Paper :- Radiological Protection

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Q.NO1 :-

Ans:- Differentiate between Deterministic and stochastic effects radiations :-

i) Deterministic effect :-

After exposure to a high radiation dose humans can experience a response within few days to a weeks

→ This intermediate response is called Deterministic effects.

of radiation exposure.

→ Such early effect are deterministic because the severity of response

Is dose related

→ dose response Chresthold, dose relationship are non linear.

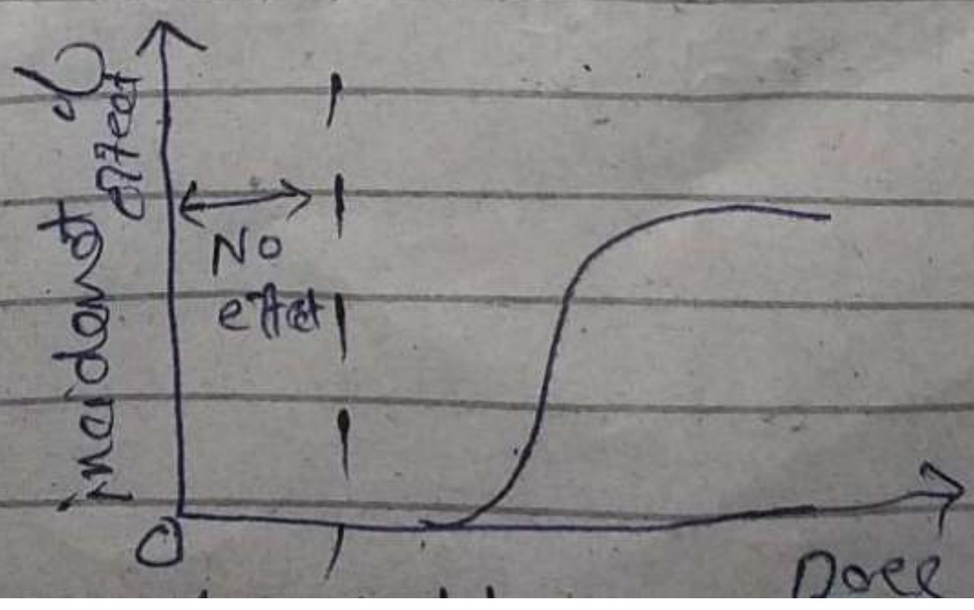
→ The acute radiation syndrom occur after high dose resulting into death with in few days.

→ When the whole body is being irradiated Eu the 50% subject die with in 60 days this refers to LD 50/60 dose eg 3.5 GY+ (350 rad).

→ The death of tissue will less exposure time, As radiation increases, the time b/w expsure & death decreases

→ All early effects and most normal tissue & late effect are determinsitic.

→ In determinsitic effect mostly hair loss, cataract, skin albeeled, anemia, infertility etc causes.



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Stochastic effects :—

→ The stochastic effect of radiation occurs a long time after exposure, but stochastic effect can result from high dose, short term exposure, but

