

# INU

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Assignment => Radiological  
protection.

Submitted To =>

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Radiology.

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(1)

Q No: 1

⇒ Role of Radiation Protection  
Officer in Radiology  
Department

⇒ A radiation protection officer (RPO) is a Specialist in radiation safety and compliance matters and is an appointed position within Radiology department and Safety Services.

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→ The Role of Radiation protection officer (RPO) is to support the department's work with ionizing radiations by ensuring arrangements are in place to manage radiation risk

→ So that the work is carried out safely and in compliance with regulation.

→ The department employees and the public are protected from harmful effect of radiation.

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## ⇒ Responsibilities of Radiation Protection Officer (RPO):-

→ The RPO has broad range of duties some of which are given below-

⇒ ALARA:- enforcing the as low as reasonably achievable doctrine.

⇒ Involvement in developing shield protocols.

⇒ Auditing ALARA and RPP programs on regular schedule.

⇒ Reviewing occupational and patient dose.

⇒ Routine reporting requirements.

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- ⇒ Reporting incident to proper authorities.
- ⇒ Monitoring fitness and regulation of instrumentation.
- ⇒ Establishing Spills response and continuation protocols.
- ⇒ Personal instruction on radiation safety.
- ⇒ Performing measurements to check radiation doses, dose rates and activity.
- ⇒ Posting regulatory notices, bulletins, labelling and Emergency Procedure.
- ⇒ Advising on training indication safety.

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- ⇒ Managing and inventory of equipment capable of emitting x-ray.
- ⇒ Arranging for disposal of radioactive waste to authorized contractors.
- ⇒ Complying and contributing to the production of local rules and local radiation safety policies.
- ⇒ Managing system for the provision of personal dosimetry and associated record keeping.
- ⇒ Assessing that BPM is being applied.

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Q No: 2

⇒ Radiation Protection  
Measure in Radiology  
Department:-

⇒ Radiation Protection:-

Radiation protection is the science and practice of protecting people and the environment from the harmful effect of ionizing radiation.

⇒ Radiation Protection Measure

→ Following are the radiation protection measure in Radiology Department.

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⇒ There is a Safety Plan that indicate the periodic inspection, maintenance and calibration of all equipment.

⇒ The Safety plan involve posting of Safety warnings on the doors.

⇒ The Safety plan also involve the provision and regular aprons and thyroid and Gonad shield for Staff and Patient.

⇒ Records are available indicating the radiation dosimetry tools and staff radiation exposure for the past twelve month.



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## ⇒ Radiation Exposure:

(\*) → The risk of exposure should balance of medical benefits

(\*) → Optimize radiation dose by exposing the patient to enough radiation to get the clear images

⇒ Remember to minimize exposure at all possible time

⇒ Measure the Occupational Dose equivalent from

(\*) x-rays

(\*) Gamma rays

(\*) High energy beta emitters.

⇒ Allow practice ALARA.  
(As low as Reasonably Achievable)

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- ⇒ Minimize the time by minimize dose.
- ⇒ Minimize time and you will minimize the time.
- ⇒ To minimize exposure time to procedure.
- ⇒ Doubling the distance source can reduce your exposure intensity by 25%.
- ⇒ Position shielding b/w yourself and the source of radiation at all permissible time.
- ⇒ Take advantage of permanent shielding i.e. equipment or existing structures.
- ⇒ Select appropriate shielding material during the planning.

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Stage of procedure.

⇒ Radiation protection in x-ray  
lead aprons attenuates scattered  
radiation by 95%.

⇒ The radiology department ensure  
the following test are  
conducted at least annually.

(\*) Automatic exposure control  
(AEC) Test.

(\*) KVP reproducibility and  
repeatability.

(\*) Half value layer test.

(\*) Mean glandular dose test  
(for mammography)

⇒ So these are the Radiation  
protection measure in  
Radiology department.

Q No: 3 :-

# Radiation Hazard

Hazard :-

→ A hazard is a natural or man made event which may cause physical damage, economic losses or threaten human life and well being if it occurs in an area of human habitation.

Now :-

⇒ Ionizing radiation is generally considered to be more hazardous to human health.

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than non ionizing radiation  
because it can remove electron  
from atoms.

⇒ This means it can damage  
living tissue and DNA.

- Like alpha radiation, beta  
is caused by particles.

Examples of Radiation

- Sunlight
- Radiowaves
- x-ray.
- Heat
- Alpha.
- beta
- gamma ionizing Radiations

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Radiation Hazard may be divided according to .

(\*) → External Radiation Exposure .

→ Hazard is related to high penetrating radiation source outside the body.

Examples :-

→ Electromagnetic Radiation

→ High Energy beta and neutron.

That could penetrate the skin and body to cause harm to the body.

