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Paper:- Radiological Protection.

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Q.No:1

ANS: Difference B/W

Deterministic effect	Stochastic Effect
1) Deterministic effect produce by high radiation dose.	1) Stochastic effect is produced by dose.
2) They have Threshold dose below no effect is seen	They have no Threshold dose.

Deterministic Effect is for Short period of time

→ Their Severity increases as dose increases.

→ As Dose increase the deterministic effect will also be increases

Stochastic effect is for long period of time.

→ Their Severity is not related to dose.

→ Their is no dose above which stochastic effect are certain to occur.

→ Deterministic effect include sickness, Acute radiation and chronic radiation Sickness.

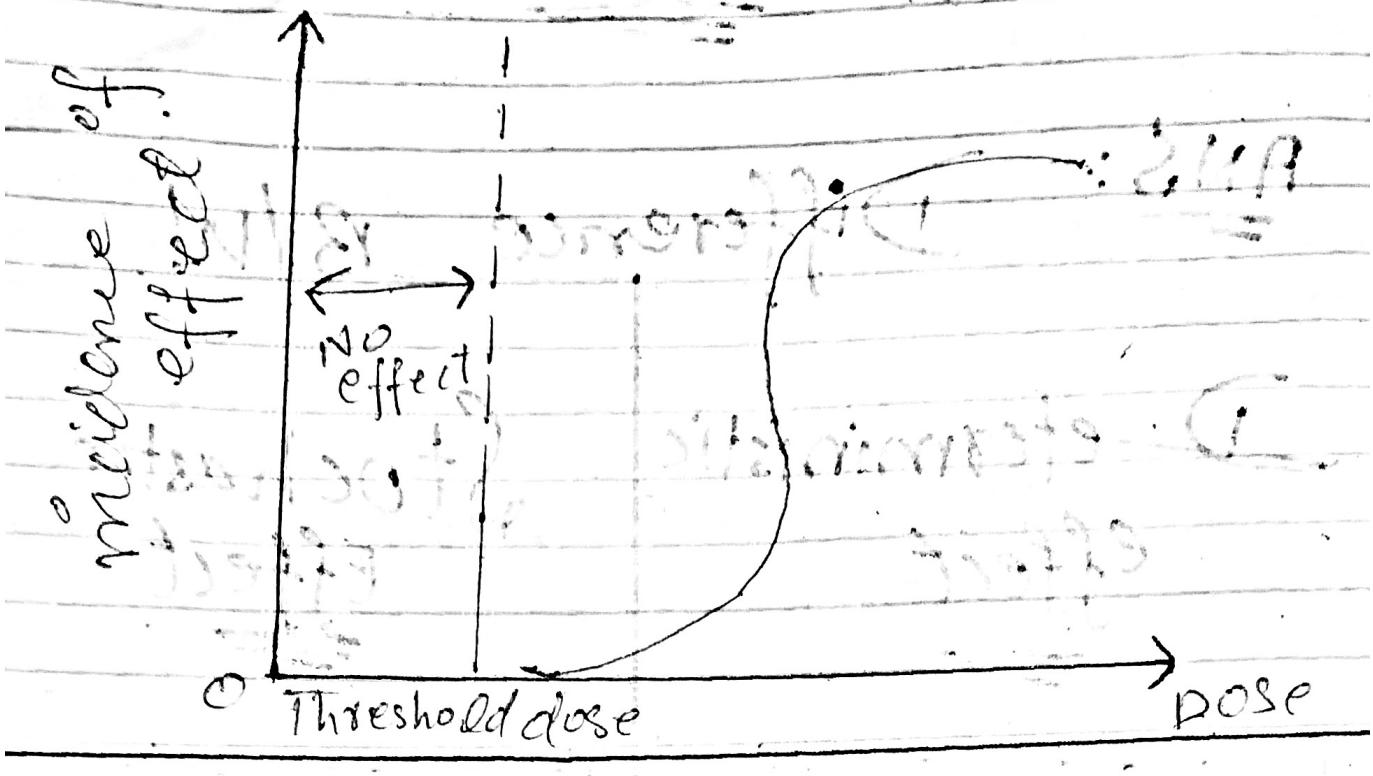
→ In determinis-ic effect hair loses, cataract and skin injury etc occurs.