→ the diagnostic imaging involves low dose exposure over time

→ They have no threshold dose and increases as dose increased

→ Severity are not dose related

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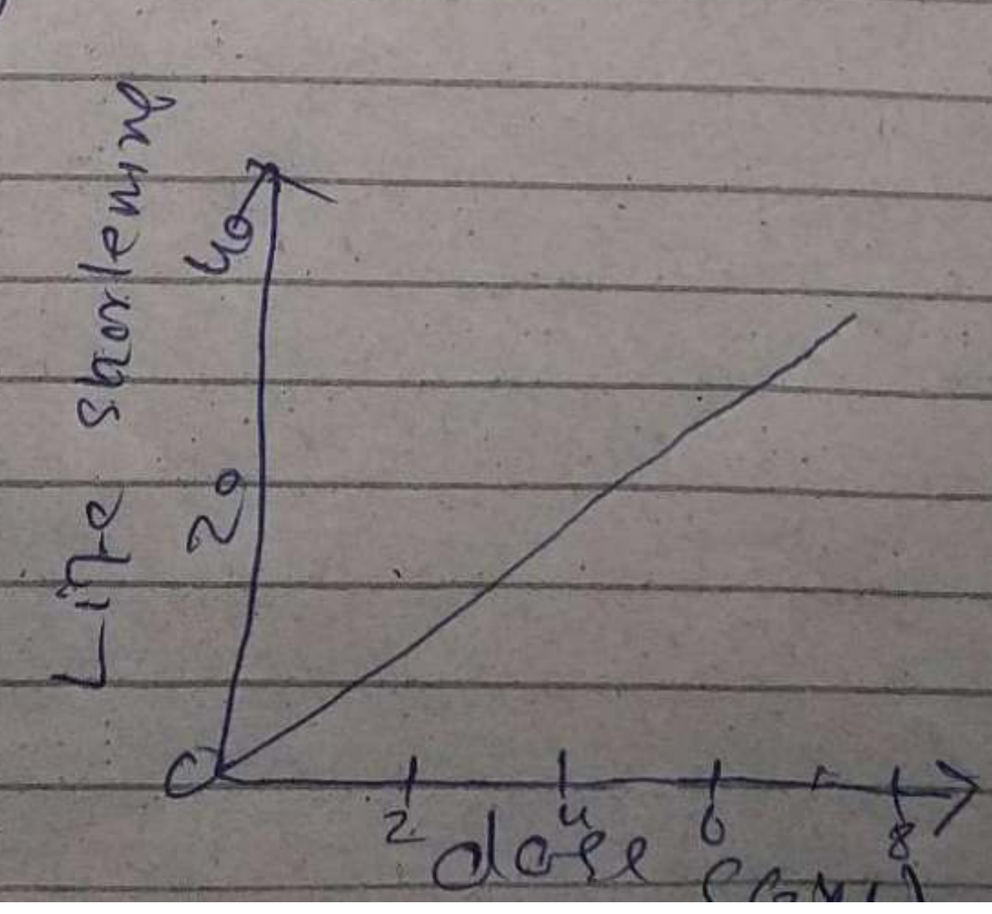
→ There is no dose above which stochastic effect are certainly to occur.

→ Stochastic effect include radiation of carcinogenesis and hereditary effects

→ In stochastic effect the local tissue irritation, cancer, leukemia and hereditary effect etc may occur.



Q No 2 :—

Ans :—

i) Radiation :— Radiation is the emission or transmission of energy in the form waves (electromagnetic) or particles (alpha, Beta & Gomana) through space or through a meterial medium

e.g :- radio waves, micro waves, Infrared, visible light, ultravoilet, X-rays & gamma radiation.

→ This are classified on the basis of energy, Frequency & wave length.

Radiation cont.....

→ ionizing & non-ionizing

→ higher energy radiation are ionizing & low energy are non-ionizing.

→ The radiation are also classified on basis of source.

→ Ionizing radiation are very important in radiography.

ii) Radioactivity :- Radioactivity refers to the particles which are emitted from nuclie as result of nuclear instability. Because the nucleus experiences the intense conflict between the two strongest forces in nature, it should not be surprising that there are many nuclear isotopes which are unstable and emiles some kind of radiation

→ There are three types of radioactivity

→ Alpha particle, helium nucle

→ Beta particle an electron emitting from the nucleus of radio active atom.

→ Gamma Particle, Photons of high energy.

→ The radioactive isotopes emitted these high energy particles.

iii) Non-Ionizing radiation :-

The non-ionizing radiation refers to any type of electromagnetic radiation that does not carry enough energy per quantum to ionize atom or molecules

→ The non ionizing radiation are unable to remove electron ($\bar{e}$) from an atom

→ This radiation only excite the electron that are move from lower shell to higher shell

(11)

→ so it does not ionize atom

→ It is safe & not harmful at all.

iv) Ionizing Radiation :—

Ionizing radiation is traveling as a particle or electromagnetic waves, that carry sufficient energy to detach electrons from atoms or molecules.

→ Ionizing radiation is made up of sub atomic particles, atoms or electromagnetic waves

→ It is traveling at speed of light

→ It is very important in radiography.

e.g X-rays, ultraviolet, alpha, Beta & gama are the example of ionizing radiation.

→ It is harmful causing serious disorders e.g cancer.

v) Harmful Radiation :-

→ The radiation is transfer of energy. This energy ionize the atoms & moleculs which brought about many changes

→ Low level of radiation present every where in sorounding which are harm less.

→ Medium energy radiation cause sickness, headach, vomiting & fever while high energy radiation

damages the cells that make up human body by causing mutation (non lethal mutation), which may lead malegneney.

