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ID 15292

Q No:- Differentiate between deterministic and stochastic effects of radiation.

Ans:- **Deterministic effect:-**

=> It is also called non-stochastic effect.

= It produced by high radiation doses.

= Exhibit increasing severity with increasing radiation dose.

= Dose threshold and the dose response relationship is non-linear.

= Deterministic effect are immediate response.

= Human response within a few days to a few weeks.

= particularly not important.

# Stochastic Effects:

Radiation exposure are the result of low doses.
Doses delivered ove a long period.
It consist of radiation induced malignancy and genetic effects.
Life span shortening.
Effect on local tissue.
Assumed linear, non threshold dose response relationship.
low and of to low LET, They are chronic in nature. because they delivered intermittenly over long period.
It is particular important.
It Exhibit an increasing incidence of responce.
Not severity with increasing dose.
No dose threshold has been established.
Dose responce relatinship is linear.

(3)

Explain breifly following terms radiation, radioactivity Non-ionizing radiation, ionizing radiation and hamful radiation.

**Radiation:**

Energy emitted and transfer through space is called radiation. Sound is the form of radiation.

Radiation is the transfer of energy. Radiation is the transfer of heat by the emission of infarred radiation Heat lamps emit not only visible light but also infarred Radiation.

# Radioactivity:-

Some atoms exist is an abnormally excited state charctarize by an unstable nucleus. To reach stability, the nucleous spontaneously emits particles and energy and transform it sely into another atom. The atom involved are radionuclides.

Radioactivity is the spontanous emission of particles and energy in order to become stable.

Radioactive decay results in emission of alpha particles, beta particles and usually gamma rays.

## Non- Ionizing Radiation:

Radiation used in diagnatic ultrasonography and magnetic resonance imaging are non-ioniz radiation

Any type of electromagnatic radiation that does not carry enough energy per quantum to ionize atom or molecules that is to completly remove an electron from an atom or molecule.

In stead of producing charged ions when passing through matter. non-ionizing electromagnatic radiation has sufficient energy only for excitation the movement of an electron to higher energy state. In contrast ionizing radiation has a higher energy static frequency and Shoter wavelenght than ionizing radiation and can be a serious health hazard, exposure to it can cause burns, radiation sickness, cancer, and gentic damage.

## Ionizing Radiation:

Special type of radiation that include x-ray. Ionizing radiation is any type of radiation that is capable of removing an orbital electron from an atom with which it interacts. This type of interaction between radiation and matter is called ionization.

Ionization occure when x-ray passes close to an orbital electron of an atom and transfers sufficient energy to the electron to remove it from the atom. The ionizing radiation may interact with and ionize additional atoms. The orbital electron and the atom form which it was separated are called an ion pair. The electron is a negative ion, and the remaining atom is a positive ion.

Ionization is the removal of an electron from an atom.

# Harmfull Radiation:

Radiation has suffient energy to affect the atoms in living cells and thereby damage their genetic materiel (DNA).

The cells in our bodies are extremely efficient at repairing this damage.

However, if the damage is not repaired correctly, a cell may die or eventually become cancerous.

Exposure to very high levels of radiation, such as being close to an atomic blast, can cause acute health effects such as cancer and cardiovascular disease. Exposure to low levels of radiation encountered in the envirement does not cause immediate health effects, but is a minor contributor to our overall cancer risk.

(8 (a)

Q no3: Write two basic principal of radiation protection?

Ans: Three basic principal should be adhereed to when dealing with radiation and making radiographs.

Time

Distance

Sheilding

**Time Minimiz:**

Time refers to the time the patient or the technician is exposed to primary or secondry radiation from the x-ray tube. Time can be minimized by:

=> keeping the time station of the x-ray machine to the lowest possible numbers. and the highest mA station, in order to obtained the desire mAs.

=> Minimizing your time in the room during the exposure.

Exposure = Exposure rate x Exposure time

① Cardinal principal:

= Keep the time of exposure to radiation as short as possible
= Maintain as large a distance as possible between the source of radiation and the exposed person.
= Insert shielding material between the radiation source and the exposed person.
= Time - Distance - Sheilding.

② ALARA :-
As low as reasonably achievable

## Distance Maximize :

The principal of distance mean that there needs to be physical distance between the examiner and the patient x-ray tube at the time of exposure.

Use the positioning device allows every one to physically exit room at the time of exposure.

if there are staff in the room at the time of exposure make sure that 2 individual holding the patient. which allows each person to further distance themselves from the x-ray tube and area of collimation.

Holding the patient at the time of exposure provides the greatest chance of secondry or scattered radiation exposure

Never stand directly in front of the x-ray tube at the time of the exposure.

If you move from 2 to 4 feet away, you will have decrease the intensity of the scatterd radiation by 25%.