Stochastic effect included Carcinogenesis and hereditary effect.

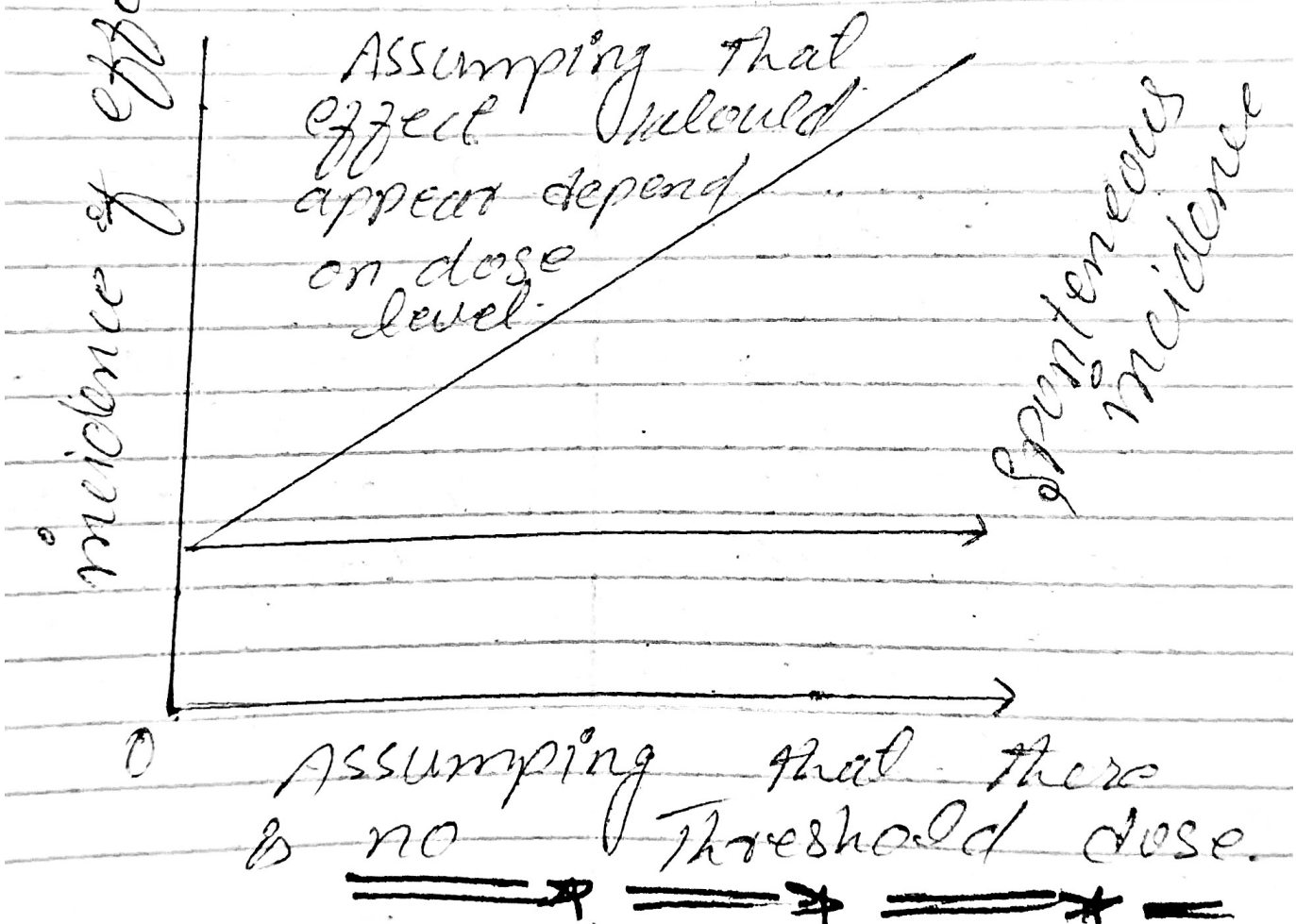
//

→ In Stochastic effect cancer, Leukemia and hereditary effect occurs.

