Sri Aurobindo College of Dentistry

Indore, Madhya Pradesh

INDIA

MODULE PLAN

- TOPIC :RADIATION PHYSICS
- SUBJECT:OMDR
- TARGET GROUP: UNDERGRADUATE DENTISTRY
- MODE: POWERPOINT – WEBINAR
- PLATFORM: INSTITUTIONAL LMS
- PRESENTER: DR.TANVI DOSI

STRUCTURE OF ATOM

IONISATION

RADIATION

HISTORY (DISCOVERY OF X-RAYS)

X – RAY TUBE

PROPERTIES OF X- RAYS.

Matter – it is anything that occupies space & has inertia, it occurs in 3 different states - .

Atoms are fundamental unit of matter.

ATOMIC STRUCTURE

As proposed by Niels Bohr -

RADIATION

Radiation is transmission of energy through space or substance in the form of waves / particles (Electromagnetic / particulate).

Particulate radiation: consists of atoms or subatomic particles that transmit kinetic energy by means of their small masses & high velocity. PR are more commonly emitted from radioactive substances.

Eg : α rays, β rays, & cathode rays.

EMR : is generated when the velocity of an electrically charged particle is altered

Eg : γ - rays, x-rays, uv rays, visible light, infrared radiation, TV, radar, microwaves & radio waves.

They can also be classified as ionizing or non ionizing radiation.

IONIZATION :

Is a process of converting atoms into ions.

X- rays were discovered by Wilhelm Conard Roentgen in Nov 8 1895.

Dr Edmund Kells was the first to make intraoral radiograph.

William Rollins – developed the first dental unit.

William D. Coolidge – invented the hot cathode x-ray tube, which is the prototype of x-ray tubes used today.

X- RAY MACHINE

Dental x-ray machine consists of 3 visible components – Control panel

Extension arm

Tube head.


2
1
3

Control panel - consists of -

On- off switch

Exposure button

Control for- time, kVp & mA

Beeper.

Tube head consists of –

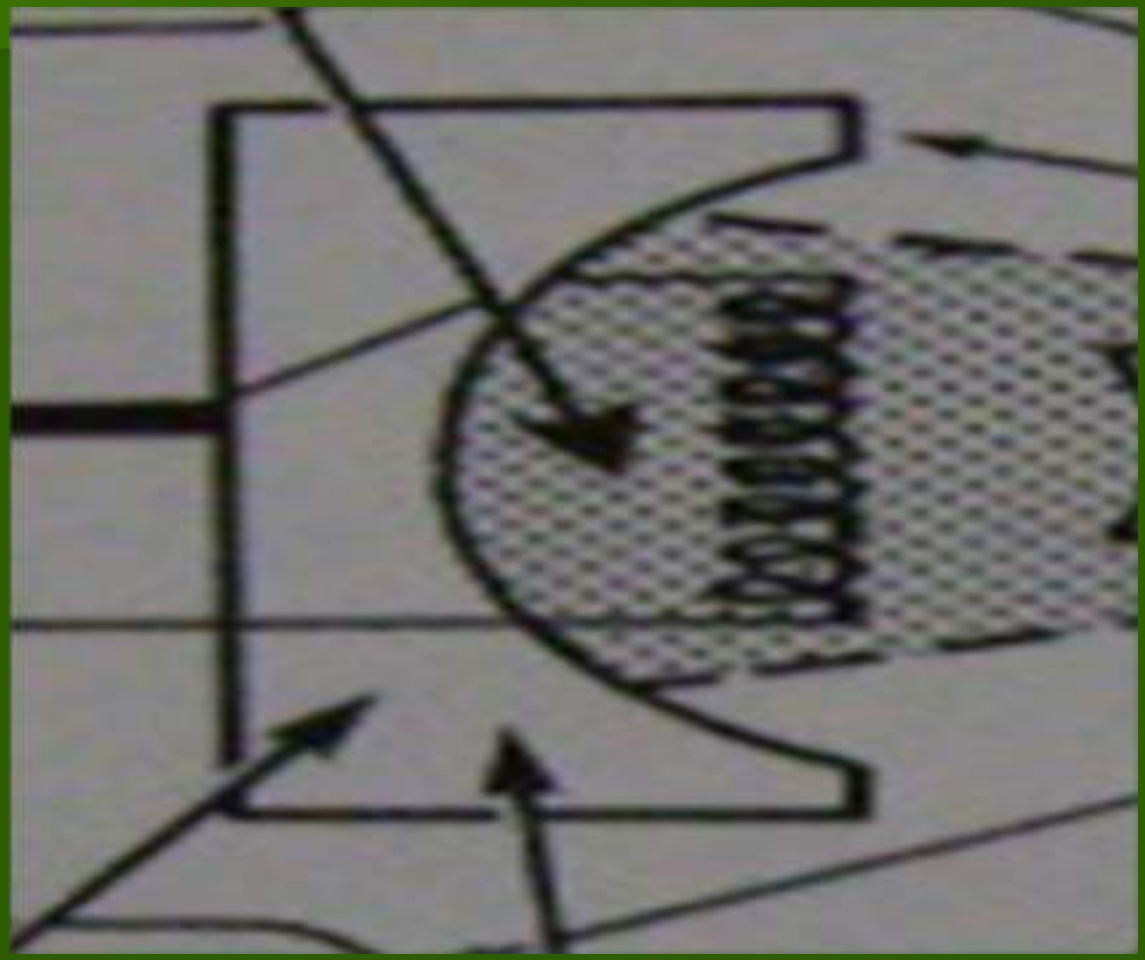
Heavy metal housing
Insulating oil
Tube head seal
X-ray tube
Transformers
Aluminium disk
Lead collimator
PID.

