Presentation Topic :-

Geiger-Muller Counter: Working

Introduction

The **Geiger Counter** is an instrument used for measuring ionizing radiation.

It detects ionization radiations such as α-particles, β-particles and γ-rays using the ionization effect produced in a **Geiger-Müller tube.**

It is perhaps one of the world's best-known radiation detecting instrument.

History

In 1908,the first model of G.M. Counter was developed by Hans Geiger and Ernest Rutherford which was only capable of detecting α-particles.

In1928, Geiger and Walther Muller developed advanced model of G.M. Counter consisting of sealed G.M. Tube capable of detecting all kinds of radiations.

Interesting fact is that it was developed under-supervision of Hans Geiger by Walther Muller who, was PhD student of Sir Hans Geiger.

Old G.M. Counter

Newest and advanced version of G.M. Counter

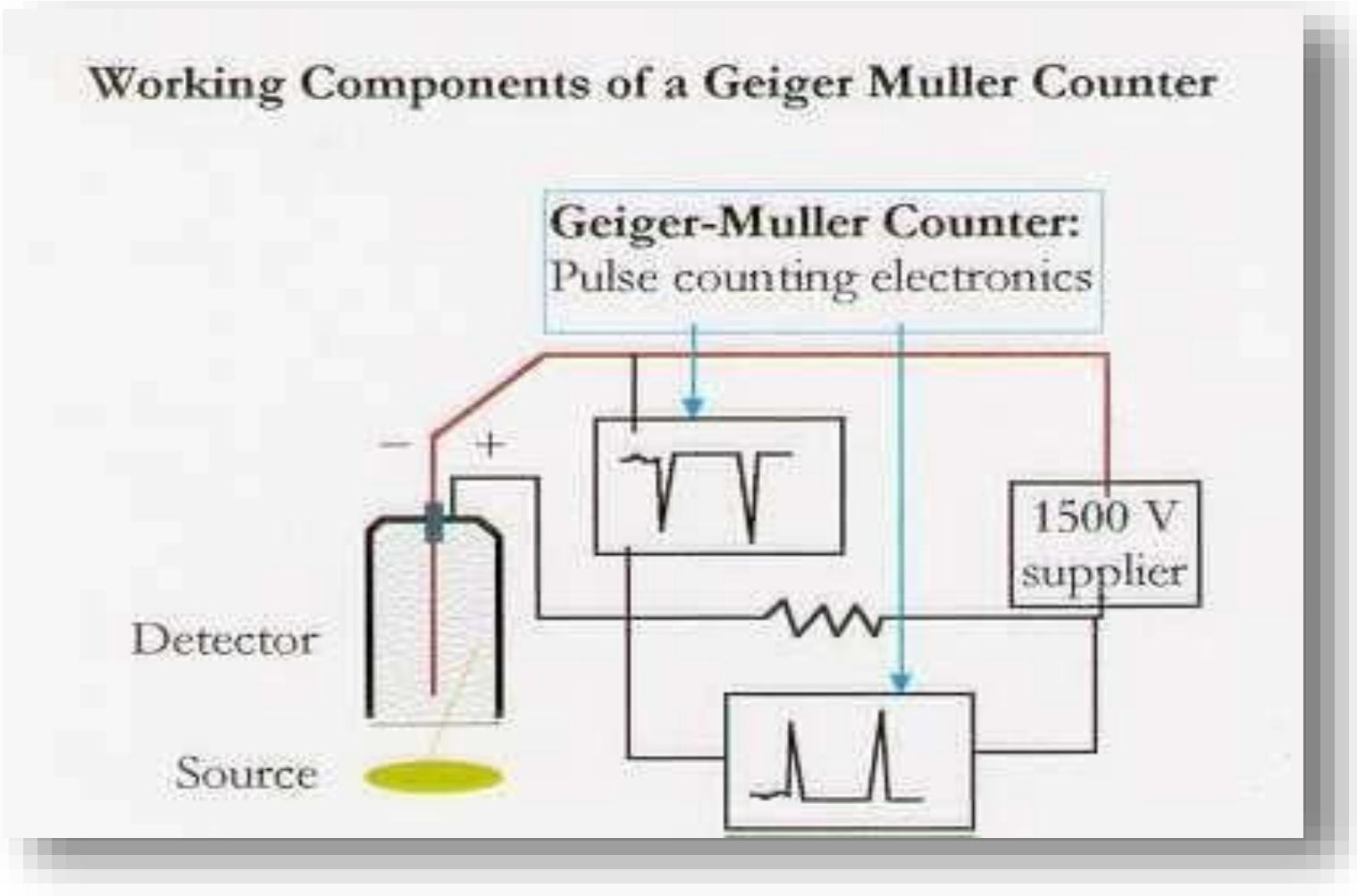
Principle

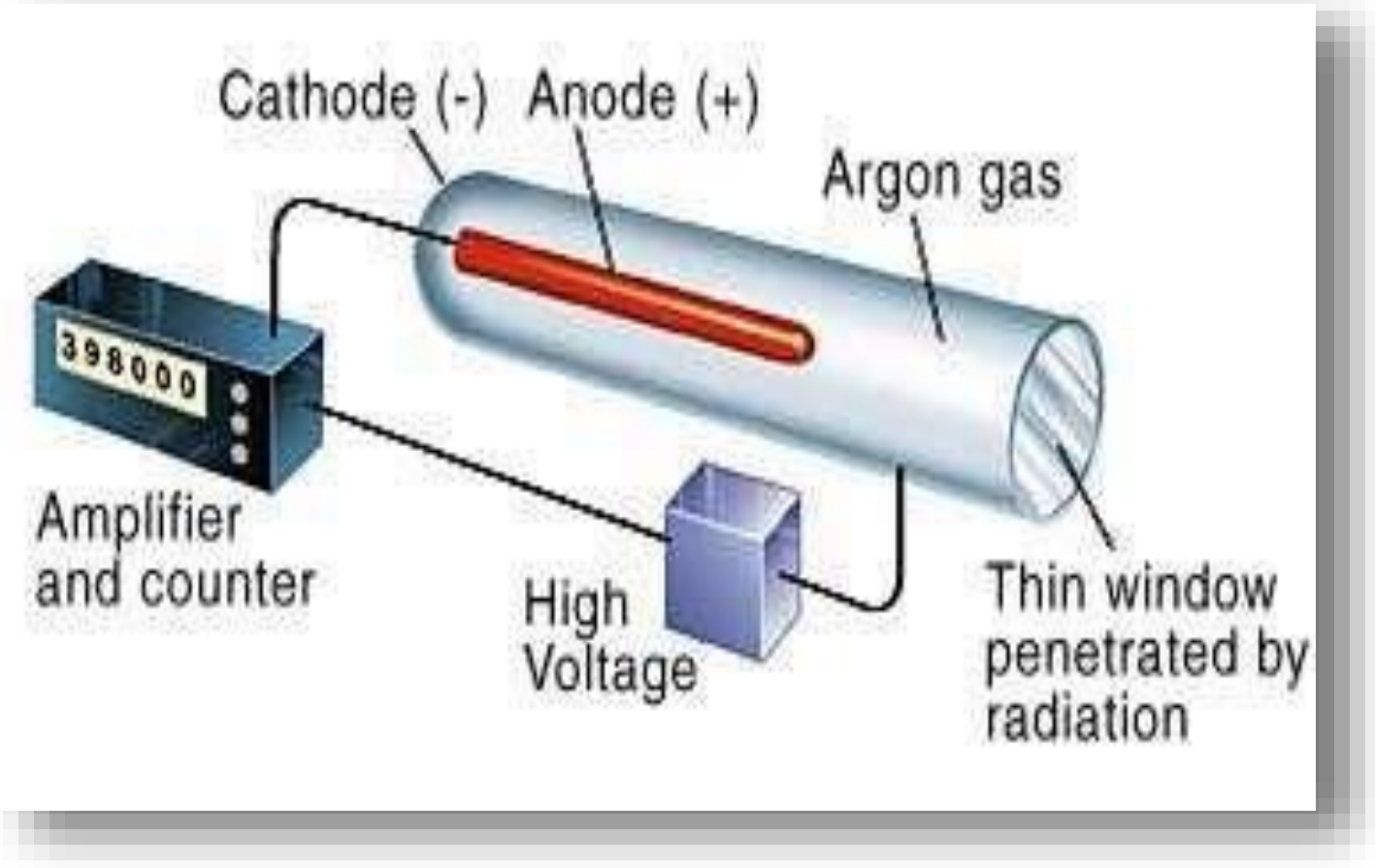
A Geiger counter consists of **Geiger-Müller tube,** the sensing element which detects radiation.

