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Paper Radiation protection

ID 15357

Discipline Bs Radiology

Semester 4th

Q No 1:- Differentiate between Deterministic and Stochastic effects of radiation?

Ans:-

Deterministic	Stochastic effects
1:- Hair loss, Cataract, Skin injury etc	1) Cancer, leukemia Hereditary effects etc
2:- When a number of people were exposed to the same dose of radiation and certain symptoms appear in 1% of them, said dose is considered to the threshold dose	2) Effects of radiation exposure under certain doses are not clear because effects of other cancer promoting factors such as smoking and drinking habits are too large. The ICRP specifies the standards for radiological

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	protection for such low dose exposures, assuming that they may have some effects as well.
3:- A threshold dose below which no effect is seen.	3:- They have no threshold dose
4:- Worsening of the effect as dose increases over the threshold.	4:- They increase in likelihood as dose increase
5:- Always occuring once the threshold dose is rached.	5:- Their severity is not dose related.
6:- Different effects tissue and people have different threshold dose for	6:- There is no dose above which stochastic effects are certain to occure

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deterministic effects.	
7:- Damage to multiple cell.	7:- Damage to single cell.
8:- Occure at level of cell	8:- Occure at level of tissues
9:- Seen when the cells are modified rather than killed	9:- Seen when the cells are killed or loose capability to divide
10:- Severity independent of dose received	10:- Severity may be proportional to the dose received
11:- Sure to occure at an adequate dose	11:- Occurs only among a small percentage of those exposed
12:- Radiation sickness	12:- Chromosomal damage.

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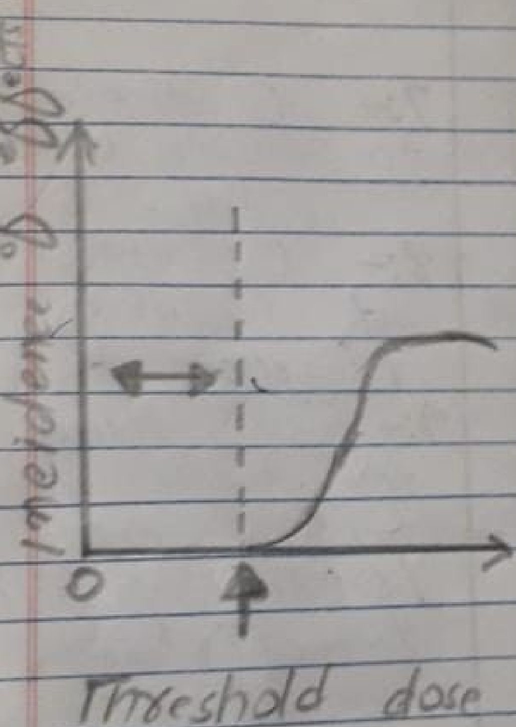

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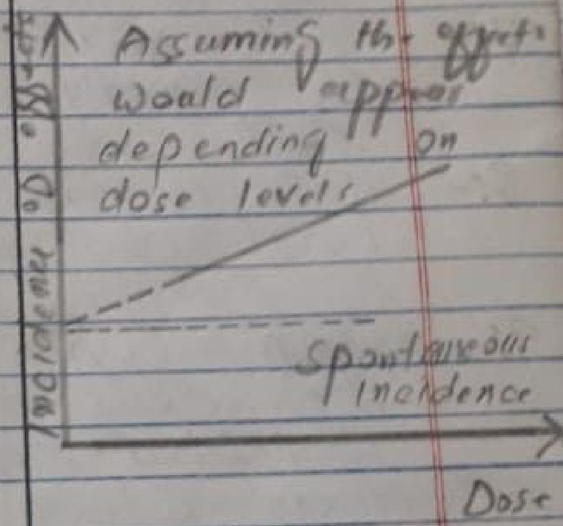

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Q no 2

Ans:-

Radiation:-

Emission and propagation of Energy through space or through a material in the form of waves or, by extension, corpuscular emissions.

- Electromagnetic radiation
- Micro Waves
- Radio Waves
- Infrared
- Visiable light
- Ultra volet
- X - rays
- Gamma radiation.

We are all exposed to to radiation every day. Mainly from the Sun and soil. Other sources of radiation are man-made.

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Radioactivity:-

spontaneous emission of radiation from the nucleus of an unstable.

→ Some atoms exist in an abnormally excited state characterized by an unstable nucleus.

→ To reach stability the nucleus spontaneously emits particles and energy and transforms itself into another atom.

→ This process is called radiactive, disintegration or radioactive decay.