X- RAY TUBE

Is a leaded glass vacuum tube, consisting of –

- Cathode
- Anode

CATHODE



CATHODE

It is a negative electrode, includes –

The tungsten filament

Molybdenum focusing cup.

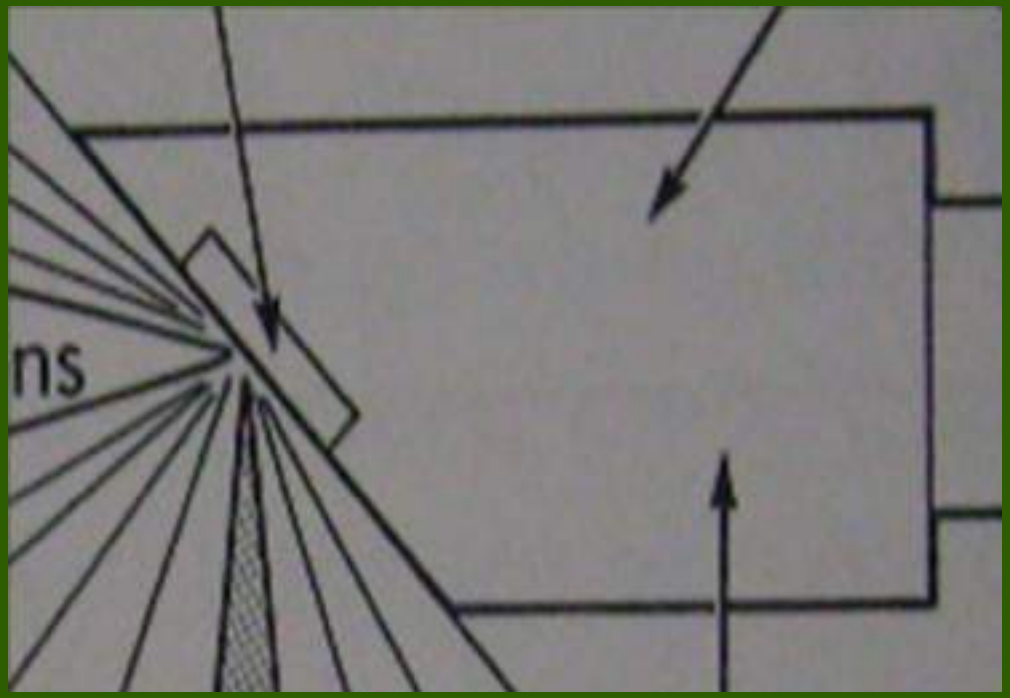
ANODE

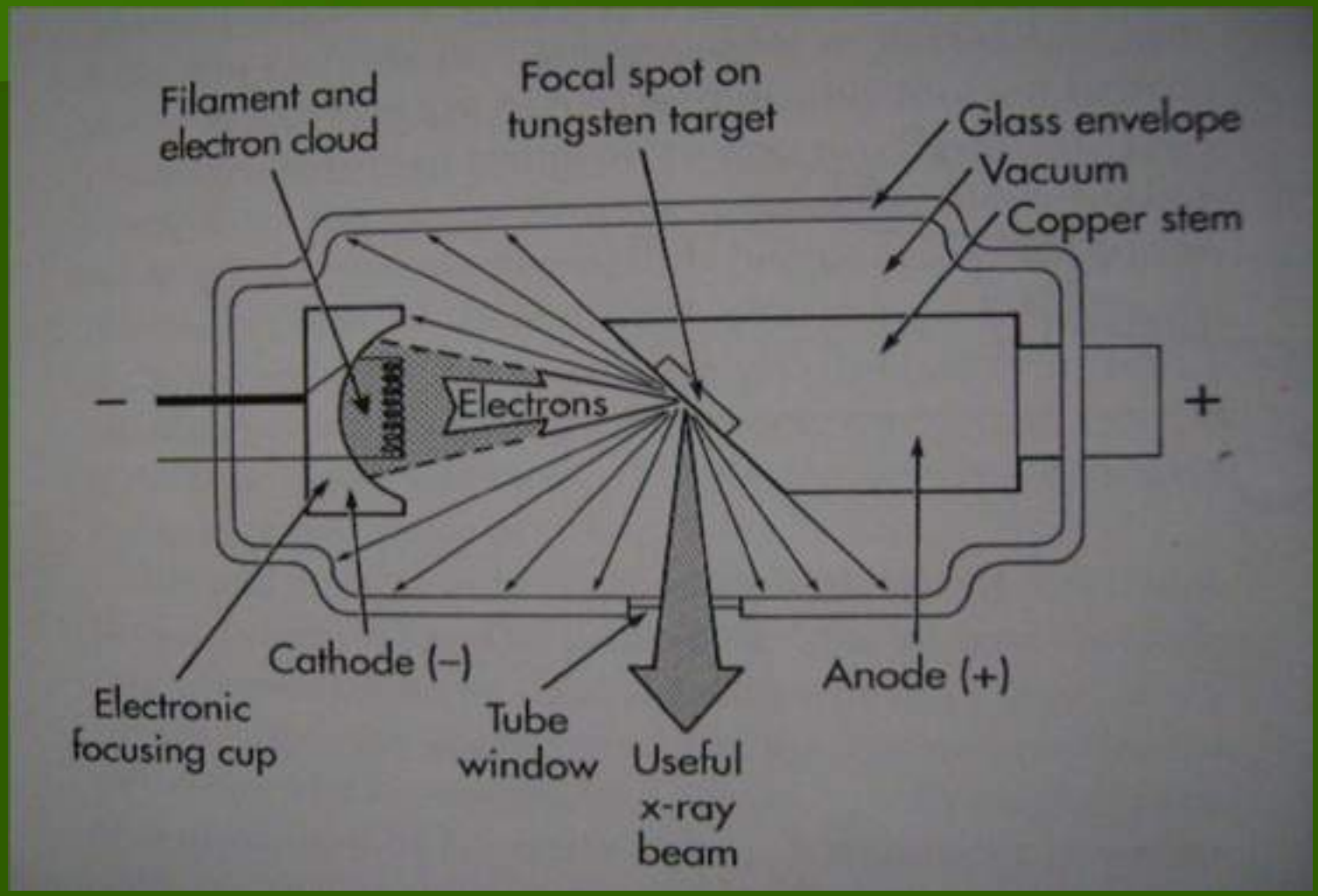
It is positive electrode, composed of –

Tungsten target
Copper stem

Line focus principle

ANODE




Filament and electron cloud
Focal spot on tungsten target
Glass envelope
Vacuum
Copper stem
–
Electrons
+
Cathode (–)
Anode (+)
Electronic focusing cup
Tube window
Useful x-ray beam