Geiger-Müller tube is filled with an inert gas such as helium, neon or argon at low pressure to which high voltage is applied.

Tube briefly conducts electrical charge when a particle or photon of incident radiation makes the gas conductive by ionization.

Diagram:-


Working Components of a Geiger Muller Counter
Geiger-Muller Counter:
Pulse counting electronics
1500 V
supplier
Detector
Source

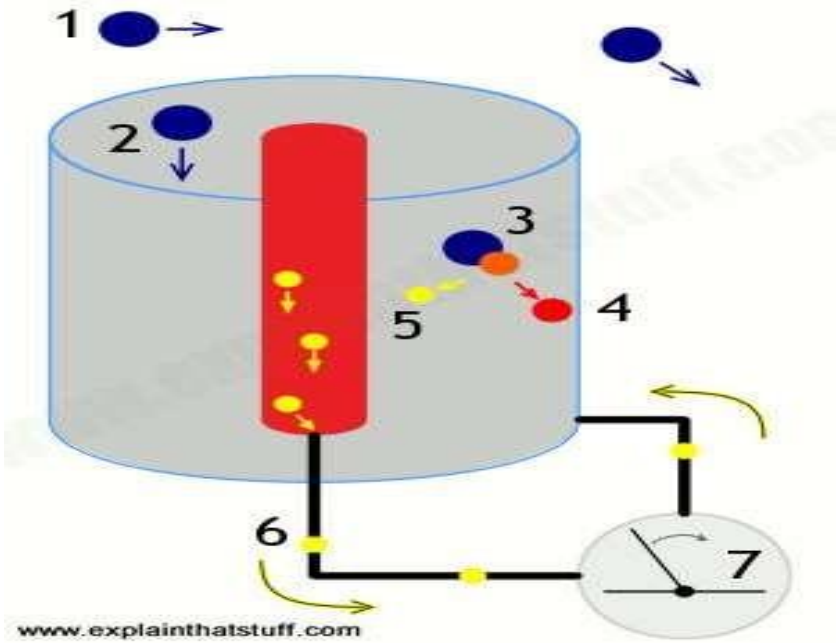

Cathode (-)
Anode (+)
Argon gas
398000
Amplifier
and counter
High
Voltage
Thin window
penetrated by
radiation

How it works

Radiation (dark blue) is moving about randomly outside the detector tube.

Some of the radiation enters the window (gray) at the end of the tube.

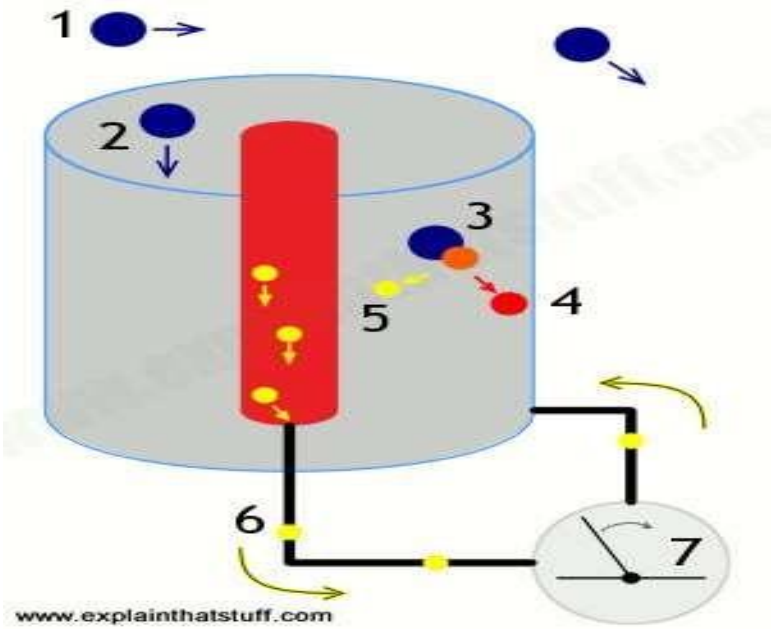
When radiation (dark blue) crash with gas molecules in the tube (orange), it causes ionization: some of the gas molecules are turned into positive ions (red) and electrons (yellow).