Non-Ionizing Radiation:-

→ This type of radiation is low energy radion no ion charge are produce in this radiation.

→ The Non-Ionizing radiation Dose not contain sufficient energy to produce ions.

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Example:- UV rays, micro waves, Radio frequency waves are some examples of non ionizing radiation.

> These x. rays are not directly harmful impact our live.

> Non- ionizing radiation originates from various naturaly originated or or man - made.

Ionizing Radiation:- particles or photons with sufficient Energy to produce ions medium.

> ionizing radiation is radiation capable of imparting its Energy to the body and causing chemical changes.

> ionizing radiation is emitted by Radioactive material.

> Some devices such as x. rays

Q No 2:- term non ioni har

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Machines.
> It is dangerous and leaves bad impact on human body.

Example:-
Alpha, Beta are some some examples of Ionizing radiation.

It has high Energy and displace Electron from orbit.

Harmful Radiation:-
Radiation damages the cells that make up the human body.

> low levels of radiation are not dangerous, but medium levels can lead to sickness, headaches, vomiting and a fever

> High levels can kill you ~~causing damage~~ by causing damage to your internal organ. It's difficult to treat high radiation exposure

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> Exposure radiation over a long time can cause cancer.

Types:-

Gamma rays:-

Are the most harmful external hazard.

Beta particle:-

can partially penetrate skin, causing beta burns.

Alpha particles:-

Can not penetrate intact skin.

Gamma and X. rays:-

can pass through a person damaging cells in their path.

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Q No : 3 (a)

Ans:-

Three basic Principles Should be adhered to when dealing with radiation and making radiographs:

- Time
- Distance:
- Shielding:

These principles from the basis of broader radiation safety concept called ALARA (As Low As Reasonably Achievable)

Time:

The referes to the time the patient or the technician is exposed to primary (X-rays in the collimated beam directed toward the patient) or secondary (X-rays scattered away from the patient and outside the collimated field). radiation from the X-rays tube.

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Time can be minimized by

> Keeping the time station of the x.ray machine to lowest possible numbers and the highest mA station, inorder to obtain the disered mAs when making the exposure.

> Minimizing your time in the room during the exposure

Distance:-

The principle of distance means that there need be physical distance between the technician and the patient x. ray tube at the time exposure.

> use positioning devices allow every one to physically exit the room at the time of exposure

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

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

Q No 3 (B)

Ans:-

Radiation protection Device:

1: Filtration:-
Metal filters, usually aluminium or copper are inserted into the x-rays tube housing which absorbed secondary x-rays broader radiation safety concept called (ALARA) As Low As Resonably Achievable)

2: Time:-
Time refers to the time the patient or the technician is exposed to x-rays in the collimated primary beam directed toward the patient or secondary x-rays scattered away from the patient and out side the collimated field radiation from the x-ray tube

→ Time can be minimized by:

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→ Keeping the time station of the x-ray machine to lowest possible number

→ Minimizing your time in the room during the exposure.

3: Distance :-
The principle of distance means that there needs to be physically distance between technician and patient x-ray tube.

2: Collimation:-
Collimation restricts the useful x-rays beam to part of the body to be imaged.

3: Protective Apparel:
Lead - impregnated material is used to make aprons and gloves worn by radiologist and radiologic technologist and during fluoroscopy and some radiographic produces

4: Gonadal shielding:-
The same lead impregnated material used in aprons and gloves used fabricate gonadal shields.

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5: Protective Barriers:-

The radiographic or CT control console is always located behind a protective barrier. Often the barrier is lead lined and is equipped with a leaded glass window.

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Q No 4:-

Radiation protection Design: Features:-

→ protection x-ray tube housing.

Protective housing to reduce leakage radiation.

→ Must be less than 100 mR/hr at a distance of 1 m from protective housing.

→ control panel:
Must show exp. conditions and when tube is energized Beam On must be clear to techs.

→ SID Indicator:-

→ Indicator must be present. (tap measure or read out

→ Must be accourate within 2% of the indicated SID

→ collimation:-
light field, variable aperture

→ x-ray beam and light

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Field must concide w/in 2% of SID

> PBL - positive Beam limitation:-
> Auto collimation circa 1974-1994
> Must be accurate w/in 2% of SID

> Beam Alignment:-
> How do we we know the tube is alligned with the image receptor.

> Filtration:-
> Inherent plus added.
> Total must be at least 2.5 mm above 70 kvp.

> Reproducibility:-
> constant out put radion intensity.
> Should not exceed 5% through same technique.