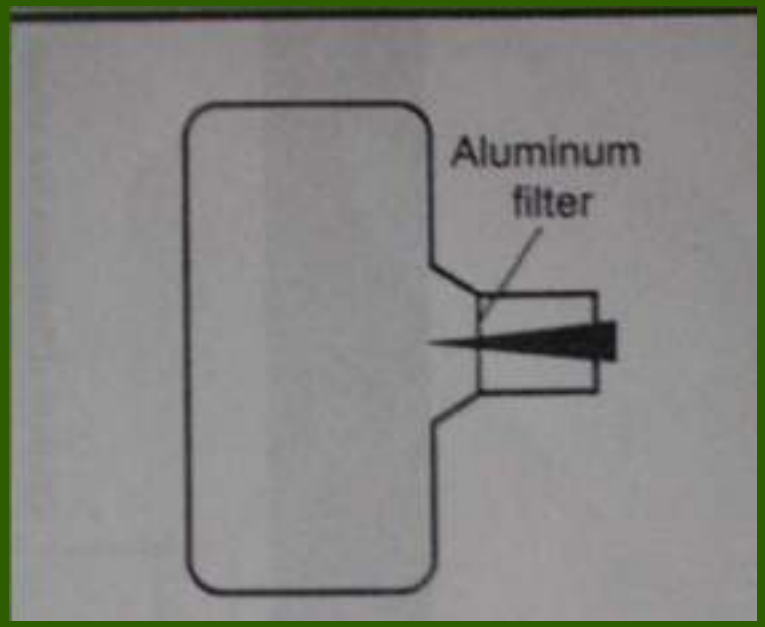
Power supply

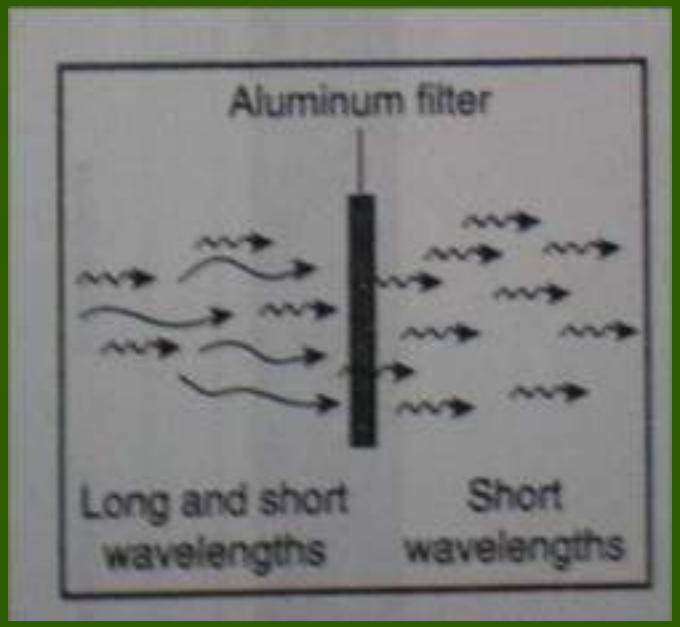
Primary function of power supply are –

To provide current to heat the x-ray tube filament, which is achieved by SDT.

To provide a potential difference between anode & cathode, which is achieved by SUT.

