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PAPER "RADIATION PROTECTION"

## QUESTION No 1

Differentiate between deterministic and stochastic effects of radiation?

## ANSWER (1)

### STOCHASTIC EFFECTS

Stochastic effects: effects that occur by chance

### DETERMINISTRIC EFFEC

Deterministic effects are also called non stochastic effects (not by chance)

# DIFFERENTIATION

| DETERMINISTIC | STOCHASTIC |
| --- | --- |
| ① Deterministic also called non stochastic (not by chance) | stochastic effect occur by chance |
| (2) It has a threshold of doses below which the effect does not occur the threshold vary from person to person | occur without threshold level of dose whose probability is proportional to dose and severity is independent of dose main effect cancer |
| (3) not cause cancer | |

## FEW EXAMPLES OF DETERMINISTIC

expressed in gray

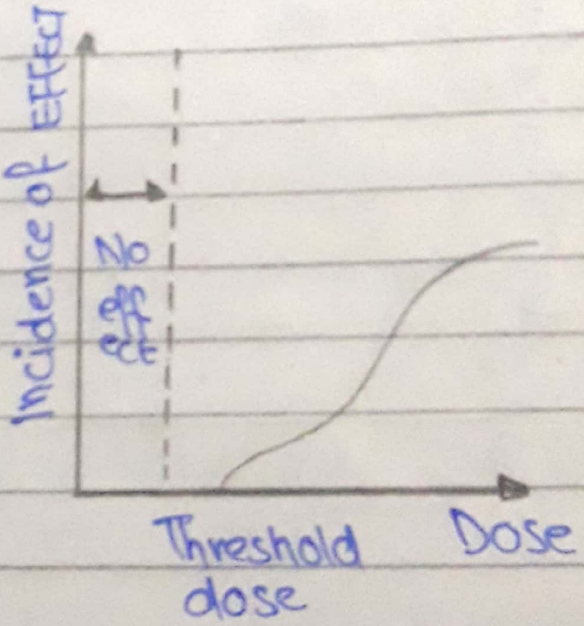
① skin erythema **20-40** Gy
② hair loss **2-5** Gy, etc

# GRAPH

## DETERMINISTIC EFFECT

hair loss, cataracts, skin injury

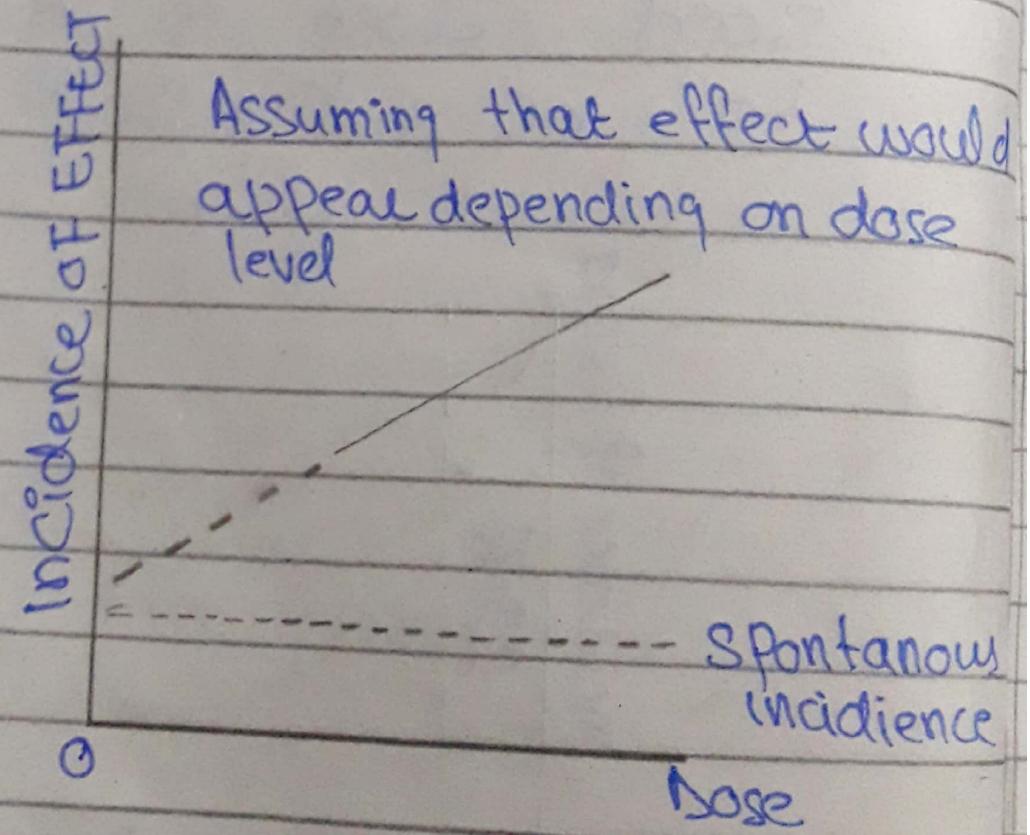
when a number of people were exposed to same dose symptoms appear in 1% of them said dose is considered to be threshold dose




## STOCHASTIC EFFECTS

Cancer, leukemia, hereditary effects,

→ effects of radiation exposure: under certain doses are not clear because of other cancer causing or promoting factors such as smoking and drinking habits are to large.



