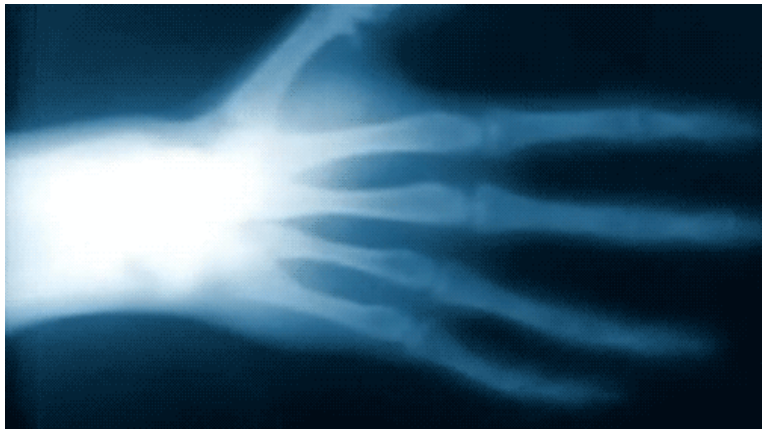
OGUN DIGICLASS

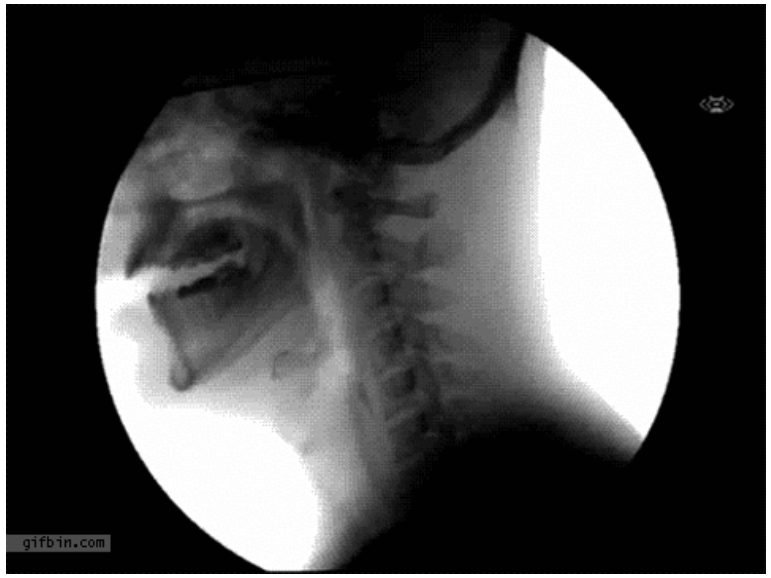
CLASS: SECONDARY SCHOOL

SUBJECT: PHYSICS

TOPIC: X-RAYS

Physics in Medicine





Learning Outcomes!

- Describe what X-rays are.
- Understand some properties of X-rays.
- Be able to give examples of how X-rays are used.
- Describe how X-rays can be used to diagnose and treat some medical conditions.
- Describe the dangers of X-rays and some of the precautions when using them.