Deterministic effect



Strochastic Effect



QNo: 2

ANS

Radiation

→ It is emission or transmission of energy in the form of waves or particles (like alpha, beta, gamma) through space or through material medium.

→ The radiation are classified

⇒ On The basis:

→ * Energy
→ * frequency
→ * wavelength.

⇒ The radiation include:

→ Electromagnatic Radiation

e.g. (*) radio waves
→ (*) microwaves
→ (*) visible light
→ (*) infrared
→ (*) ultraviolet rays.
→ (*) Gamma Radiation
→ (*) x-rays.

→ The radiation which have high energy are ionizing in nature.

→ Non ionizing radiation have low energy.

→ The ionizing radiation is most important in the radiograph.

(b) Radioactivity

Radioactivity is refers to the particle which are emitted from nuclei as a result of nuclear

Nuclear instability

→ The nucleus experience the intense conflict B/w the two strongest forces in nature!

→ Unstable nucleus will decompose spontaneously or decay into more stable configuration.

→ Radioactive decay is the several naturally occuring elements. as well as artificially produced. isotopes of elements.

→ The rate which radioactive is half-life.

→ The emission of most common form of Spontaneous radioactive decay are.

(*) Alpha (α) particles.
(*) Beta (β) particles.
(*) Gamma (γ) particles.

→ less common forms of radioactivity fragments, fission neutron. or proton may be emitted.

=> Types of Radioactivity

→ Uranium and Thorium ores.

two distinct types of radioactivity are.

(*) Alpha and Beta decay.

(iii) Non ionizing Radiation

→ The non ionizing radiation is refers to any type of electromagnetic radiations.

That does not come per [redacted] quantum to ionize atom or molecules.

→ It unable to remove electron from an atom

→ The non-ionizing radiation are only excite the electron [redacted] that are move from lower shell to higher.

→ So it does not ionize atom it is safe and not harmful at all.

1) # Ionizing Radiation

It is travelling as particles or electromagnetic waves that carries sufficient energy to detect electron from atoms or molecules

There is ionize to atom. or molecules.

→ Ionizing Radiation is made up of substances, particles, atoms. or electromagnetic Waves

→ It traveling at the Speed of light.

→ It is very important in radiograph.

→ It causing Serious disorders

(V) Harmful Radiations

→ Radiation is a transfer of energy.

→ The low level of radiation is present every where in

Sorrounding.

→ low level of Radiation are not harmful but medium energy Radiation is harmful and can cause sickness, headache, Vomiting, fever.

→ High energy radiation is very harmful. it damaging the cell that is the ~~ball~~ building block of body

causing mutation which lead to melagnancy.

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Q No: 3

Ans:-

Two Basic Principle of Radiation Protection:-

→ The two Basic Principle for radiation Protection are.

(1) Time
(2) Distance

(1) Time:-

→ The amount of radiation recieved by an individual is directly related to the length of time.

→ If the time during which one expose to radiation is increases and also the radiation will increases.

→ Time minimized dose will be decreased.

→ If time Spend in a given radiation field is double the work dose is also double. Therefore the limit radiation dose the time Spend in field must be limited.

→ Example of reducing radiation dose by reducing the time of exposure might be improving.

→ Operator training to reduce time they take handle of radiation dose.

(2) Distance

→ The radiation dose is recieved from a source is inversly proportional to the square of distance of Separation.

→ As a Rule if you double the distance, you reduced the exposure by a factor of four.

→ Greather the distance from source less radiation recieved.

→ The exposure of an individual sitting 4m from a radiation

Source. will be 1/4 the exposure of an individual sitting 2 m from some source.

⇒ Shielding :-

The greater the sheilding around radiation source will be the smaller the exposure.

→ Shielding simply means having something that will absorb radiation b/w you and source.

→ The amount of shielding required to protect is depend on the different types of radiation and energy.

xx xx

(b):

Names of Radiation Protection Devices.

(1) Gas filled Detector.
(2) Scintillation Detector.
(3) Thermoluminescene Dosimetry.
(4) optical stimulated.
(5) Luminescene Dosimetry

xx xx xx

Q No :: 4 :-

Features of Radiation Protection:

The features for a Radiation protection Designed to Reduce patient dose during x-ray examination

Feature of radiation protection are.