ALUMINIUM DISK

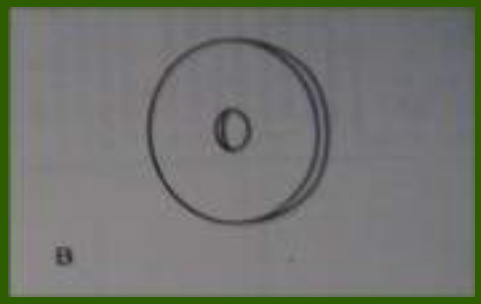


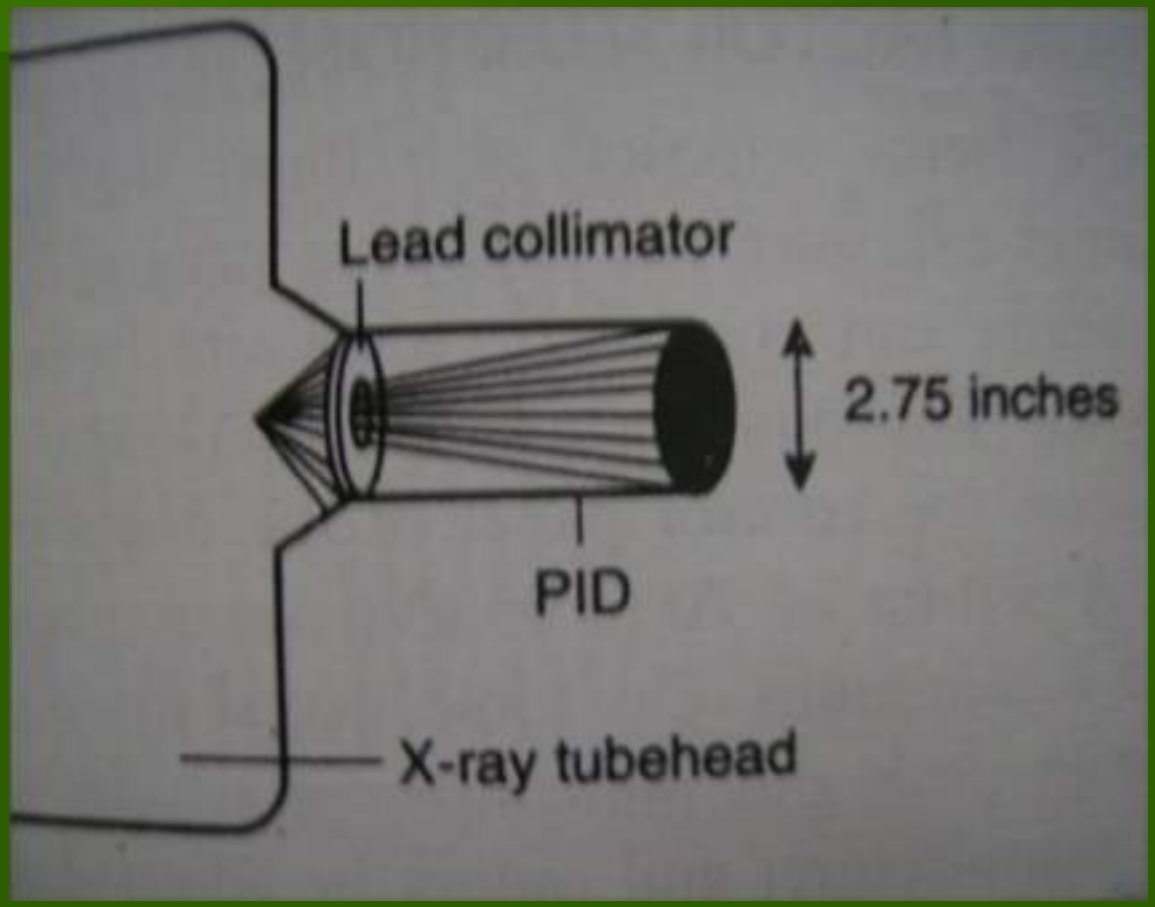


LEAD COLLIMATOR

It reduces the size of x-ray beam & thus the volume of irradiated tissue.

Types -




Lead collimator
2.75 inches
PID
X-ray tubehead

PRODUCTION OF X RAYS

The kinetic energy of electrons is converted into x- ray photons at the focal spot by 2 mechanisms –

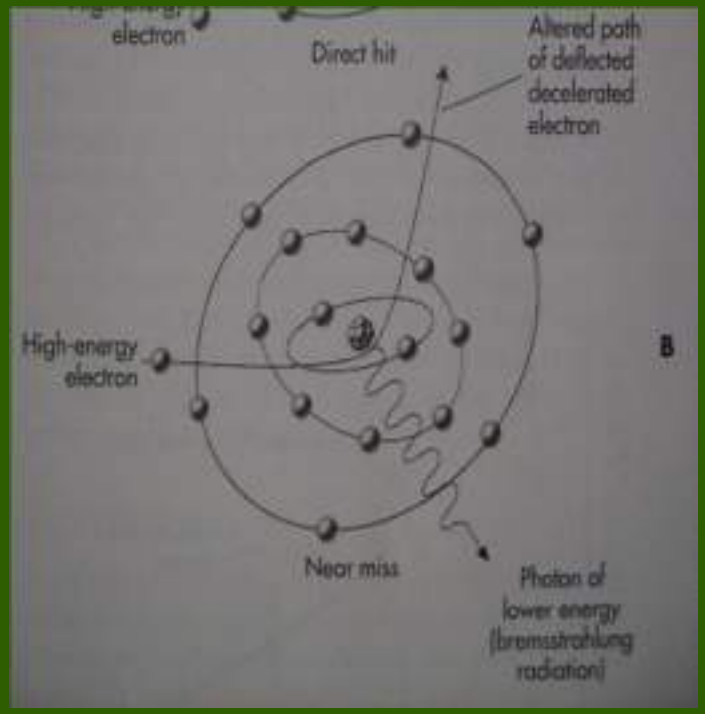
1. Bremsstrahlung radiation (BR)