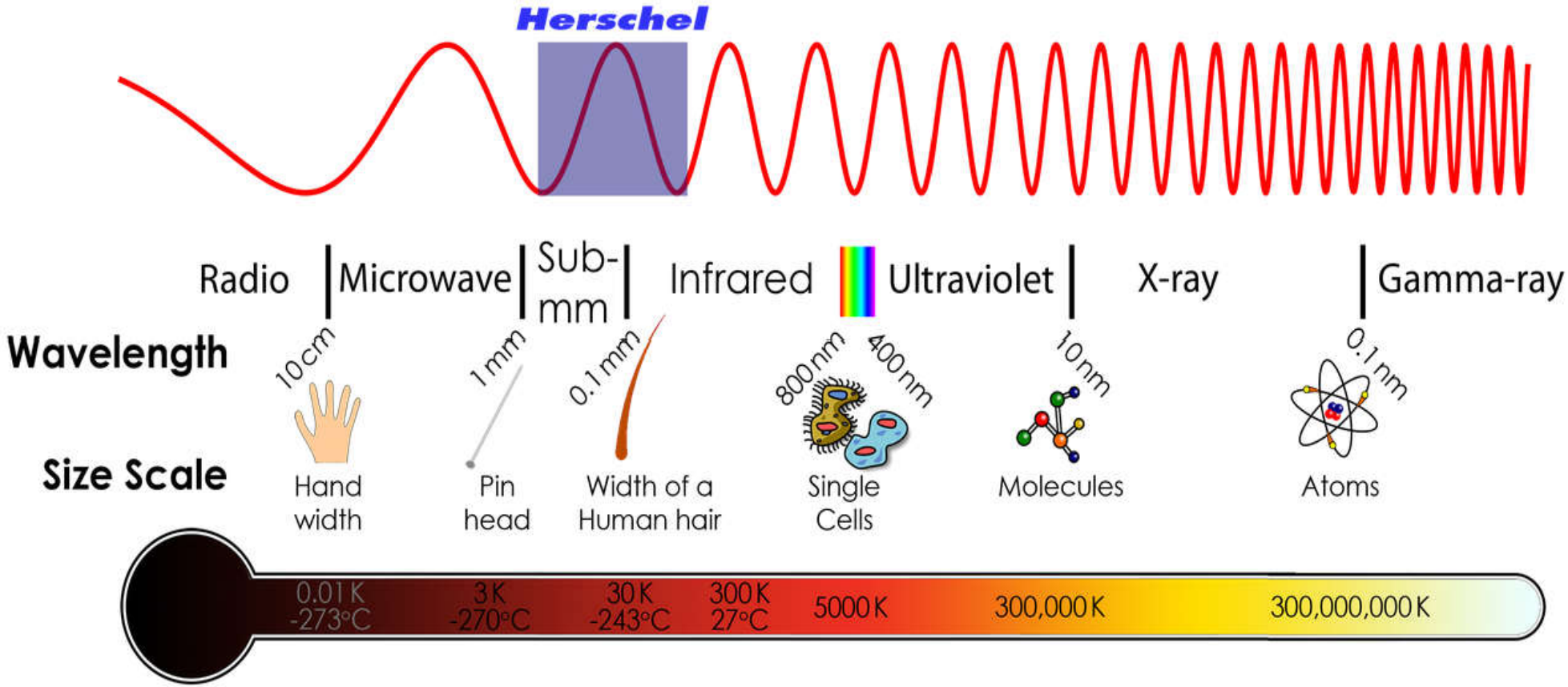
So how do we describe them?

X-rays are Electromagnetic Waves

with a short wavelenght

.

Describing X-rays!