(1) Protective x-ray tube Housing:-

→ Every x-ray tube must be shold within a

protective housing.

→ Benefit of protective housing is that it reduce leakage radiation during use.

→ leakage radiation will be less then 1mGy/hr at distance of 1m from protective housing.

(2) Control panel

→ It show the condition of exposure.

→ It positively show when the x-ray tube is energized.

→ Same time visible and audible signal should.

⇒ KVP and mAs are indicator for their requirement.

→ x-ray beam will be clearly show to Radiologic technologist.

3): Source to Image Receptor Distance.

→ SID indicator must be accurate to within 2% of indicated SID

→ Indicator must be provided.

→ Simple as tap measure attached to tube housing.

(4):- Collimation.

The x-ray beam and light beam must be coincide to within 2% STD.

Attenuation of useful beam collimation shutter must be equivalent to attenuation by protective housing.

Positive Beam Limitation:

→ The Special x-ray beam imaging system make in united state b/w 1974 and 1994.

→ They must be adjusted with any image Receptor Siz in use and al all standard SID.

→ Collimate Shutters provided to with in 2% of SID.

Beam Alignment

Every Radiograph Should be provided proper x-ray beam aligment.

Filteration

→ All x-ray beam Should be have total filteration.

At least 2.5 mmAl. when operate above 70KVp.

Radiograph tube operate blw 50 and 70 KVp should have at least 1.5 mm Al.

→ 0.5 mm Al filteration should be required below 50 KVp.

⇒ **Reproductibility :-**

Constant output radiation intensity.

→ Should not be exceed 5% Through Same technique.

⇒ Linearity :-

The exposure time is adjusted for constant mAs The output radiation intensity will be remain constant.

The maximum variation in linearity is 10%.

From one mAs station to adjusted mA station.

⇒ Operator Shield

It must not be possible to expose in room outside of operator both.

→ Portable x-ray must have 2m theter for expose

Fluroscopic Protection Feature :-

(1) Source to Skin Distance :-

The divegge of x-ray beam, The entrance Skin exposide (ESE) is lessend for require exit dose as the Source to Skin (SSD) is mcreased.

If fluoroscopic x-ray tube is moved from 40cm SSD to 20cm SSD, the ESE is greatly increased.

→ Exposure required to at image intensifier is 10 uGy.

→ ESE will be 22.5mGy and 40mGy respectively.

(2) Primery protective Barrier:-

→ The fluorscopic image receptor assembly serves as a primery protective barrier

→ must be 2mmPb eq

(3) Filteration:-

→ Total filteration must be at least 2.5mmAl above 70kvp

(4) **Collimation :**

visible Unexpected borders 3 5cm above II

(5) **Exposure Control :** *

→ The fluoroscopic exposure control should be of dead man type.

→ operator should drop dead or just release pressure.

(6) **Bucky Slot Cover :** *

→ At least 0.25mmPb eq

7) **Cumulative time :** * Audible signal if time 75min.

Q NO: 5

ANS:-

⇒ GM Counter :-

→ It is also known as Geiger-Muller Counter.

→ It was discovered in 1932 by Grieger Muller.

→ It is the type of Gas filled Detector.

→ A Gm counter is an instrument

used for detecting and ionizing radiation.

→ It is use in application such as radiation dosimetry radiological protection. Experimental physics and nuclear industry. It is also defined as a GM counter is a device used for detection and measurment of all types of radiations i.e Alpha, Beta and Gamma.

Construction of Gm Counter:-

Gm Counter consist of following Components

1) → Metallic cylinder
2) → Gaseous Medium
3) → Cathode.
4) → Anode.
5) Counter.
6) Voltage.
7) Insulator | plaque.
8) Amplifier.

Now we explain every components.

(1) Metallic cylinder :-

→ It is hallow from inside

→ Contain some kind of Gaseous medium.

→ walls of mettalic cylinder is connect with terminal of battery.

(2) Gaseous Medium

→ It is present inside metallic cylinder.

→ It contain noble gases.

mostly argon → 90%

Alcohol → 10%.

3) Anode:-

→ A wire that work like anode.

→ Approximately 0.01 mm in diameter.

