NAME: HUMA NAWAZ

ID NO: 15037

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SEMESTER: 4th

PAPER: RADIATION PROTECTION

SUBMITTED TO: MAM ATOOFAH

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INU PESHAWAR

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# QUESTION NO : 1

Differentiate between deterministic and stochastic effects of radiation?

## DIFFERENTIATE BETWEEN

| DETERMINIS-TIC EFFECTS | STOCHASTICS EFFECTS |
|---|---|
| 1. Deterministic effects are also called non-stochastic effect. | 1. Stochastic effect is those effect which occur when a person receives a high dose of radiation. |
| 2. These effects depend on time of exposure, dose, type of radiation | 2. These effects have an increase probability of occurrence with increase dose. |

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| | |
|---|---|
| 3. It has a threshold of doses below which the effect does not occur the thresold may vary from person to person. | 3. There is no threshold dose below which is creatinely certain that stochastic effect cannot occur. |
| 4. Deterministic effects are those responses which increase in severity with increased dose if the dose increases the severity of an effect increased. | 4. Severity does not depend on magnitude of absorbed doses these effects occur by chance usually without threshold level of dose. |
| 5. Deterministic effects are of two types.<br>a) Acute radiation sickness<br>b) Chronic radiation sickness | 5. Stochastic effects are also of two types.<br>a) Somatic stochastic effect.<br>b) Genetic effect |
| 6. Damage to multiple cell | 6. Damage to single cell. |
| 7. FOR EXAMPLE<br>1. malformations<br>2. mental or growth retardation | 7. FOR EXAMPLE<br>1. Childhood Cancer<br>2. mutageric |

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# QUESTION NO : 2

Write a note on the following.

## ANSWER :

## 1. RADIATION :

### DEFINITION :

Radiation is the emission and propagation of energy in the form of waves, rays or particles.

### EXAMPLES OF RADIATION :

1. The sun emits radiation in the form of light, heat and particles.

2. Uranium - 238 decaying into Thorium - 234 emit radiation in the form of alpha particles.

## 2. RADIOACTIVITY :

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## DEFINITION:

→ Radioactivity refers to the **decay** or **splitting** of an atomic nucleus.

→ A radioactive material releases radiation when it decays.

## EXAMPLES OF DECAY INCLUDES

a) Alpha decay
b) Beta decay
c) Gamma decay
d) neutron release
e) Spontaneous fission.

All radioactive isotopes release radiation, but not all radiations comes from radioactivity.

# 3. IONIZING RADIATION:

## DEFINITION:

It is the radiation with **sufficient energy** to remove an electron from an **atomic orbital**, forming an ion.

## EXAMPLES INCLUDES:

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a) X-rays
b) Gamma rays
c) alpha particles
d) Beta particles

# 4. NON-IONIZING RADIATION:

## DEFINITION:

It is the release of energy from the lower energy region of electromagnetic spectrum.

## SOURCES OF NON-IONIZING RADIATION:

a) Light
b) radio
c) microwaves
d) infrared (heat)
e) ultraviolet light.

# 5. HARMFUL RADIATION:

Some types of radiation are known as **ionizing** and **non-ionizing** radiation can be harmful radiation.

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FOR EXAMPLE:
IONIZING RADIATION can cause burns, radiation sickness and cancer.
NON-IONIZING RADIATION:
Using a sunbed or staying out in the sun too long will expose you to ultraviolet radiation, which can cause premature aging, contaracts & skin cancer.

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# QUESTION NO: 3

(i) Write two basic principles of radiation protection?

## ANSWER:

## TWO BASIC PRINCIPLES OF RADIATION PROTECTION ARE:

1. ALARA (as low as resonably achievable).
   → This is the guiding principle

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of radiation safety.

→ This principle means that even if it is a small dose if receiving that dose has no direct benefit, you should try to avoid it.

## 2. CARDINAL PRINCIPLES:

- Time
- Distance
- Shielding

### 1. TIME:

→ Keep the time of exposure to radiation as short as possible.

### 2. DISTANCE:

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

### 3. SHIELDING:

→ Use shielding between the radiation source and exposed persons greatly reduces the level of radiation exposure.

⇒ Shielding used in diagnostic radiology usually consists of lead, conventional building materials also used.

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(ii) Write names of the radiation protection devices.

ANSWER:

# NAMES OF RADIATION PROTECTION DEVICES:

1. Thyroid shields
2. Lead Apron
3. Apron racks
4. Barriers and table shields
5. Drape shields
6. Lead Glasses
7. Cover and screen
8. Collar
9. Mitten
10. Lead Gloves

# QUESTION NO: 4

What are the features for radiation protection design? Explain briefly.