How are X-rays produced

- They are produced by very fast moving electrons.
- These electrons smash into a metal plate and X-rays are emitted.(inverse of a photoelectric effect)
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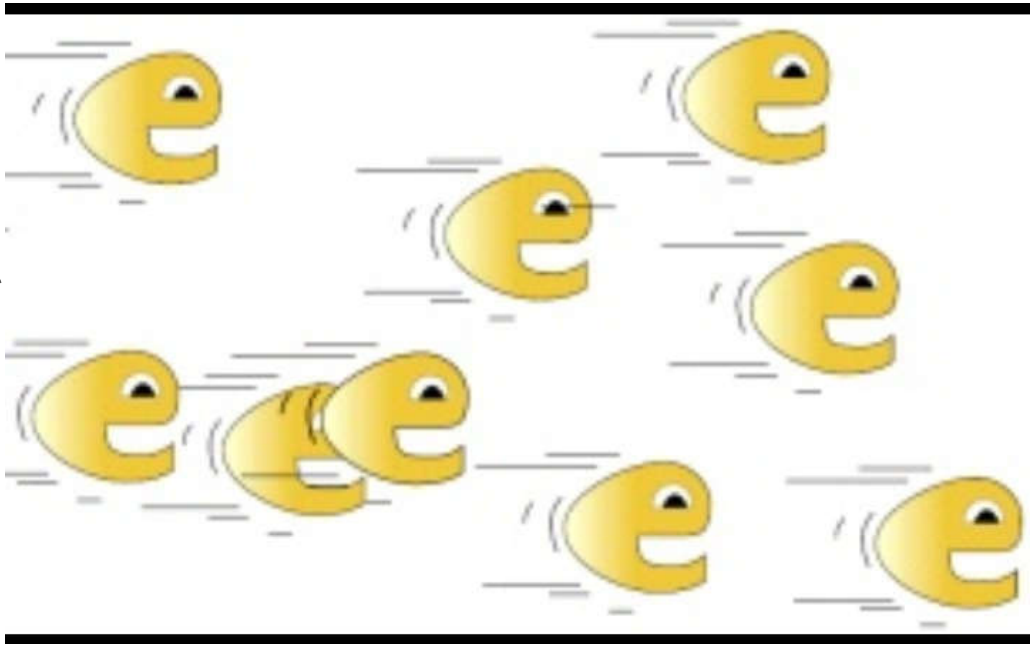
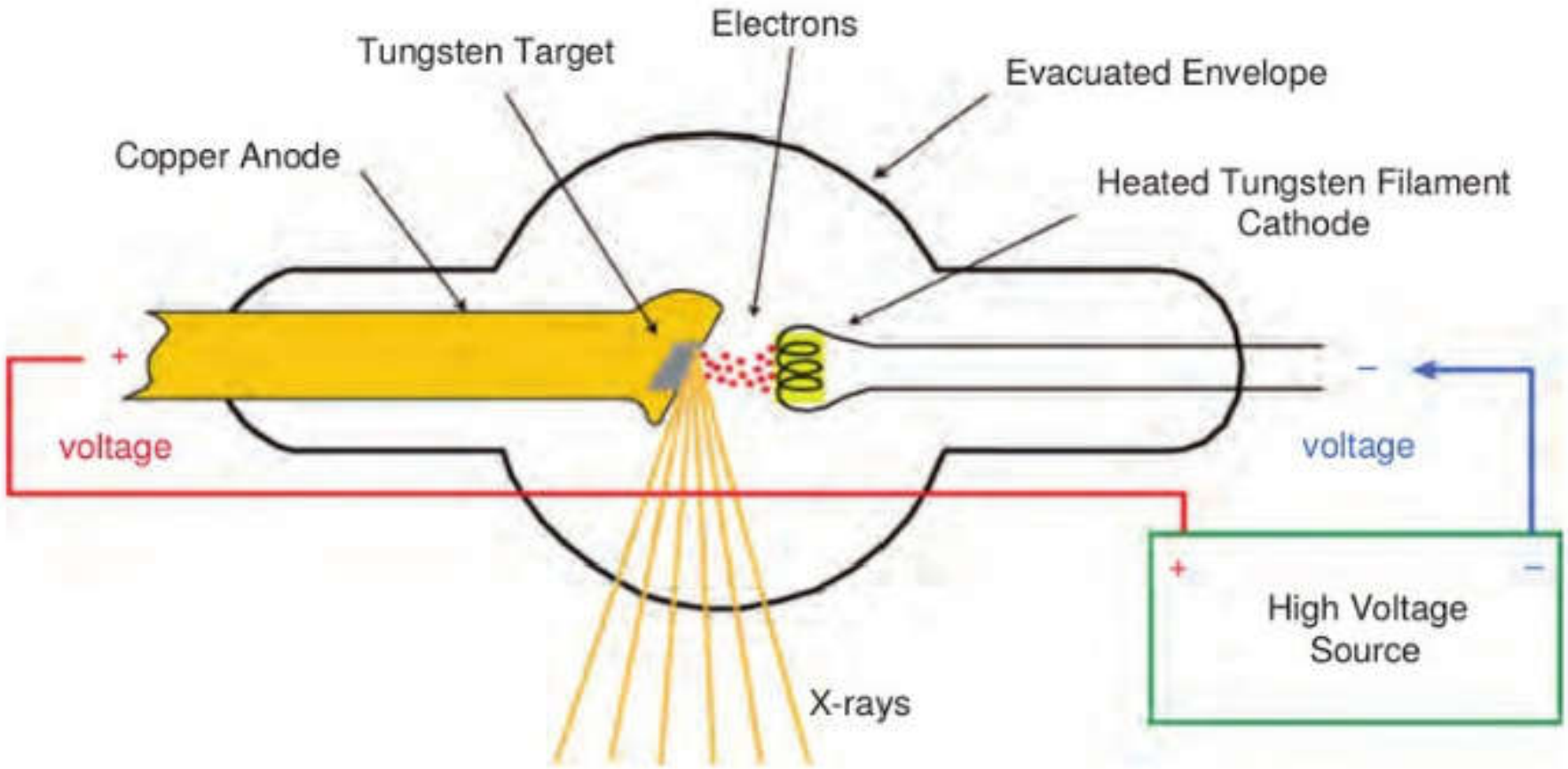