4) Insulating plaque

→ It is placed between anode and cathode therefore because to avoid Direct contact b/w anode and cathode.

(5) Voltage :-

Applied voltage approximately 1000v.

(6) Amplifier :-

→ placement of amplifier is necessary

to amplify weak signals.

(7) Counter :-

→ useful signal send to counter for counting.

→ After to detect Hall signals.

Metallic Electrode:-

→ It is located at the centre of metallic cylinder.

→ It is made up of tungsten.

→ It is connected to load Resistance which is connected to the same power supply.

→ Across load resistance

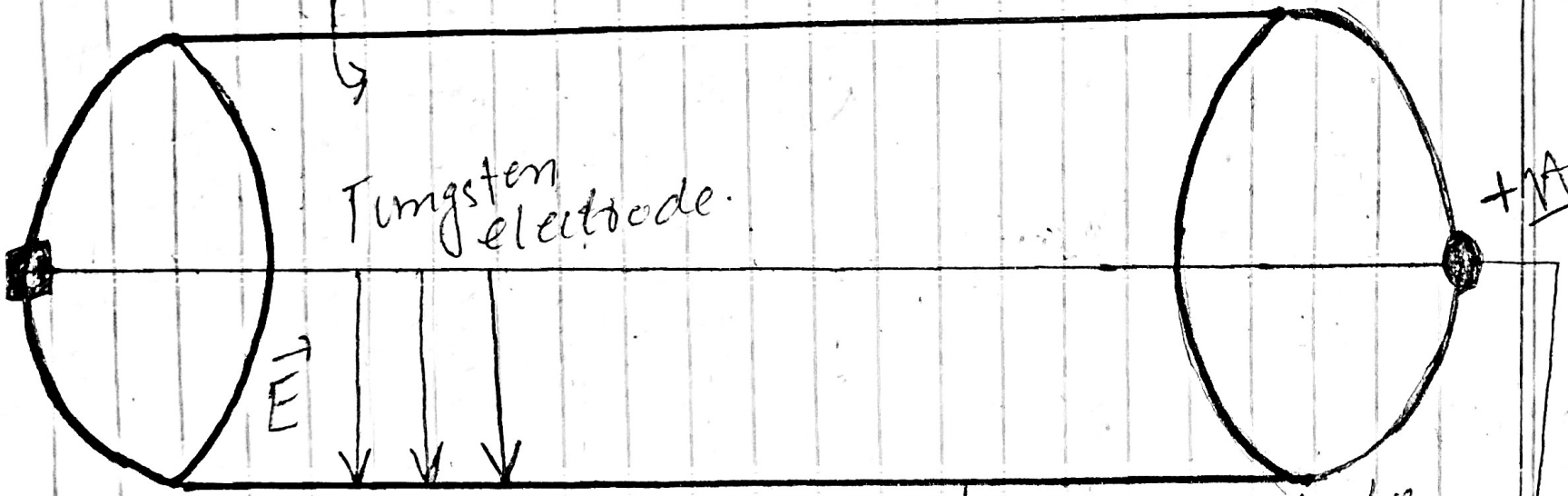
Electronic Setup.

Which is capable of determing any kind of potential drop that have been across RL.

Diagram of GM counter

Counter :-

Gas medium
(90% argon + 10% alcohol)



(1000 - 3000) V

R2 (100 MΩ)

amplifier or pulse counter

Gm Counter

=> Working Mechanism

Working mechanism of this type of setup is very simple when some external particles like alpha particle, Beta particle or Gamma Radiation

→ Enter the medium.

→ Basically leads to ionization.

→ Central electrode is connected to positive terminal of battery.

→ Metallic Surface is connected to negative terminal of battery.

→ Central electrode is acting as anode.

→ metallic Surface acting as cathode.

→ The ionization particles passing through the tube ionizes the gas and electron. So particles move toward anode.

→ The velocity is quite high and they later produce secondary e.

→ when external particles inducing ionization and leaves the creation of free electron.

→ positive ion move toward the metallic

Surface.

→ Negative ion move toward the central electrode.

→ If potential is extremely high and

→ electron will be accelerated to very high velocity.

→ This $\bar{e}$ will also collide with gaseous molecules.