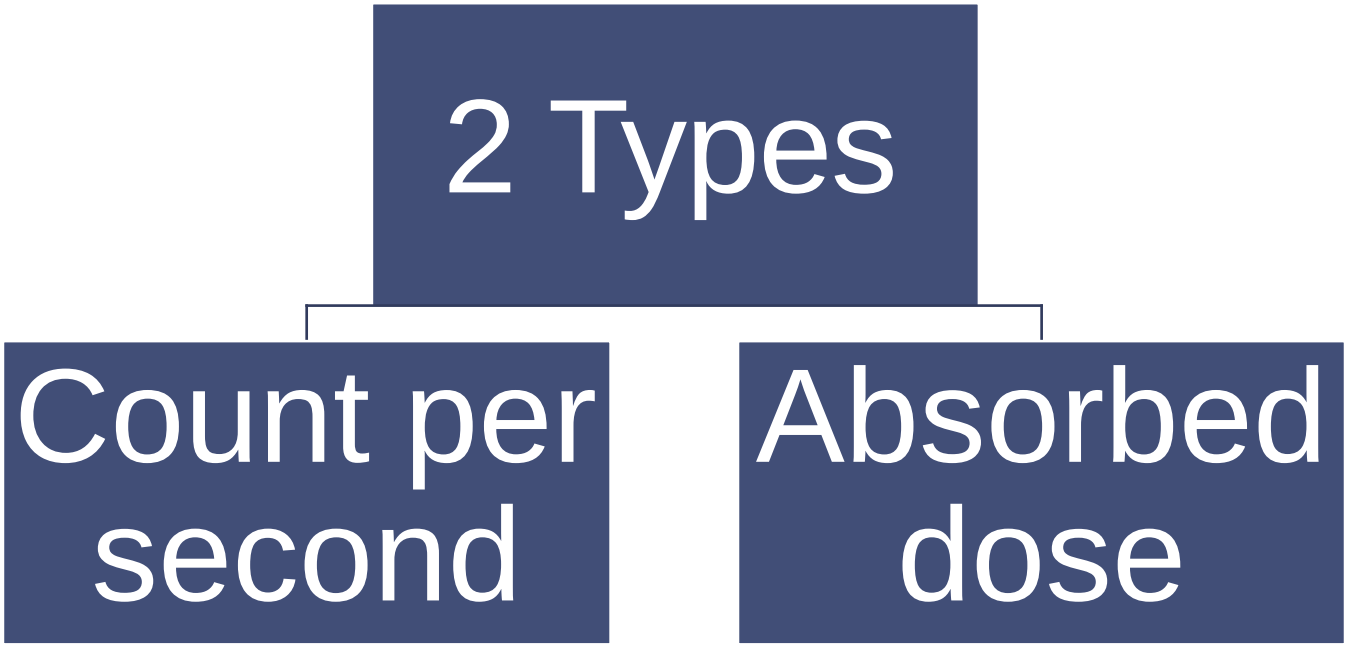
The positive ions are attracted to the outside of the tube (light blue).

The electrons are attracted to a metal wire (red) running down the inside of the tube maintained at a high positive voltage.

Many electrons travel down the wire making a burst of current in a circuit connected to it.



Readout:-



Count per second:-

The number of ionizing events displayed either as a count rate, commonly "counts per second“.

The counts readout is normally used when alpha or beta particles are being detected.

Absorbed Dose:-

A physical dose quantity ‘*D’* representing the mean energy imparted to matter per unit mass by ionizing radiation. Unit- “**Gray**”.

Normally used for measuring gamma or X-ray dose rates.

Application

For the detection of alpha and beta particles.

To detect radioactive rocks and minerals in the course of mineral prospecting or as a mineral collector.

To check for environmental levels of radioactivity.

For Fire and Police first responders to a analysis for making an initial determination of radiation risk.