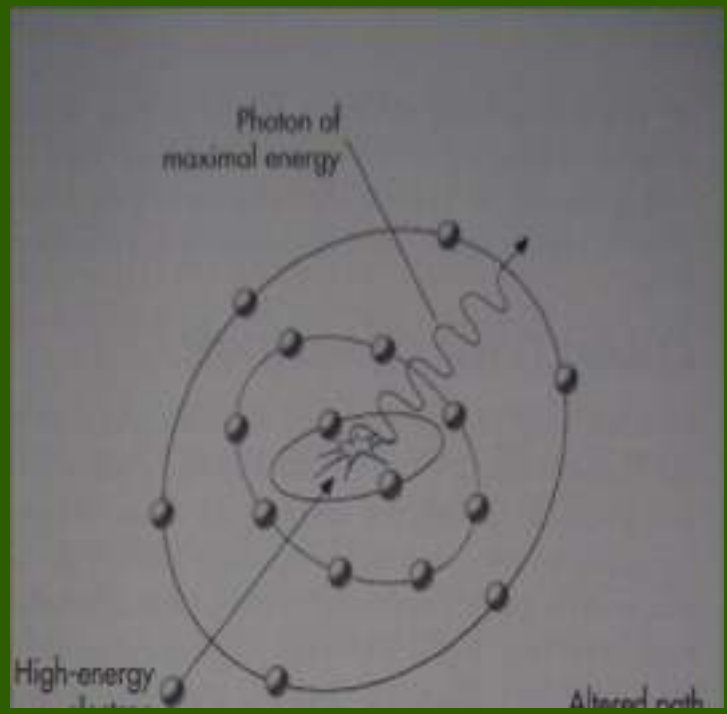
2. Characteristic radiation (CR).

1. Bremsstrahlung radiation / General radiation / Breaking radiation :

BR is the primary source of x ray photons.

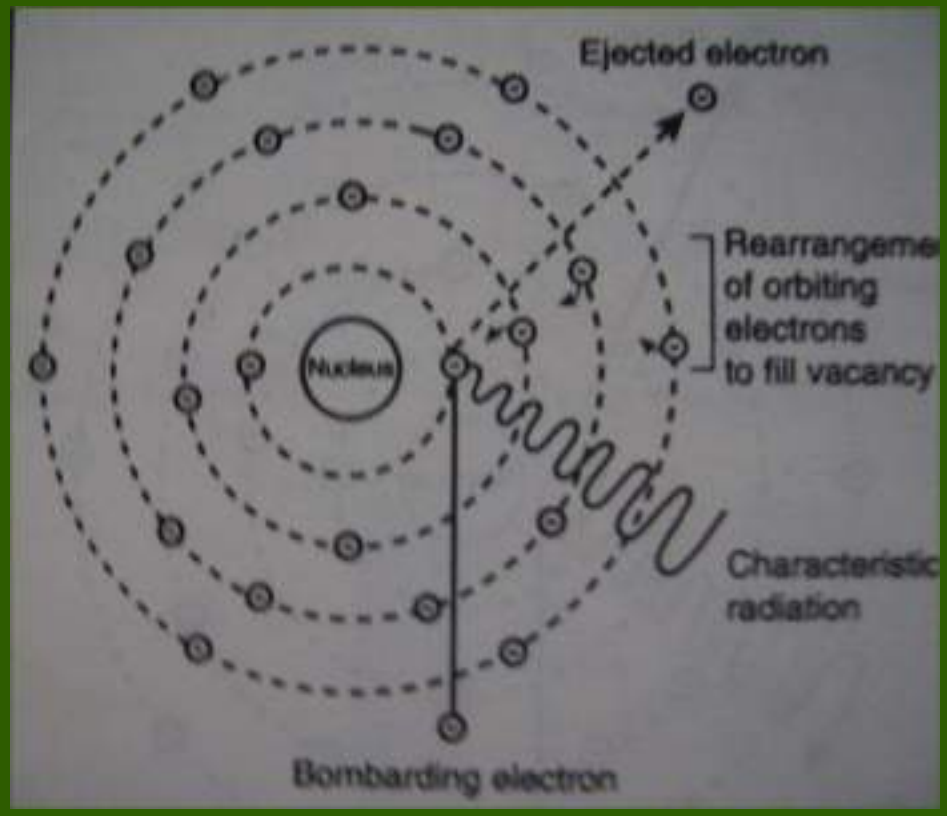
BR is produced by direct hit of electron on nucleus or by passage of electron near nucleus, which results in deflection of electron & losing some of its velocity. This de acceleration causes it to lose some of its energy – which is given off in the form of x- ray photon.


electron
Direct hit
Altered path
of deflected
decelerated
electron
High-energy
electron
B
Near miss
Photon of
lower energy
(bremsstrahlung
radiation)


Photon of
maximal energy
High-energy

Only a small fraction of electron have head on collisions with nucleus. When it occurs , all its kinetic energy will be converted to a single x ray photon of high energy (it depends on kVp, more the kVp – more the velocity of electron – so ↑ mass – so high energy x ray photon).

2. Characteristic radiation :



Properties of X- rays :