# Question No 2

## RADIATION

is any energy that comes from a source and travels through space such as light or heat. OR

The emission of energy as electromagnetic waves or as moving subatomic particles especially high-energy particles which cause ionization.

## RADIOACTIVITY

- The emission of ionizing radiation or particles caused by the spontaneous disintegration of atomic nuclei
- Radioactive substances, or the radiation emitted by these.

# NON-IONIZING RADIATION

→ non ionizing radiation refers to any type of electromagnetic radiation that does not carry enough energy per quantum to ionize atoms or molecules - that is to completely remove an electron from an atom or molecule.

# IONIZING RADIATION

→ is a type of energy released by atoms in the form of electromagnetic waves or particles.

→ Ionizing radiation such as in soil, water and vegetation, as well as in human made sources such as x-rays and medical devices.

# HARMFUL RADIATION

→ Radiation damages the cells that make up the human body

→ low level radiation are not dangerous

→ medium level cause sickness, headaches, vomiting and fever

→ high level damage internal organs,

It difficult to treat high radiation exposure

# QUESTION NO 3

write two basic principles of radiation protection

# ANSWER

ALARA, CARDINAL principle

# CARDINAL PRINCIPLE

→ Time, distance shielding.

# ALARA

→ ALARA → As low as reasonably Achievable

# B PART

## RADIATION PROTECTION

→ Radiation protection Aprons
→ Apron Accessories

→ Radiation Protection gloves.
→ protection glasses should be use
→ Thyroid shields
→ protection Apron RAcks
→ Radiation protection barrier or Table shields
→ Drape shields.

# CALDINAL PRINCIPLE

## TIME

Radiation exposure can be accumulated over the time of exposure

→ reduce time → better Image

## DISTANCE

A greater distance from the radiation source can reduce radiation exposure

## SHIELDING

→ Shielding must use
→ such as Caps, gloves etc
→ radiologist or physician protect from radiation.

# QUESTION NO 4

what are features for radiation protection design? Explain

# ANSWER:-

# RADIOGRAPHIC PROTECTION FEATURES

## (1) 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 1 mGy$_a$/hr (100 mR/hr) at a distance of 1m from the protective housing

# CONTROL PANEL

→ The control panel must indicate the conditions of exposure and must positively indicate when the x-ray tube is energized

→ These requirements satisfy with kvp and mAs use.

# SOURCE TO IMAGE RECEPTOR DISTANCE INDICATOR

→ A source to image receptor distance (SID) indicator must be provided.

→ This can be simple as tape measure attached to the tube housing or as a laser

# COLLIMATION

light localized - variable aperture rectangular collimators should be provided.

# POSITIVE BEAM LIMITATION

→ positive beam limitation must be accurate to within 2% of the SID
→ positive beam limiting devices are no longer required but to be a part of new radiological / radiographic imaging systems.

# BEAM ALIGNMENT

To ensure proper alignment of the x-ray beam and image receptor

# FILTRATION

All general purpose diagnostic x-ray beam must have a total filtration of at least 2.5mm Al when operated above 70 kvp.
→ mammography have 30µm Mo or 60µm Rh filtration

## REPRODUCIBILITY

→ For any given radiographic technique the output radiation should be constant from one exposure to another.

## LINEARITY

→ The maximum acceptable variation in linearity is 10% from one MA station to an Adjacent MA station

## OPERATOR SHIELD

→ It is not possible to expose an image receptor when the technologist is unprotected outside a fixed protective barrier usually the Console both.

## MOBILE X-RAY IMAGING SYSTEM

These x-rays machine

is a movable machine

→ A protective lead apron must be provide / assigned to each mobile x-ray imaging system.

→ also use in ICU and emergency units for severe patients.

# QUESTION NO 5

what is GM Counter, how it can be use as a radiation protection device

# ANSWER

## GEIGER COUNTER

① A Geiger counter is a device used for the detection and measurement of all types of radiation

② detect Alpha, beta gamma radiation

→ It consist pair of electrodes surrounded by gas.

→ gas use in geiger counter are helium and argon.

→ Geiger counters are used for contamination control in nuclear medicine laboratories.

⇒ detect radioactive contamination

⇒ They are not use as a dosimeters because of varing conditions of radiation

→ geiger counters are sensitive devices that are capable of detecting and indicating lonizing radiation.

⇒ Geiger counter does not have a very wide range most instruments are limited to less than 1mGy hr (1000mR/hr)

# GEIGER MULLER COUNTERS

→ A Geiger muller counter is a gas filled detector designed for maximum gas amplification effect

→ The principles of a GM counter are the center wire anode is maintained at a high positive voltage relative to the outer cylindrical electrode

→ Some GM have a thin radiation entrance window at one end of the tube.

→ when Ionization occur in a GM counter electrons accelerated towards ↓ wire.
centre

# GM COUNTER AS A RADIATION PROTECTION DEVICE

→ (Geiger counter) GM survey meters are widely used at very low radiation levels (e.g in areas of public occupancy around radio-therapy treatment room.)

→ They are particularly applicable for leak testing and detection of radioactive contamination

→ GM counter exhibit strong energy dependence at low photon energies

→ not suitable for use in pulse radiation fields.

# GEIGER-MULLER COUNTER