→ This electron is also capable for inducing

Secondry ionization:

→ After repeated collision with particle of Gas.

→ Due to large multiplication

→ A large ionizing current is produced

1 Detection of Radiation

A GM tube is gas filled device that when high voltage creates an electrical

Pulse

→ when radiation interact with the wall of gas in tube.

→ pulses are converting to a reading on the instrument meter

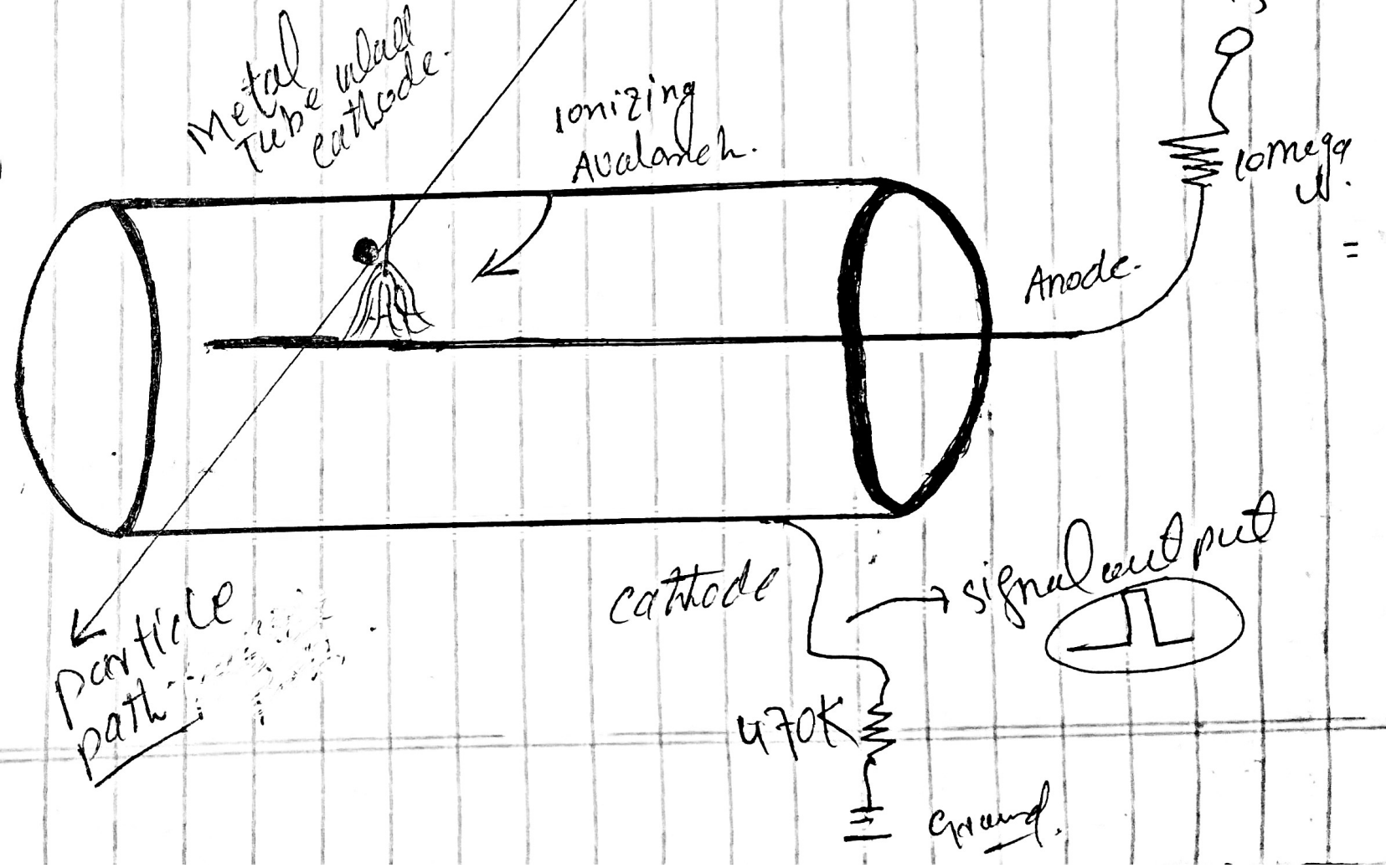
→ It is very sensitive.