(b) Write down the names of the radiation protection devices:

(1) Radiation protection Aprons
(2) Radiation protection Apron accessories
(3) Radiation protection Gloves
(4) " " Glasses
(5) " " Thyroid sheilds
(6) " " Apron Racks.
(7) " " Barriers and table sheild.
(8) " " Drape shields
(9) pediend Radiation protection
(10) Veterinary " " .

Qno4:- What are the features for Radiation protection design? Explain briefly:

Ans:- Many Radiation protection devices and accessories are accociated with modern x-ray imaging systems. Two that are appropriate for all diagnostic x-ray imaging system relate to the protective housing of x-ray tube and to the control pannel.

## protective x-ray Tube Housing:-

Every x-ray tube must be contained within a protective housing that reduces leakage radiation during use. Leakage radiation must be less than 1mGy a/hr (100mR/hr at a distance of 1m from the protective housing.

## Control panel:-

Must be indicated the conditions of exposure and must positively indicate when x-ray tube is energized.

X-ray beam on must be positively and clearly indicated to the radiologic technologist.

**Source to - image Receptor Distance Indicator:**

SID indicator must be provided. The SID indicator must be accurate to within 2% of the indicated SID.

**Collimation:**

Light - localized, variable aperture rectangular collimator should be provided. Cones and diaphragms may replace the collimator for special examination.

The x-ray beam and the light beam must coincide to within 2% of SID.

**positive - Beam Limitation:**

Automatic, light - localized, variable - aperture collimator were required on all but special x-ray imaging system manufactured in the US between 1974 & 1994.

The PBL must be accurate to within 2% of SID.

**Beam Alignment:-**
In addition to proper collimation, each radiographic tube should be provided with a mechanism to ensure proper alignment of x-ray beam, and the image receptor.

**Filtration:-** All genral purpose diagnostic x-ray beams must have a total filtration of at least 2.5 mm Al when operated above 70 kVp.
x-ray tubes designed for mamography have 30 µM Mo or 60 µm Rh filtration.

**Reproducibility:-** for any give radiographic technique, the output radiation intensity should be constant from one exposure to another. This is checked by making repeated radiation exposures at the same technique and observing the average variation

in a radiation intensity. The variation in x-ray intensity should not exceed!

## Linearity:-

When adjacent mA stations are used, for example 100 mA and 200 mA, and exposure time is adjusted for constant mAs, the out put radiation intensity should remain constant.

The maximum acceptable variation in linearity is 10% from one mA station to an adjacent mA station.

## Operator sheild:-

It must not be possible to expose an image receptor while the radiologic technologist stands unprotected out side a fixed protective barrier, usually the console booth. The exposure control should be fixed to the operating console and not to a long cord.

## Mobile x-ray imaging:-

A protective lead apron should be assigned to each mobile x-ray imaging system. The exposure switch of such an imaging system must allow the operator to remain at least 2 m from the x-ray tube during exposure. The useful beam must be directed away from the radiologic technologist while positioned at this minimum distance.

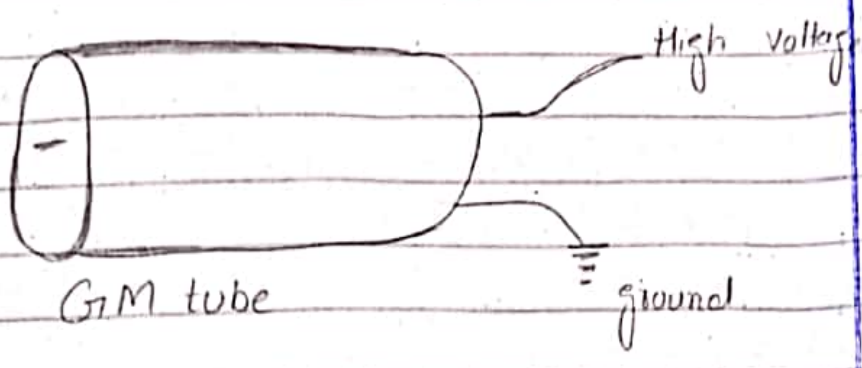
Qno:- What is GM counter. How it can be used as a radiation protection device?

