RADIATION PROTECTION PAPER

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Q1: Differentiate between deterministic and stochastic effect.

DETERMINISTIC EFFECT:

Deterministic radiation responses usually follow high dose radiation exposure and appear as an early response. They exhibit a dose threshold, there is a dose below which no response occurs. As radiation dose increases, the severity of response increases. Radiation-induced skin burns represent deterministic response.

STOCHASTIC EFFECT:

Stochastic responses are cancer, leukimia or genetic effects. Such responses follow low radiation exposure and appear as late radiation response, years later. There is no dose threshold and as a result dose increases, the frequency of response in a population increases.

Q2: Explain briefly the following terms

(i) **RADIATION:** Energy emitted and transferred through space is called radiation or in simple words we can say that, radiation is the transfer of energy.

IONIZING RADIATION:

It 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 matter and radiation is called ionization.

(iii) **RADIOACTIVITY:**

It is spontaneous emission of particles and energy in order to become stable.

(iv) NON-IONIZING RADIATION:

Radiation for which the mechanism of action in tissue doesn't directly ionize atomic / molecular systems through a single interaction.

The type of radiation use in diagnostic ultrasonography and in magnetic resonance imaging are non-ionizing radiation.

(v) HARMFUL RADIATION:

Radiation that damages cell / molecule that make up human body.

The abnormal molecule may in time function improperly or cease to function, which can result in serious impairment or death of cell.

Q.34 Write down 2 basic principles of radiation protection.

BASIC PRINCIPLE OF RADIATION PROTECTION

(i) CARDINAL PRINCIPLE:

Time, distance, sheilding.

Keep the time of exposure as short as possible.

Maintain large distance as possible between source of radiation and the exposed person.

Insert sheilding material between the radiation source and exposed person.

(ii) ALARA:

As low as resonably acheivable.

We should apply as low (radiation) as possible.

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

RADIATION PROTECTION DEVICES:

i) Photographic emulsion.

ii) Ionization chamber.

iii) Proportional counter.

iv) Geiger - muller counter.

v) Thermoluminescence dosimetry.

vi) Optically stimulated luminescence dosimetry.

vii) Scintillation detection.

Q4 What are the features for radiation protection design.

RADIATION PROTECTION

FEATURES:

i PROTECTIVE XRAY HOUSING

Every x ray tube must contain a protective housing that reduces leakage radiation during use.

ii CONTROL PANEL:

It must indicate the conditions of espossure and must positively indicate when x ray tube is energized. These requirements are usually satisfied with the use of KVp and mA indicators.

iii SOURCE TO IMAGE RECEPTOR DISTANCE INDICATOR:

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

iv COLLIMATION:

Light, localized, variable aperture rectangular collimators must be provided. Attenuation of useful beam by collimator shutters must be equivalent to attenuation by protective housing.

v. POSITIVE BEAM LIMITATION:

These positive beam limiting (PBL) devices are no longer required but continue to be a part of most new radiographic imaging systems. They must be adjusted so that with any image receptor size in use and at all standard SIDs, the collimator shutter automatically provide x-ray beam equal to image receptor.

vi **BEAM ALIGNMENT:**

Radiographic tube be provided with a mechanism to ensure proper alignment of x-ray beam and the image receptor.

vii **FILTRATION:**

All general purpose diagnostic x-ray beams must have a total filtration of atleast 2.5 mm Al when operated above 70 kvp; tubes operated between 50 and 70 kvp must have atleast 1.5 mm Al. Below 50 kvp, a minimum of 0.5 mm Al filtration is required.

viii **REPRODUCIBILITY:**

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

ix **LINEARITY:**

When adjacent mA stations are used, for example

100 mA and 200 mA, the exposure time is adjusted for constant mAs, the output radiation intensity should remain constant.

x **OPERATOR SHEILD:**

The exposure control should be fixed to the operating console and not to a long cord.

xi **MOBILE XRAY IMAGING SYSTEM:**

A protective lead apron should be assign to each mobile x ray imaging system. The exposure switch of such an imaging system must allow the operator to remain atleast 2 m from the x ray tube during exposure.

Q5: What is GM counter, how it can be use as radiation protection device.

GM COUNTER:

It is radiation detection and measuring instrument that detects individual ionizations.

It is primary survey instruments for nuclear medicine facilities

These are use for contamination control in nuclear medicine laboratories. As portal survey instruments, they are use to detect the presence of radioactive contamination on work surfaces and laboratory apparatus,

They are not particularly useful as dosimeters because they are difficult to calibrate for varying conditions of radiation. Geiger counters

are sensitive instruments that are capable of detecting and indicating single ionizing events. If they are equipped with an audio amplifier and speaker, one can hear the crackle of individual ionizations.

The geiger counter does not have a wide range, Most instruments are limited to less than 1 mGy$_a$/hr.