→ The high energy radiation changes genetic make up by ionization

→ It also depend upon exposure time, higher exposure cause more damage

→ exposure to radiation over a long time can cause cancer.

Q No 3 :—

Ans :—

a) Basic Principles of Radiation protection.

The two basic radiation Protection are Time & distance.

Distance :— The radiation dose received from a source is inversely proportional to the square of the distance of separation. As you reduce the distance by half you increase exposure by a factor of four.

→ Greater the distance from the source lesser will be the radiation recieved

→ The exposure of an individual in 1 m from source will be 1/4 while 2m from a source of a person sitted it is some source

Time :— The amount of radiation recieved by a person is directly proportional to the length of the time

→ increase in expesure radiation will also increases

→ When the of time decreases

The dose will also minimize

→ If the time spend in a given radiation field is double the dose received by a person will double

→ There fore to limit the radiation dose the time spent in a field must be limited

→ An example of reducing radiation dose by reducing the time of exposure might be improving operator training to reduce time taken to handle a radiation sources

Sheilding :- When the sheilding around radiation source are greater, lesser will be radiation dose.

→ Sheilding absorb those radiation which is unnecessary between you & source.

→ There are number of sheilding uses for protection e.g console room sheilding, tube & House sheilding, patient shielding & radiologist sheilding.

We should apply → ALARA. all around.

(20)

b) :-

Ans :- The of the radiation protection devices , → GM counter

→ Gas Filled Detectors

→ Scintillation Detectors

→ Thermoluminescence Dosimetry

→ Optically Stimulated Luminsesence Dosimetery.

→ But for protection Apron , gloves , gonadal sheild , Thyroid Sheild , Glasses , protection barriors Se table sheilds are used ,

This are not devices but the only tools used for protection

Q NO 4 :—

Ans :— Feature for radiation protection design.

→ The feature for radiation protection designed to reduce patient radiation dose during radiographic examination.

1) Protective X-ray tube Housing :—

→ The X-ray tube should be sheilded & protecting by protective housing.

→ The housing absorb & prevent the leakage of radiation

2) Control Panel :—

The control panel shows the condition of exposure

→ Positive sign shows & indicated when the tube are energized with visible & audible time.

→ The signal shows when x-ray tube are get energized.

→ KVP & mAS are indicate and used according to their requirments.

→ The ~~sta~~ beam should clearly showed to technologist.

3) Source to Image Distance :—

→ The SID indicators must be accurate to within 2% of indicated SID

→ Indicator should be provided.

→ simple is tape measure attach to tube Housing.

4) Collimation :—

The x-ray beam & light beam must be coincide & with in 2% of SID

→ useful beam shuter must equal to housing shuter.

→ variable aperture localized — light (triangular collimator) should be provided.

5) Positive beam limitation :—

→ The speed beam imaging system ~~inunited~~ made in United state b/w 1974 & 1994.

→ Positive beam should adjusted to the size of image receptor

→ Collimator shuter & X-ray beam equal to IR.

6) Beam Alignment :—

→ The radiograph should be taken in proper beam alignment.

7) Filteration :—

- To reduce patient dose Ie unwanded x-rays it must filter (total beam)

→ At 70 KVP at least 2.5 mm Al

→ For tube during operation at 50-70 level at least 1.5 mm Al filteration

→ below 50 :0.5 mm Al filteration should maintain

(26)

Intensity :—

→ The exposure time is adjusted for constant mAs, the out put Radiation intensity value be ~~com~~ Remain constant.

Operator Sheild :—

It must not be possible to expose in room out side of operator both

→ Portable, x-ray must have 2m there for exposure

→ Fluroscopic protection should also maintained.