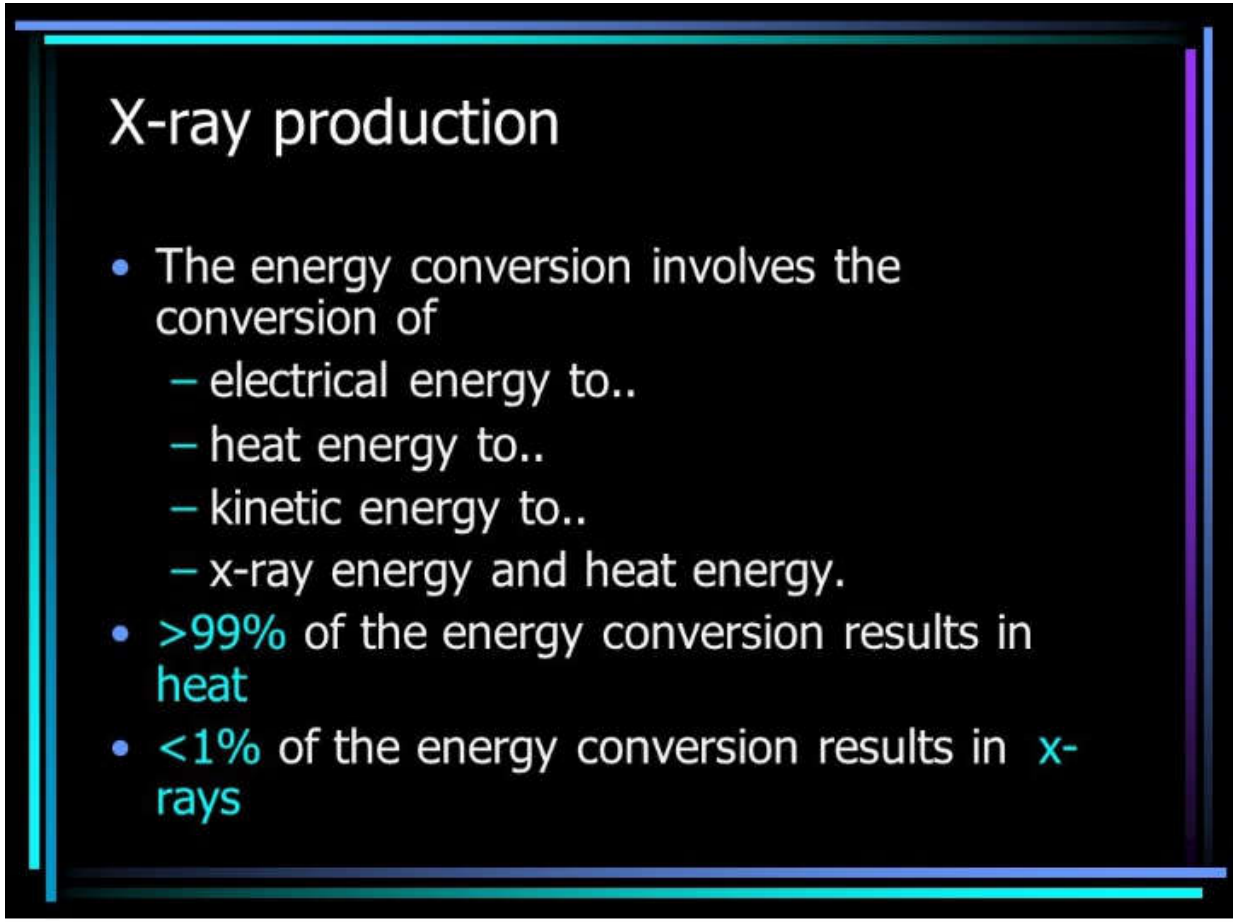
PRODUCTION OF X RAY



2: The general concept of an X-ray tube.

