Q1:. RADIATIONS SIDE EFFECTS

INTRODUCTION: Radiations are used for treating various cancers without going for surgeries but radiations may also give rise to various side effects, depending upon type and location of cancer, radiation dose, on individual undergoing for a treatment.

SIDE-EFFECTS: Depends on cancer location where cancer is present according to which side effects develop.

short term effects — long term effects

NOTE: side effects are the results of damage to normal healthy cells in cancer area by radiations.

SHORT TERM EFFECTS:

(i) Fatigue (lack of energy) / Exhaustion

(ii) Skin changes depending on which part is going under treatment.

→ (dry mouth, skin peeling, itching, blistering)

⇒ Effects usually go away within few weeks after treatment ends.

LONG TERM EFFECTS: Effects which may continue for a long time after treatment (or) effects which develop many years later after treatment.

=> Secondary cancer (sarcoma)
=> Lymphedema
=> Lung's problem (even cancer)
=> Rib fracture
=> Heart problem
=> Hair loss

=> also called late effects.

SITE-SPECIFIC EFFECTS OF RADIATIONS:

① Head & Neck: Dry mouth, dysphagia, jaw stiffness, Hair loss, tooth decay, lymphedema

② Chest-area: shortness of breath, nipple soreness, dysphagia, shoulder stiffness, cough, fever, chest-fullness, permanent lung scars.

③ Abdomen: Nausea, vomitting, diarrhoea.

④ Pelvis: urinary incontinance, bladder irritation, rectal bleeding.

In men sexual dysfunction, low sperm count, low sperm activity.

In women menstural changes, menopause, vaginal itching, burning, dryness, infertility (cann't concieve sperm), maintain pregnancy.

(3) Thyroid-cancer also side effect of radiations.

Q4)- - - - - - - - - - - - - - 3

BRACHYTHERAPY

INTRODUCTION: also known as internal radiation therapy. The therapy which is delivered by placing radiation inside (or) next to area requiring treatment.

INDICATIONS: Indicated in cervical, prostate, breast and skin cancer and for many tumours in many other sites.

BRAND NAMES: As with stereotactic radiations, brachytherapy are often known by their brand names e.g

(i) SAVI, Mammosite, Contura for breast cancer.

(ii) Theraseed, Protellian for prostate cancer.

ADVANTAGE: In brachytherapy radiation source is precisely placed near cancer area so nearby healthy cells are not damaged and therefore is more effective method than external beam therapy. Very high dose radiations can be applied in brachytherapy so that's why tumor can be treated in short time as compared to external beam therapy thus reducing the survival of cancer cells during interval b/w radiation sessions.

EXAMPLE: SAVI (breast cancer brachytherapy) which delivers radiations through multiple catheters and

each catheter is individually controlled.

Q 3) - - - - - - - ?

(1) PHOTOELECTRIC EFFECT: is defined as the type of photon-tissue (molecules, atoms) interaction in which photons comes in contact with electron and electron by gaining all energy cause ionization of atoms and molecules. Photons are basically Energy packets, bundles.)

DEPENDENCY: Photoelectric effect depends upon photons energy and molecules atomic number.

$$\text{Photoelectric effect} \propto \frac{1}{\text{atomic number of molecule}}$$

Photoelectric effect $\propto$ atomic number.

Higher atomic number, more will be photoelectric effect.

EXAMPLE: Atomic number of bone is 60% higher than soft tissues so photoelectric effect is more in bone than soft tissues and bones give more details than soft tissues

ENERGY:

10 - 25 Kev. energy range.

COMPTON'S EFFECT: Photon-tissue interaction in which photon collides with "free electron" unlike photoelectric effect (electron-bounded to atoms) used for treating "cancer".

⇒ Here both photons and electrons are scattered so Photons can undergo additional interactions with lower energy.

DEPENDENCY:

