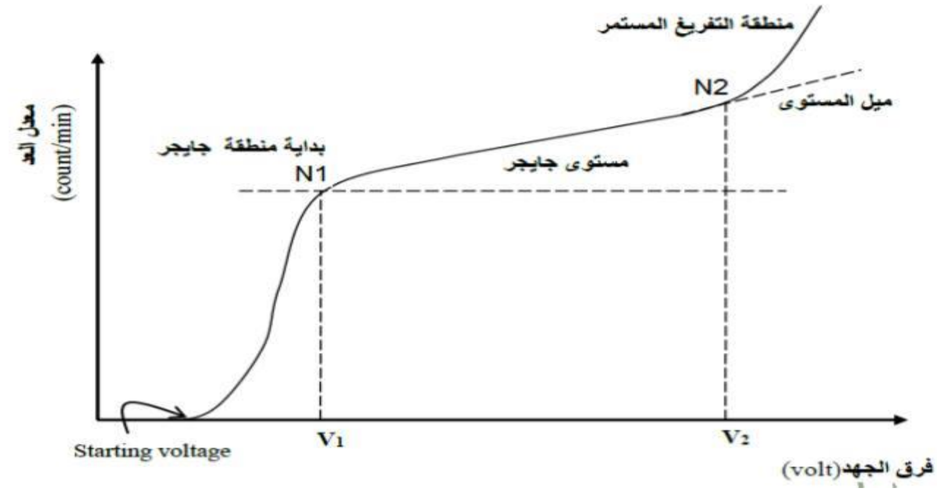
$N_{B1} = 36$

$N_{B2} = 53$

$N_B = (N_{B1} + N_{B2})/2 = 44.5$ القراءة الخلفية بدون مصدر

V (volt)	N1 (count/100sec)	N2 (count/100sec)	N average =(N1+N2)/2	N = Naverage - N_B
300	0	0		
320	0	0		
340	671	686		
380	675	727		
400	900	920		
440	1725	1744		
480	4490	4402		
520	3944	5864		

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



N1=……………………………

N2=……………………………

V1=……………………………

V2=…………………………….

A- Length of the plateau

L=V2-V1

L=

B- Slop of a plateau =[(N2-N1)/N1(V2-V1)] *100%

C- Operation Voltage

Vop = (V1 +V2) / 2

Vop =

<u>Discuss the results and questions:</u>

1. Discuss the graph you obtained, explaining the parts in detail

2. Answer the questions:

A. Why does the counter not work at the beginning of the experiment despite putting in a small effort... When does the counting start?

B. What do you notice when the voltage increases?

C. When is the Geiger counter most efficient?

D. Can the Geiger counter distinguish between the two pulses produced by beta and gamma radiation?

E. How does a meter measure gamma rays?