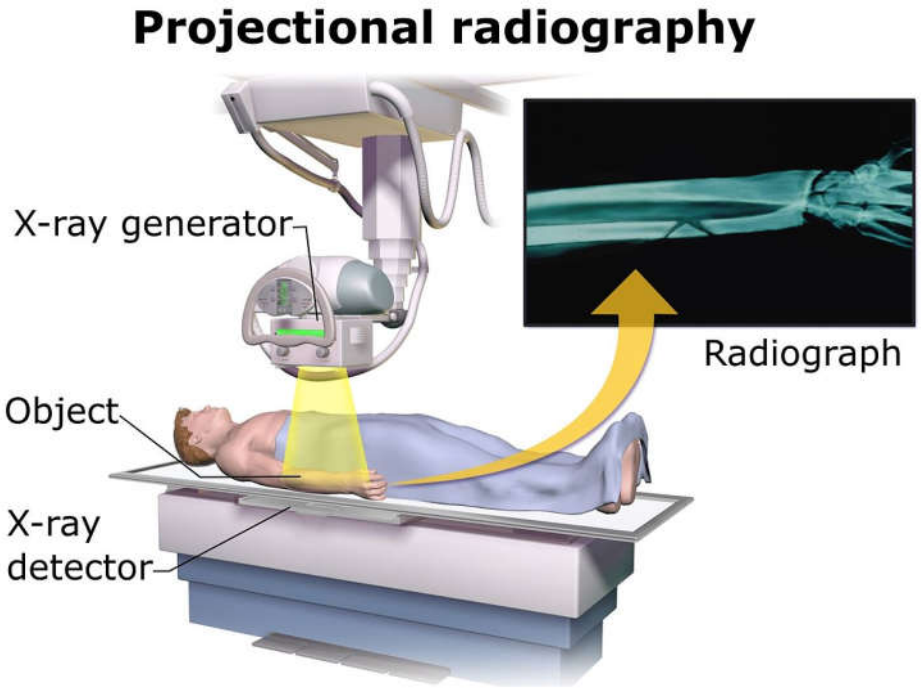
- The Energy conversion during the production of an x ray is

Electrical energy to thermal energy to kinetic energy to electromagnetic energy (x ray) and thermal energy.



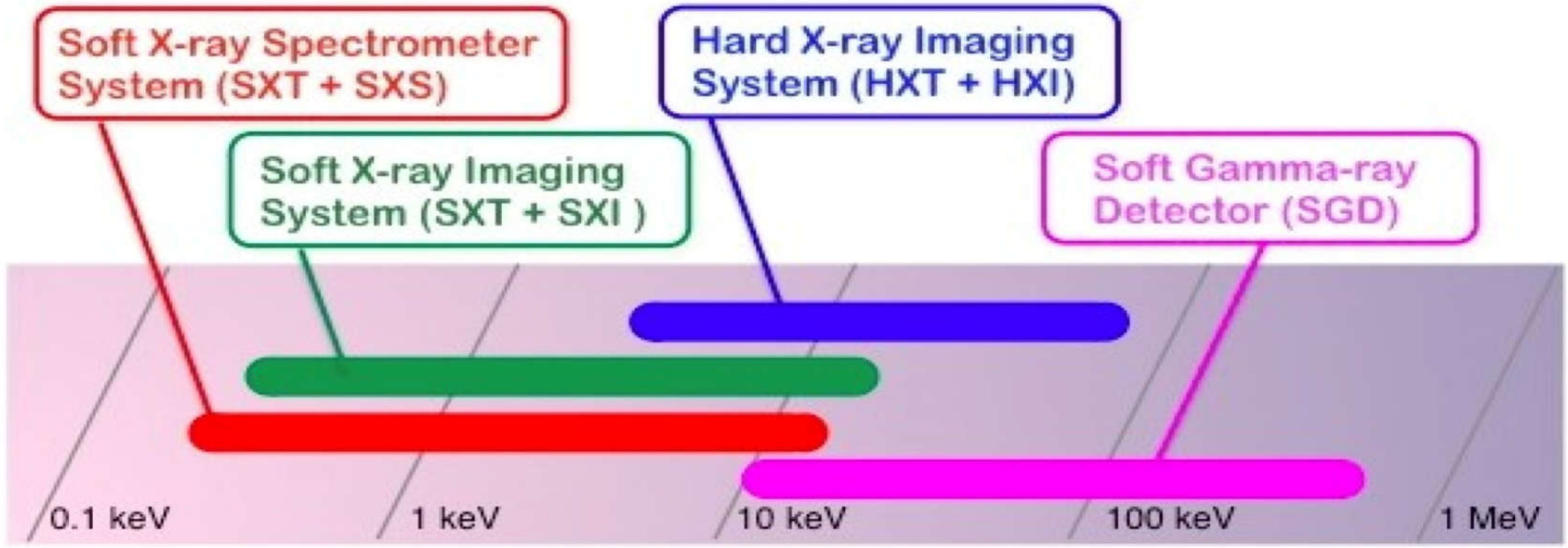
Hardness of X ray is the strength or penetrating power of the x ray , it depends on the speed of electrons which can be increased by increasing the p.d across the tube i.e $eV = \frac{1}{2} mv^2$.