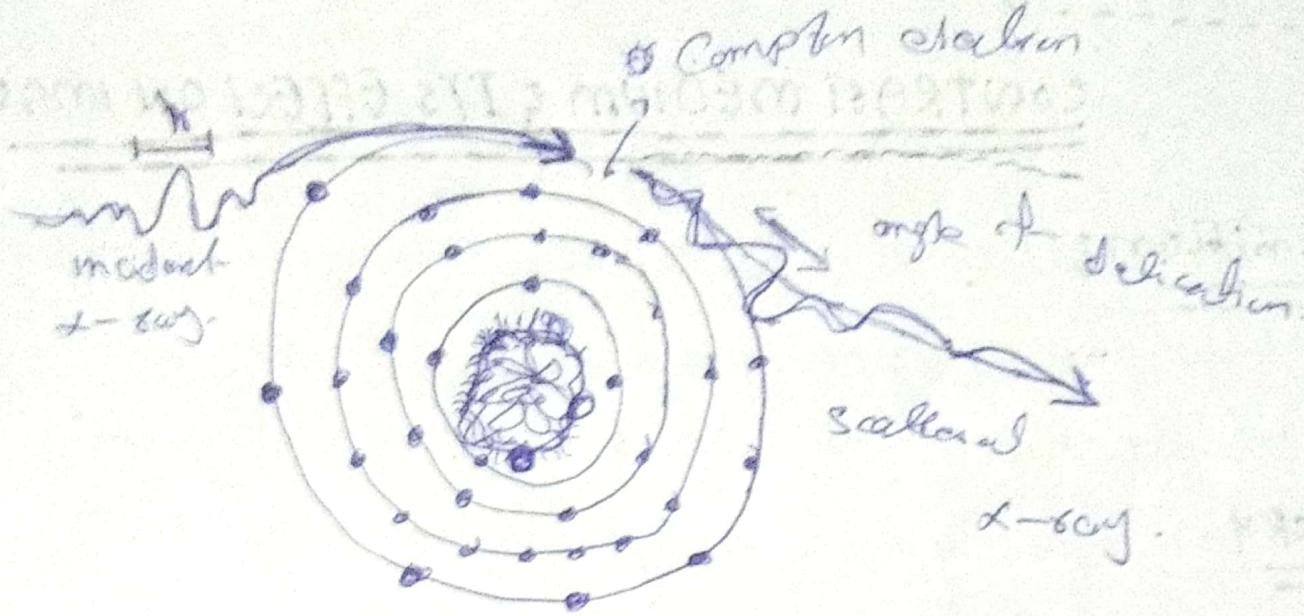
(i) Compton effect $\propto \frac{1}{\text{Photon's energy}}$

(ii) independent of molecules atomic number.

ENERGY RANGE:

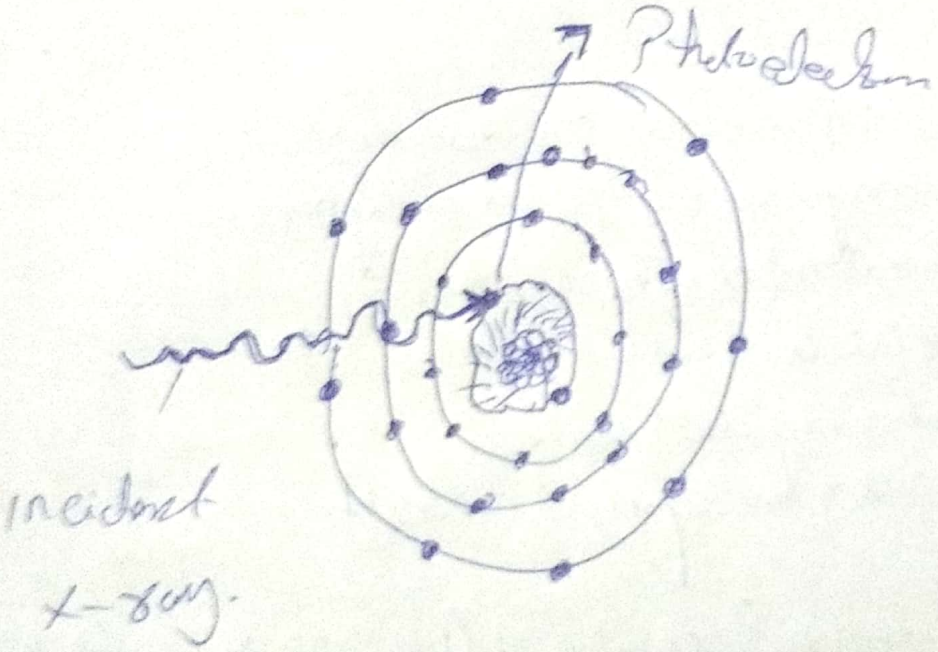
25 KeV – 25 MeV

NOTE: compton's effect most common interaction occuring clinically, at most radiation treatments are performed at energy levels of about 6-20 MeV.



$\lambda < \lambda'$

COMPTON EFFECT:- DIAGRAM



Photoelectric DIAGRAM:-

Q5.....?

VOLUMETRIC MODULATED ARC THERAPY

INTRODUCTION: VMAT is a highly new technique of radiation for achieving highly conformal dose distribution on target volume coverage and normal tissue sparing.

EXPLAINATION: specific for modification of 3- parameters during treatment.

GANTRY Radiations delivery by rotating gantry (with 360° rotating the field with one more arcs), changing speed & shape of beam with multiple collimator and fluencing output rate (dose rate) of medical linear accelerator.

ADDITIONAL FUNCTION: reducing delivery time of radiation as compared to conventional IMRT method.

Q2:-

LINEAR ACCELERATOR

DEFINITION: Linear accelerator is a machine accelerating subatomic particle which are charged (or) ions to a very high speed by subjecting them to a series of oscilating electric potentials along with linear beamline.

HISTORY: First linear accelerator machine was constructed by Rolf-Widere in 1928 at Aachen university.

NOTE Linear accelerator also called Linacs.

APPLICATIONS: Linear accelerator generates X-rays (electromagnetic radiations of very high frequency) which are used for medicinal purposes in radiology field.