(\*) Internal Radiation Exposure .

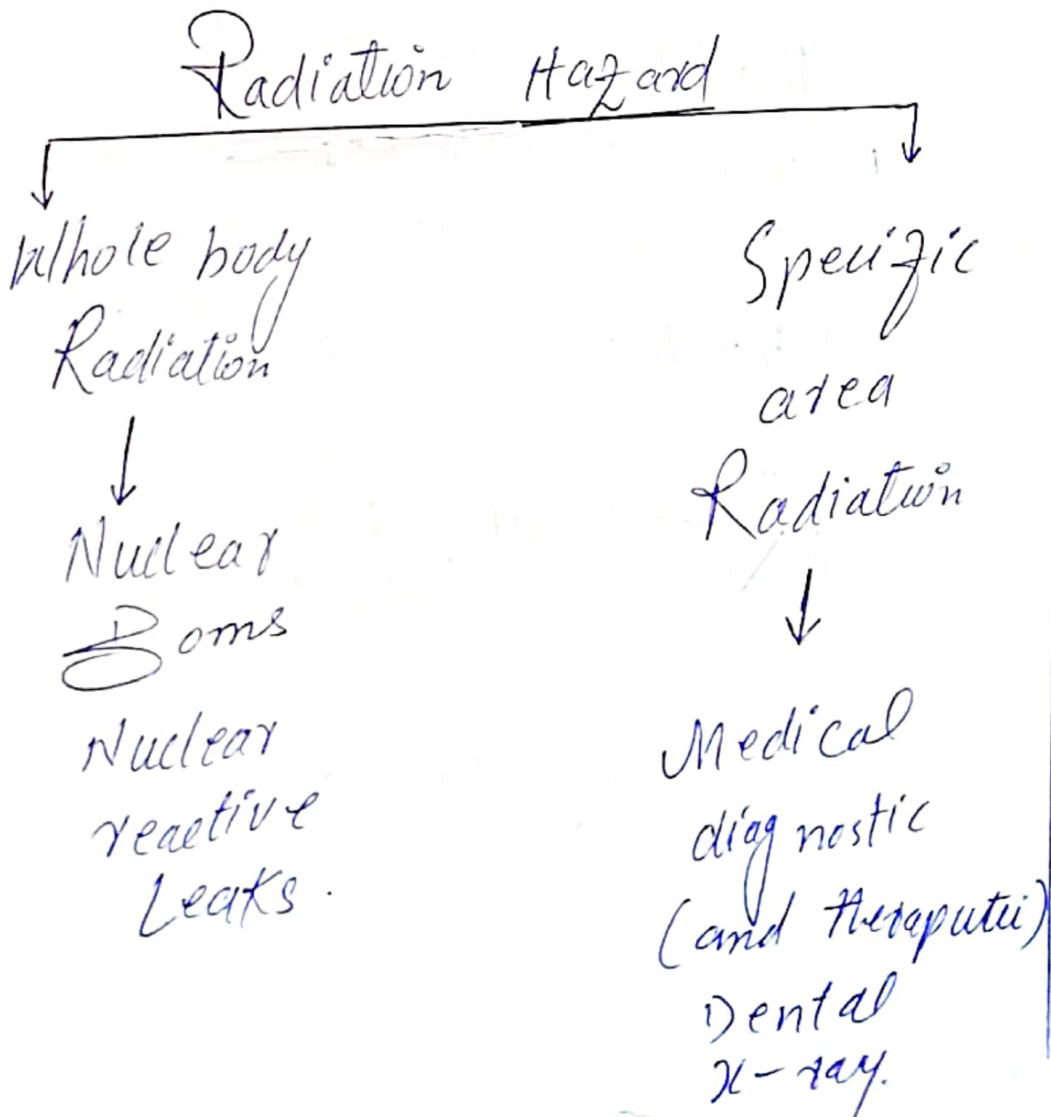
→ Hazard related to radiation source in body.

→ involve radiation with low penetrating power.

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## ⇒ Types of Radiation Hazard

- Alpha Radiation
- Beta Radiation
- Gamma rays.
- x-ray.
- Neutron particles.



# Radiation Damage

Indirect

↓  
Somatic  
Affects individual  
No effect on  
egg spring.