Intensity of the x ray is the energy radiated per unit area. Intensity increases when the number of electrons hitting the target is increased and this can be controlled by the filament current i.e $I \alpha e$.

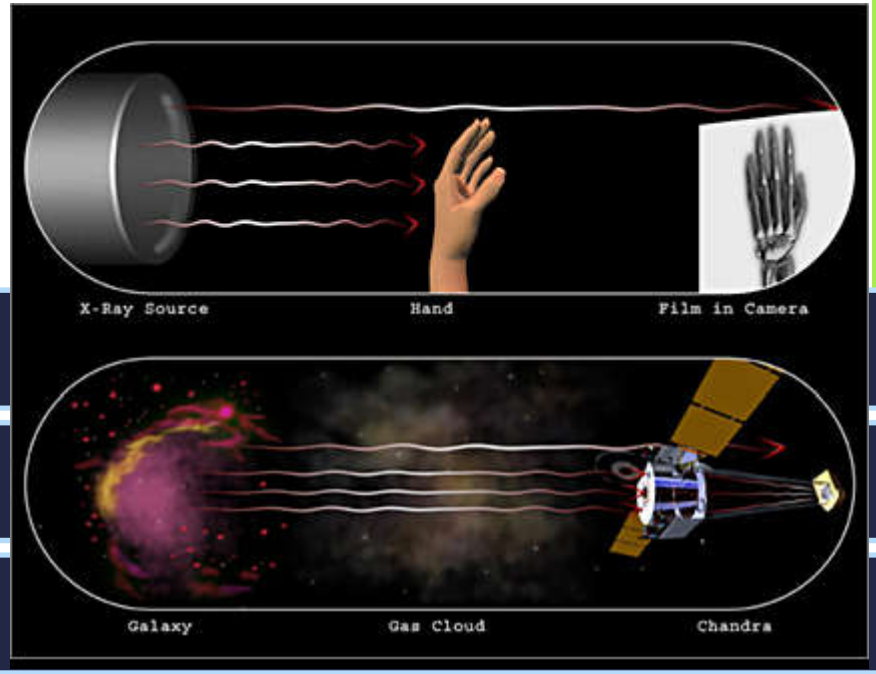


TYPES OF X RAYS

HARD X RAYS	SOFT X RAYS
High (target) voltage	Low voltage
Short wavelength	Long wavelength
High penetrating power	Low penetrating power



Properties of X rays



- They travel very fast.
- They have a high frequency.
- They have a very short wavelength.
- It is so small that you can fit 1,000,000,000 of them across your fingernail!!
- They travel in straight line.
- They can not be deflected by electric and magnetic fields.
- They undergo refraction, reflection, diffraction, interference and polarization.
- They ionise gases

+ The main uses of X-rays

Medical imaging to detect bone breaks, stomach and intestinal problems, as well as fractures.

Security in airports!(Baggage scanners, Useful to detect weapons, electronics, compressed gas (such as deodorants))