Q No 5 :—

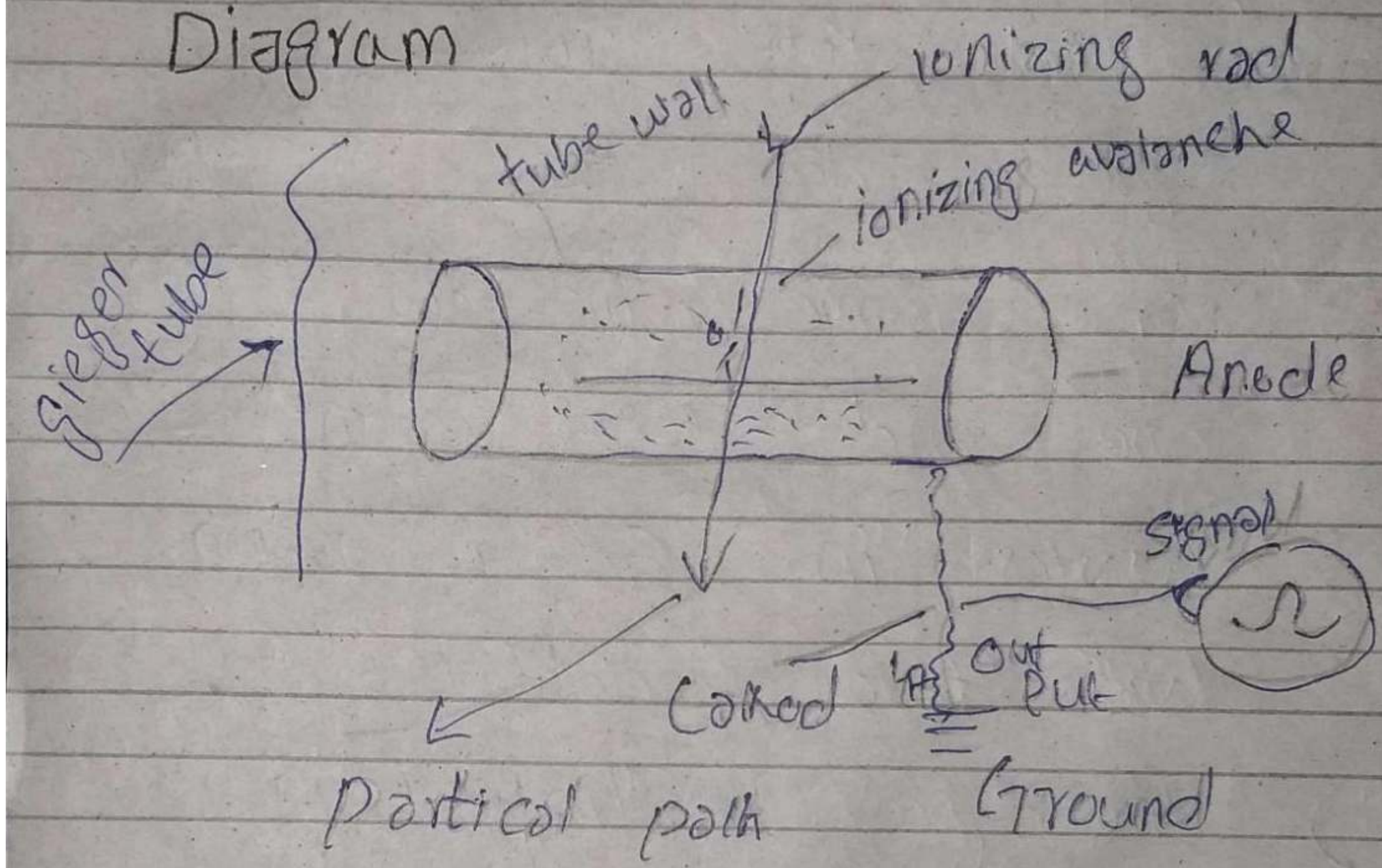
Answer:— Gieger muller is a scientist who discover the Gieger tube

→ It is a metal cylinder filled 10th low pressure gas sealed with a plastic or ceramic wind—ow at one end this counter works in Gieger region with two specialities

1) The gas multiplication factor is so large that an avalanche die in at one end (Point) but spreads all over the entire length of the central wire

Large out put pulse is independent both of the energy and nature of the Particle detected

Diagram



Principale of working :-

The ionizing Particle passing through the tube ionizes the gas and electron so producing move towards Anode.

The velocity is quite high and they later produce secondary electrons after repeated collision with the particle of a gas

→ Due to large multiplication action, a large ionizing current is produced.

Detection of Radiation :—

1) GM tube is a gas filled device that when a high voltage is applied creates an electrical pulse when radiation interacts with the wall of tube or gas There Pulse are converted

to a reading on the instrument meter

→ It is very sensitive Ee readable

→ The unit of this device is sivert

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