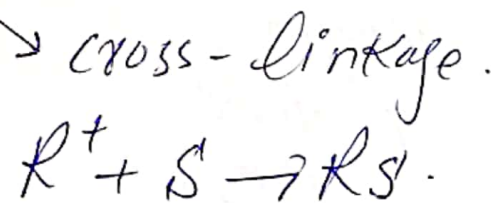
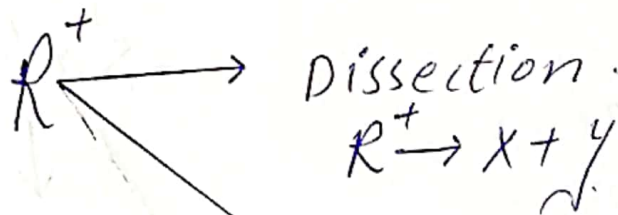
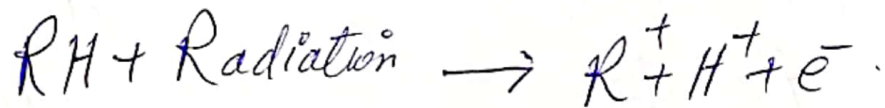
Direct

↓  
Genetic.

Do not effect  
individual  
egg spring is  
ejected.

Radiation Hazard.

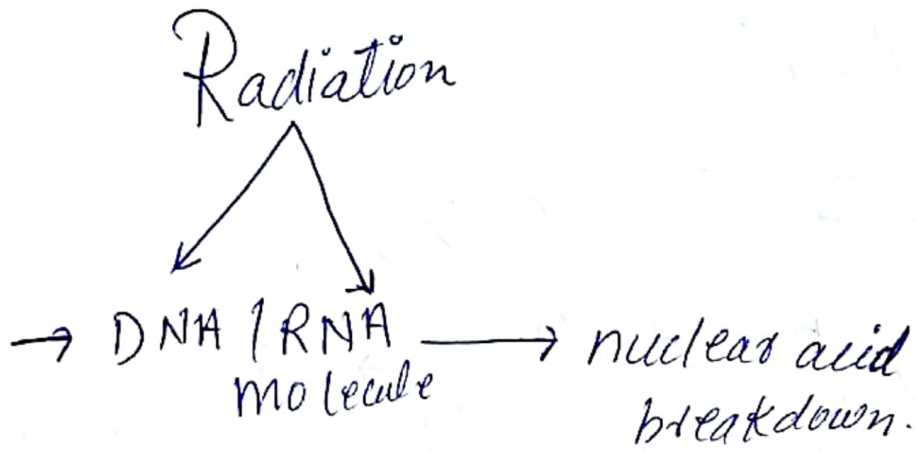
## Direct Damage :-





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→ Nucleic acid breakdown.

(\*) Somatic cells.

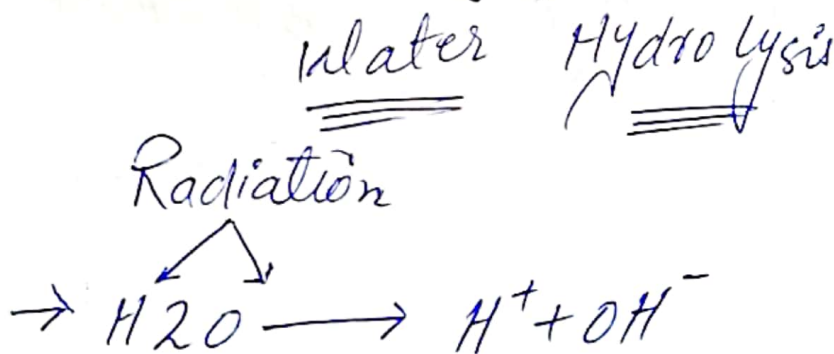
(\*) Genetic cells.

→ Radiation induced  
, Malignancy.

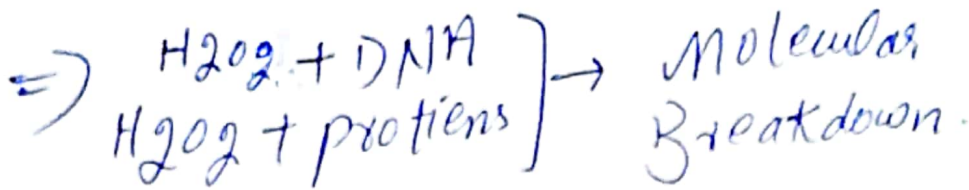
(\*) Radiation induced

(\*) Congenital abnormality.

⇒ Radiation Hazard (indirect  
Damage)



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$\Rightarrow$  Molecular Breakdown  $\rightarrow$  cell damage.

## Radiation Damage.

Somatic

Direct  
DNA/RNA hit  
Radiation induced  
malignancy.

Indirect  
 $H_2O_2$  formation  
TOXIC  
Breakdown of  
large molecule  
(proteins/DNA).

# Radiation Damage.

↓  
Genetics

→ Direct  
DNA/RNA hit.  
Radiation induced  
mutagenicity

→ Indirect  
H<sub>2</sub>O<sub>2</sub>  
formation.  
Toxic.

Breakdown of  
large molecules

⇒ The LD<sub>50/60</sub> is the dose  
of radiation to whole  
body that cause 50%  
of irradiated subject to  
die within 60 days.