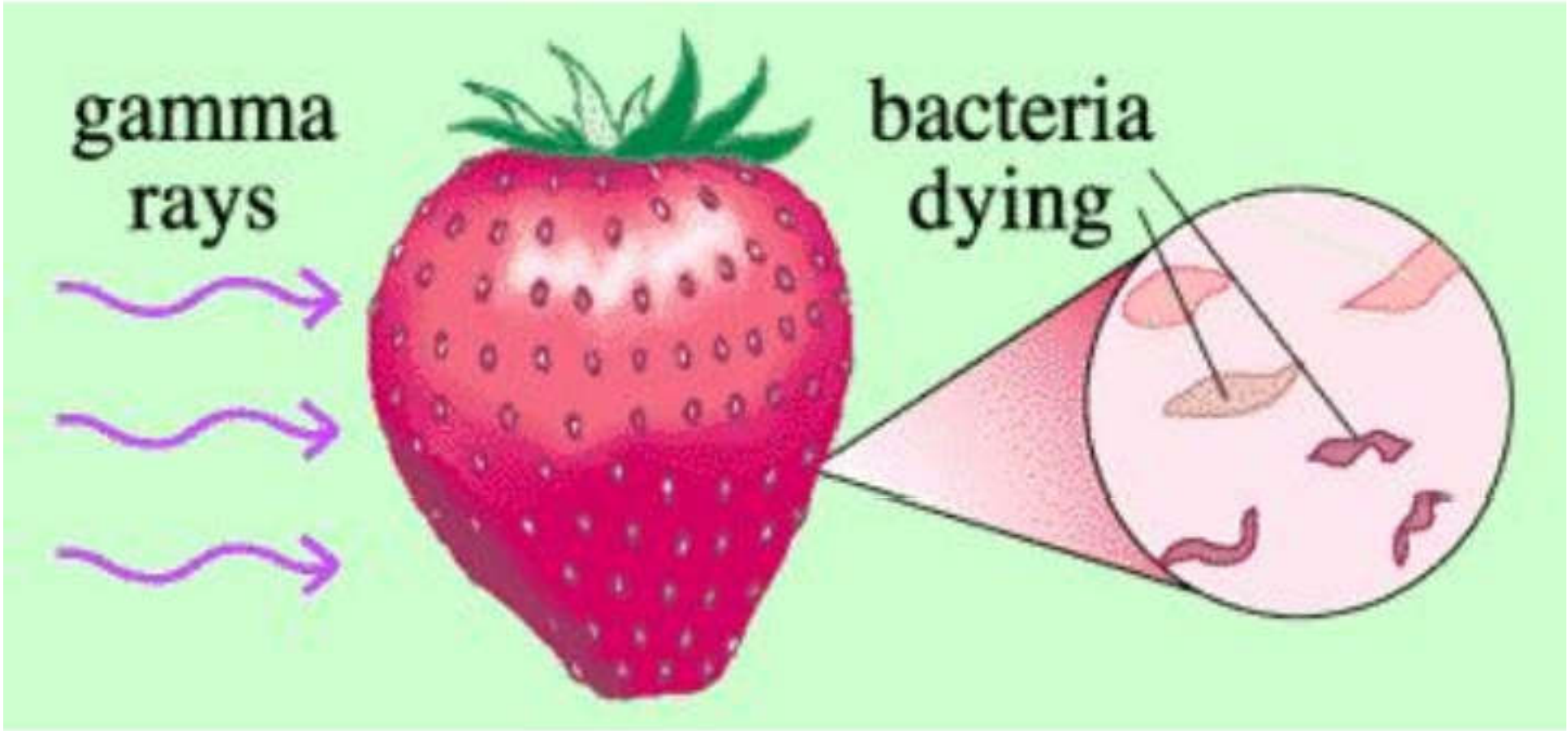
In industry: To examine materials without damaging them, to study crystal structure, to detect presence of cracks in welding.