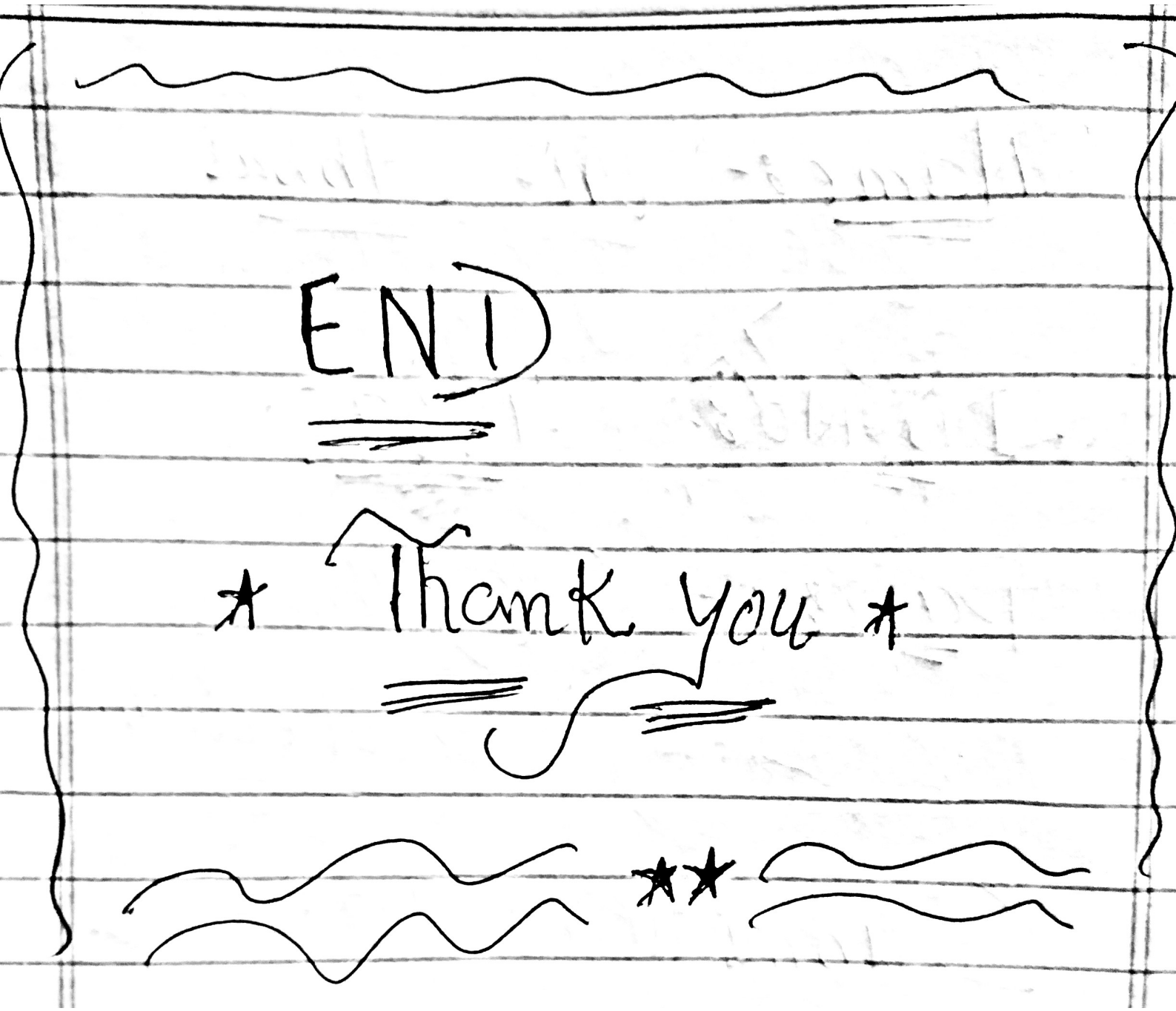
→ It is used for protection for technologist to count its dose.

(51)

Geiger Muller Tube :-

Mica Window

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Thank you