⇒

Q

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Effect of γ Radiation  
on organism | Tissue level.

(a) → (1) deterministic effect and

(b) → Stochastic effect.

↳ Carcinogenesis

↳ Genetic effect.

(a) → (1) deterministic effect

→ Are caused by the cell death.

→ If dose of radiation exposure is less than the threshold dose.

Examples:- → death of individual

→ cataracts

→ Damage of skin

→ Damage of bone marrow.

## Stochastic effects

- Are caused by mutant cell.
- It may cause the effect of radiation if dose of radiation increases.
- The probability of effect also increases.
- Stochastic effect means that even low level of radiation exposure do guaranteed safety.

Examples → Carcinogenesis.  
→ Genetic influence.

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So these are the

Radiation hazard and

Therefore everyone should  
be beware of it :-

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Q NO:4Ans:-

Radiologic Technologist  
 Protection from Radiation  
 Dose and Annual occupational  
Dose:-

⇒ Occupational Radiations

Dose Management by  
Radiological Technologists:-

The radiation dose is measured  
 in Gyf while exposure  
 dose measured in Gy<sub>a</sub>  
 (Rontgens). But the exposure

②

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is to radiologic. due to  
longer beam on time for  
procedure

⇒ Extremity exposures often  
significant.

⇒ Collimate as much as  
possible. and avoiding bending  
projection during procedure.

⇒ Mammography:-

→ low personal exposure

→ Normal walls and barriers  
adequate.

→ Dosimetry probably not  
required and the dose setting  
low of portable machine.



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6 (3) Occupational dose is the dose of radiation to which the radiological staff expose during working in department.

To minimize occupational Dose - the cardinal principle of radiation protection are.

- (1) (\*) → Time
- (2) (\*) Distance.
- (3) (\*) Shielding.

(1) Time :-

→ The amount of exposure an individual receive is directly proportional to time of exposure.

→ The technologist should minimize the amount of time spent with radiation source.

Example: time of fluoroscopy procedure should kept to a minimum.

2 (\*) → Distance :-

→ The distance has inverse relation.

→ Doubling the distance from source will decrease the exposure by four.

→ X-ray, CT staff should outside the room behind the shielding when machine

5)

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Behind machine is on.

- Perform fluoro from as far as practicable.
- Variety of restoring devices can be used for patient immobilization.

### 3) \* → Shielding:-

→ Any object b/w technologist and source of radiation must provide with same shielding.

→ The more dense or object or material the better will be the shielding.

The technologist must wear

- (\*) protective apron
- (\*) gloves
- (\*) gonad shielding.

⇒ Radiation Safety by  
Modality :-

⇒ Fluoroscopy :-

→ Personnel exposure directly related to beam on plus time.

→ The technologist must be use ALARA principle for to reduce dose.

→ protective apparel must be worn during fluoroscopy.

⇒ Interventional Radiography

→ Exposure is higher

technologist and radiologist

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⇒ Computer Tomography

→ personnel exposure low.

→ Collimated beam result in low scatter x-ray.

→ technologist should remain in room if necessary with lead aprons.

⇒ Mobile Radiography

→ usually low personnel doses.

→ exposure card should be long enough for technologist to be out of scatter area.

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- Be aware of location of IR.
- Mobile x-ray unit should have protective apron assigned to it.
- The exposure cord on a portable x-ray unit be at least 2m long.
- The useful beam should never be directed toward console.

⇒ Occupational Radiation  
Monitoring :-

→ Require of worker expected to exceed 10% of annual limit (500 mrem)

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→ All machine user technologist require to wear dosimeter.

⇒ Dosimeter :-

Calculate the exposure radiation.

→ Wear out side the apron.

→ Dosimeter offers no protection just record the radiation exposure.

⇒ Female technologist

→ If the female technologist become pregnancy the worker should limit exposure.

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- Concern about exposure.
- Training should be provided to pregnant workers to inform her potential risk.

⇒ Patient holding

- Mechanical devices should be used.
- If mechanical devices are impractical than relative or friend should hold the patient.
- Check protective barriers, apparel etc each year for leak and check the



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dosimeter performance.

⇒ Radiation worker

Risks :-

- Leukemia.
- Bone cancer
- Lung cancer
- Infertility
- Hair loss.
- Skin cancer.
- Kidney cancer
- Bronchitis.

⇒ Annual occupational  
Dose :-

→ The recommended annual occupational dose is  
 $0.5 \text{ Sv/yr}$   $5000 \text{ mrem/yr}$ .

→ But Average radiologic personnel dose per year is  $0.7 \text{ mSv/yr}$  for whole body exposure.

== XY == XY ==

The End

Thank You