Dental

Cancer Treatment

In artistic works for determining the authenticity of such works

In Agriculture to kill germs


gamma
rays
bacteria
dying

HEALTH HAZARDS OF X RAYS

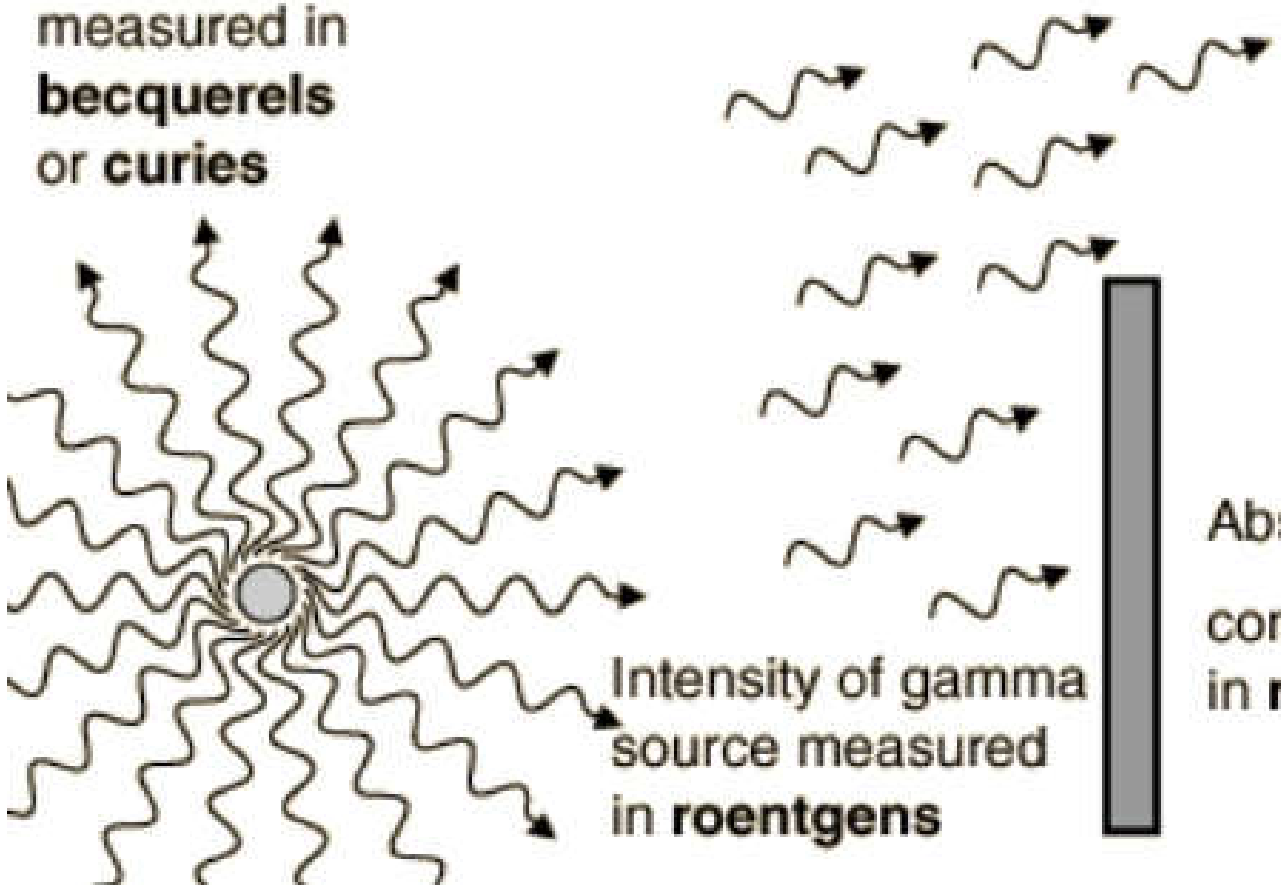
- They can cause damage to living cells and tissues of large animals.
- They kill small organisms.
- They cause Baldness
- They cause Leukemia
- They cause genetic mutation
- They make skin to burn
- They cause cataract

THE SAFETY PRECAUTIONS

- The use of the dosimeter, badges or G-M counters to track accumulated dosage over a given period of time.
- Wearing of lead coat
- Periodic medical check up
- Remote control tongs
- X ray workers should be given leave to reduce the period of exposure

Film badge or dosimeter measures personnel exposure in rems or sieverts.

Activity of radioactive source measured in **becquerels** or **curies**



Intensity of gamma source measured in **roentgens**

Absorbed dose in **rads** or **grays**

converted to dose-equivalent in **rems** or **sieverts**

ASSIGNMENT

l(a) state two (i) properties of x-rays. (ii) reasons to show that x-rays are waves (iii)uses of x-rays other than those in medicine. (iv) hazard of x-rays

(b) The potential difference between the cathode and target of an x-ray tube is 5.00 X 10^4V and the current in the tube is 2.00 X 10^{-2} A. Given that only one percent of the total energy supplied is emitted as x-radiation, determine the (i)maximum frequency of the emitted radiations. (ii) rate at which heat is removed from the target in order to keep it at a steady temperature.

{ Planck's constant, h=6.63 X 10^{-34} Js ; electronic charge e = 1.60 X 10^{-1} C }

{WAEC, June 2004}

2(a). (i) With the aid of a labelled diagram describe the mode of operation of a modern

X-rays tube.

(ii) State the energy transformation that take place during the operation of the X-rays.

(b) define as applied to X-rays, the following terms (i) hardness (ii) intensity . (c) State (i) four uses of X-rays (ii) one hazard of over exposure to X-rays in a radiological laboratory

{WAEC, June 2007}