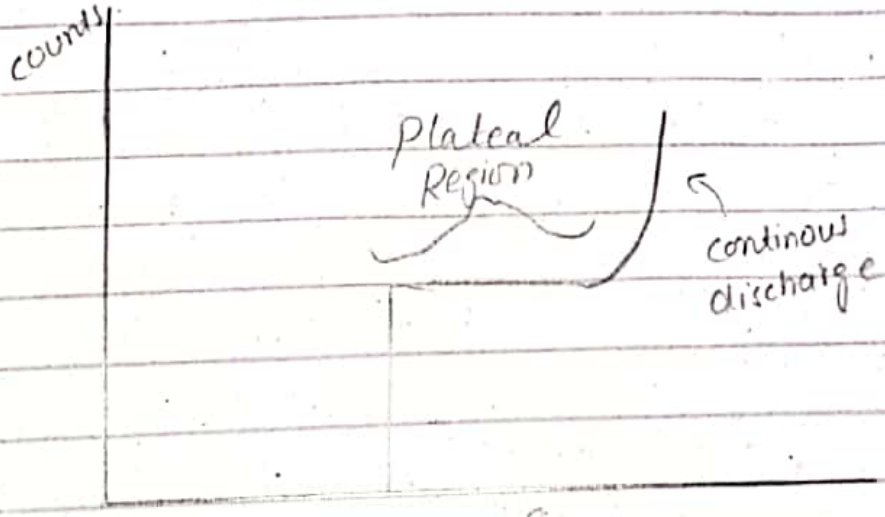
Ans:- **GM counter:-**

A Geiger - Miller (GM) counter is a gas - filled detector designed for maximum gas amplification effect.

The principal of GM counter The center wire (anode) is maintained at a high positive voltage relative to the outer cylindrical electrode (cathode) the outer electrode may be a cylinder or a metalic film sprayed on the inside of the glass or plastic tube. Some GM counter have a thin radiation entrace window at one end of the tube. The cylinder of the tube is sealed and filled with a special gas mixture. typically argon plus a quenching gass. It measured radiation. alpha, beta and gamma radiation. Basically It consist of a pair of electrode, surrounded by gass.

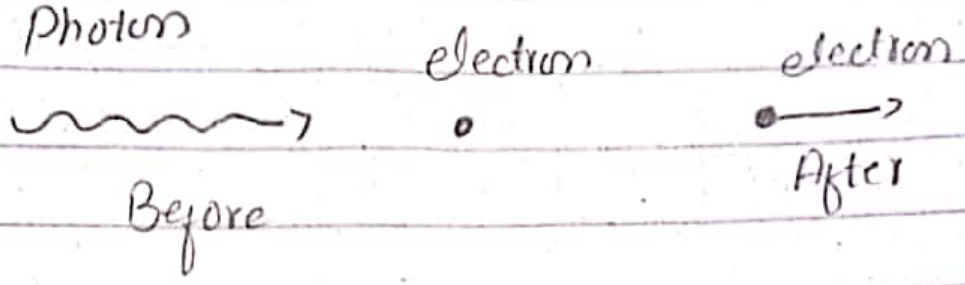
For voltage no count are recorded. This is because the electric field is too weak for even one pulse to be recorded. As the voltage increase, eventually one obtain a counting rate.



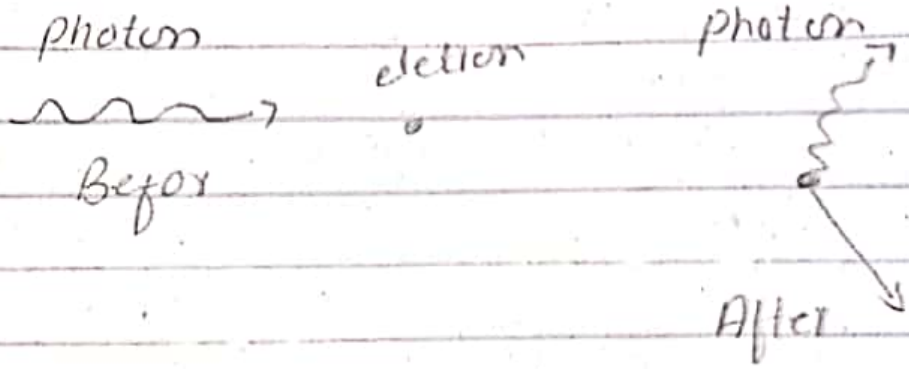




$\varepsilon$ = number of particles of radition detected / number of particles of radiation emitted.

# PHOTO- ABSORPTION




# COMPTON SCATTERING



It can be used radiation protection device :-

It detected ionizing radiation such as alpha particles, beta particles and gamma rays using the ionization effect produce in the GM tube.

Limited to 1 mGy a/hr portable. survey for low radiation levels and radioactive contamination.

proportional counter are sensetive instruments used primarily for the assay of small quantities of radioactivity.

GM are used for the contamination control of nuclear medicine laboratories. As portable survey instrument, they are used to detected the presence of the radioactive contamination on work. Surface and laboratories apparatus.

GM ~~are~~ counter are sensative instrument that are capable of detecting and indicating single ionizing events.

(20)

Owing to the large charge amplication.

GM survey meters are widely used at very low radiation levels. They are particularly applicable for leak testing and detection of radioactive contamination.

GM counters exhibit strong energy dependence at low photon energies and are not sutible for use in pulsed radiation fields.