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# ANSWER:

# FEATURES FOR RADIATION PROTECTION DESIGNING:

## 1. PROTECTIVE X-RAY TUBE HOUSING:

➔ X-ray tube must contain protective housing that should reduces leakage Radiation.

➔ Leakage radiation must be less than 1mGya/hr at a distance of 1m from the protective housing.

## 2. CONTROL PANEL:

➔ must indicate the conditions of exposure when x-ray tube is energized.

➔ X-ray beam on must be positively and clearly indicate to technolog-ist.

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## 3. SID INDICATOR:

- This indicator must be provided.
- Simple as a tape measure attached to the tube housing.
- Must be accurate to within 2% of the indicated SID

## 4. COLLIMATION:

- Light localized and rectangular collimators should be provided.
- x-ray beam and the light beam must coincide to within 2% of the SID

## 5. FILTERATION:

- Inherent plus added
- Total must be at least 2.5mm above 70 Kvp.

## 6. REPRODUCIBILITY:

- Constant output radiation intensity
- Should not exceed 5% through same technique.

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# QUESTION NO: 5

What is GM counter, how it can be used as a radiation protection device?

## ANSWER:

# GM COUNTER:

## INTRODUCTION:

- GM counter is also called Geiger-Muller tube or counter.
- It is an instrument used for detecting and measuring ionizing radiation

## CONSTRUCTION:

⇒ A GM counter consist of a fine wire mounted along the axis of a cylindrical cathode made of glass or metal

⇒ Metalized inner coating filled with a suitable gas mixture.

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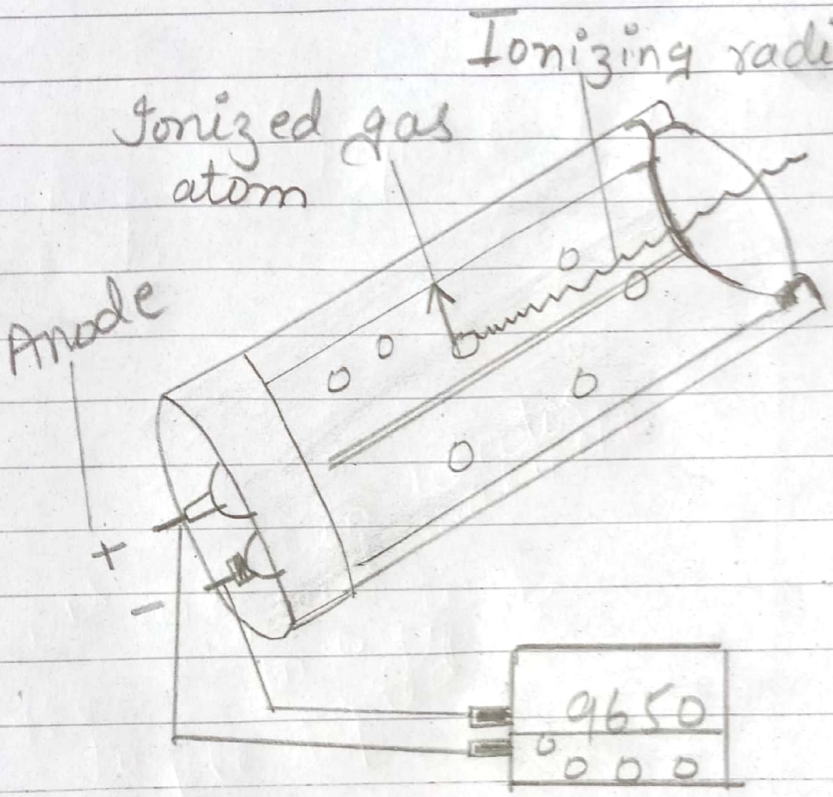
➡ The gas mixture usually consists of argon (90%) at 10cm of Hg ethyl alcohol (10%) at 1cm of Hg.




## USED AS A RADIATION PROTECTION DEVICE:

- It detects the ionizing radiation such as alpha particles, beta particles and Gamma rays using ionization effect produced in GM tube.
- The tube is filled with an inert gas such as helium neon or argon at low pressure

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to which a high voltage is applied.

- It is a Gaseous ionization detector and uses the Townsend avalanche phenomenon to produce an easily detectable electronic pulse.
- It can also be adapted to detect neutrons.
- Used for the contamination control in nuclear medicine.
- Detecting and indicating single ionization.

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# End Of Paper

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