> Linearty:
> Constantly out put while mA settings or varied time is adjusted to keep mAs the same.

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> operator shield:-

> It must not be possible to expose in a room outside of the operator booth.

> Portable x. ray. mus have > 2 m tether for exposure.

> Fluoroscopic protection:-

> SSD - source to skin distance

> Divergence of x. ray beam means the ESE or entrance skin exp. is lessened for the required exit. exposure as SSD is increased.

> SSD must be not less than 38 cm on stationary fluroscopy and not less than 30 cm on mobile fluroscopy.

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Q No 5

Ans:-

GM counter:

Counter Geiger - Muller counter is a device actually used for detecting and measuring ionizing radiation like alpha particles, Beta particles and Gamma rays.
A G M (Geiger Muller) counter can count individual particles at rates up to about 10,000 per second and is used widely in medicine and prospecting for radioactive ores.
Basically it consists of a pair of electrodes surrounded by of a gas. The electrodes have a high voltage across them the glas used is usually Helium or Argon.

construction of Geiger Müller counter:-

> It consists of a hollow metal case enclosed in a thin glass tube. This hollow metal case acts as Cathod.

The tube is evacuated and then partialy filled with a mixture of 90% argon a 10 cm pressure and 10% ethyle alcohol vapours at 1 Cm pressure.
The fine tungsten wire is connected to positive terminal of a high tension battery through a resistance and the negative terminal is connected to the metal tube.

The direct current voltage is kept slightly less that which will cause a discharge between the electrodes.

At one end of the tube a thin window of mica is arrenged to allow the entry of radioactive into the tube.

Geiger - Muller counters bassically consist of three main elements.

1: Geiger Muller tube.

2: processing and display electronics.

3:- power supply

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Principle of GM (Geiger Muller) Counter:-

The basic principle of the GM counter can be understand on:

When an Ionizing particle pass through the gas in an Ionizing chamber it produces a few ions if the applied potential difference is strong enough these ions will produce a secondary ions avalanche whose total effect will be propotimally to the Energy associated with the primary ionizing event.

If the applied potential difference is very high the secondary ionization phenomenon becomes so dominant that the primary ionizing event loss its importance. In other words the size of a final pulse produced depends only on the triggering off of ionizing particle but low an ionizing of energy of indenpendent this particle.

A high Energ particle enter through the mica window will cause one or more of the argon atoms to Ionize.

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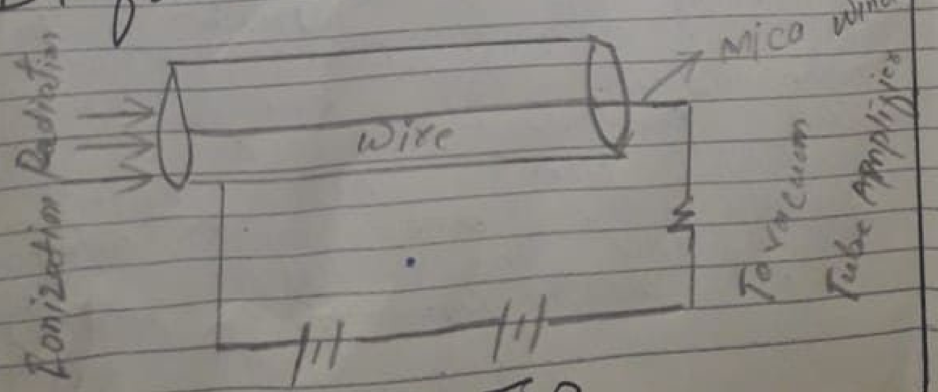
The electron and ions of argon thus produced cause other argon atoms to ionize in a Cascathad effected.
The result of this one event is sudden massive electrical discharge that causes a current pulses the current through Reproduced. voltage pulse of the other of 10 CIV.
An electon pulse Amplifier accepts the small pulse voltage and amplifies them to about 5 to 50 V. aplied to a counter. As each incoming particle produces a pulse, the number of incoming particles can be counted.

The Geiger counter is an instrument used for radiation dosimetry, radiological protection experimental physics and nuclear indeastory

Diagram:-



GM as protection device of radiation:-

The tube is filled with argon gas and around voltage of 400 volts is applied to the thin wire in the midle When a particles arrive in a tube it takes an electron from argon atom. The electron is attracted to the centre wire and is rushes towards the wire the electron will knock other electron from argon atoms. Causes an avalanche. Thus one single incoming particle will cause many electrons to arrive at the wire creating a pulse which can be amplified and counted this give us a very sensitive detector.

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