

X-RAY



Prepared by :
Eng . Hawra Kadhom
& Zahra Eisa

Introduction

- X-radiations (or x-rays) is a form of electromagnetic radiation.
- Most X-rays have a wavelength of 0.01-10 nanometers.
- Frequencies in the range of 30 petahertz (3×10^{16} Hz) to 30 exahertz (3×10^{19} Hz).
- Energies in the range of 100eV to 100keV.

Discoverer of X-Radiations-

- It was invented by a German physicist Wilhelm Röntgen in 1895.
- He named it X-Radiations to signify an unknown type of radiation.



Wilhelm Röntgen

Properties of X-rays

- Electromagnetic nature.
- It propagates in a vacuum at the speed of light along straight lines.
- It leads to ionization of the gases that pass through it, and this is used to measure the number of X-rays using an Ionization chamber.
- It can penetrate the human body, and this is easier as its permeability is greater.
- It is an important diagnostic tool for medical conditions like bone fractures, pulmonary tuberculosis, etc.

Duane and Hunt's law

Assume that all the kinetic energy of the electron is converted into X-ray radiation. In this case, we can determine the minimum wavelength λ_{\min} for the x-ray emitted by the tube given by the following mathematical formula:

$$\lambda_{\min} = \frac{h \times c}{eV}$$

Where,

h is planks constant

c is the speed of light

E is electron charge

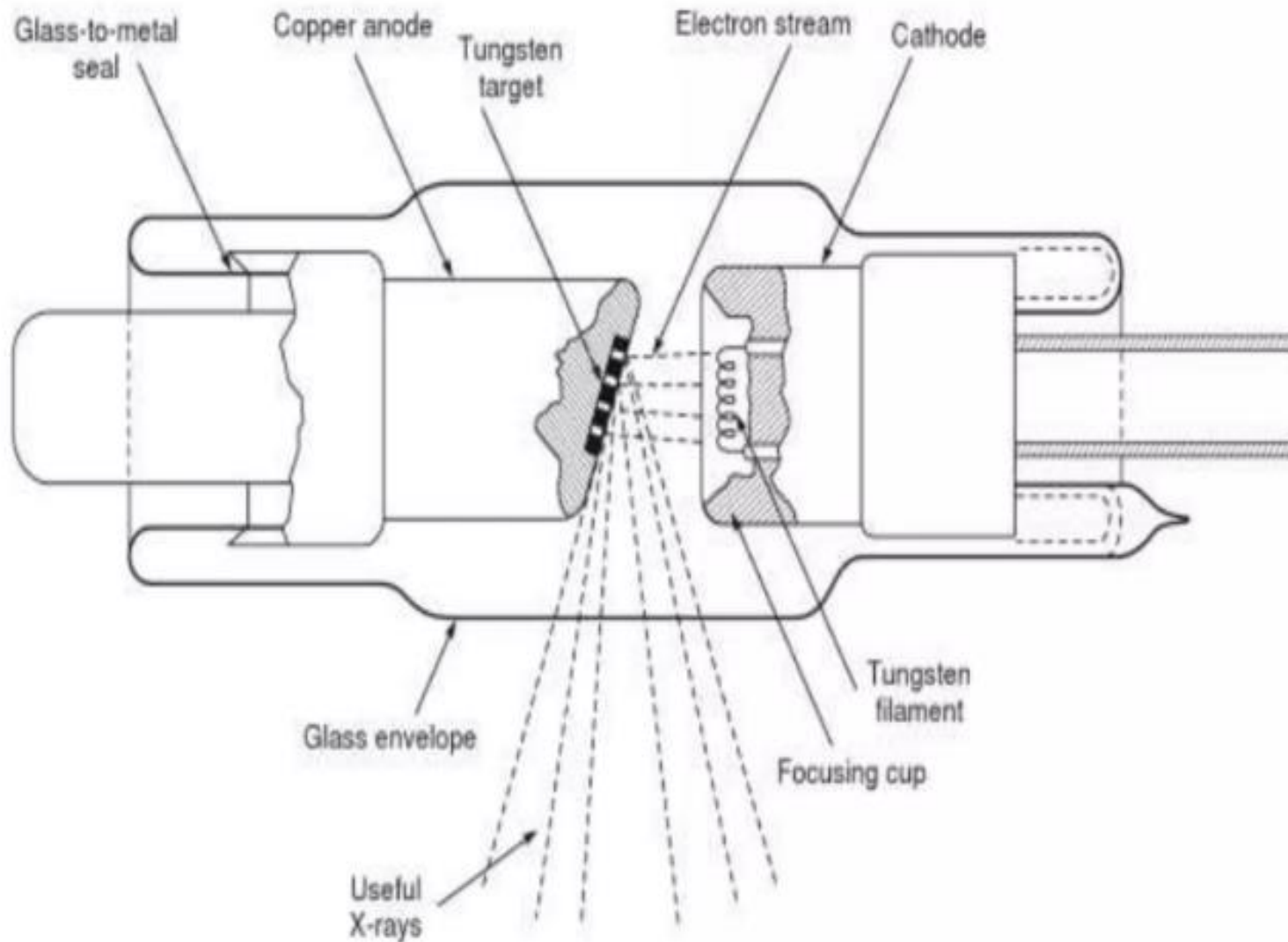
PARTS OF X-RAY MACHINE

1. X-ray tube
2. Transformer
3. Tube stand
4. Control panel

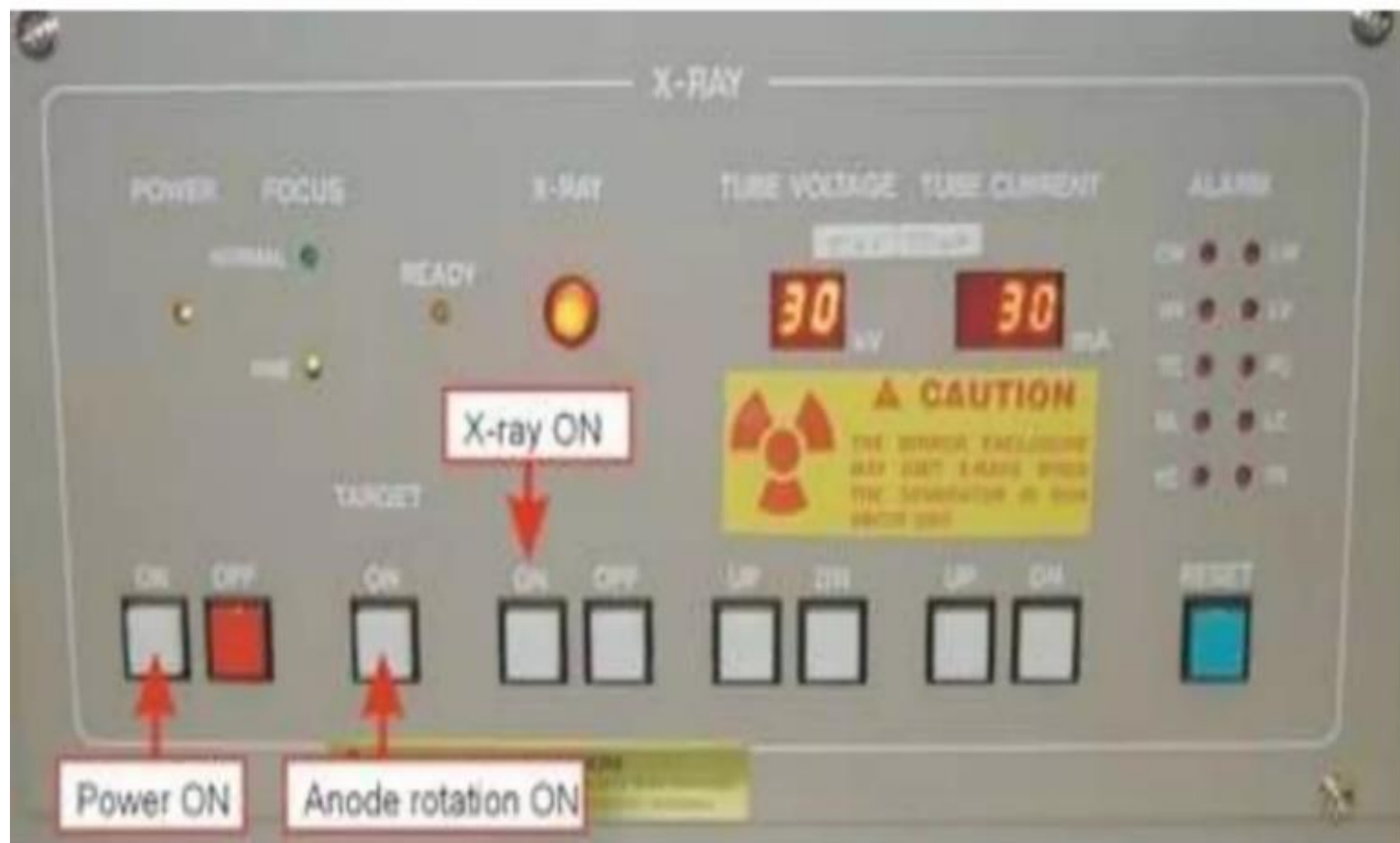
X-RAY TUBE

This is the heart of the X-ray machine where X-rays are generated. It contains a cathode and an anode within a vacuum-sealed glass or metal housing. When high voltage is applied, electrons emitted from the cathode are accelerated towards the anode, resulting in the production of X-rays through interactions with the target material.

X-RAY TUBE



CONTROL PANEL



X-RAY MACHINE



Advantages of X-rays

- **Medical Diagnosis:** X-rays are commonly used in medical imaging to visualize internal structures of the body, such as bones, organs, and tissues.
- **Treatment Planning:** In addition to diagnosis, X-rays are also used in treatment planning, particularly in radiation therapy for cancer treatment.
- **Speed and Convenience:** X-ray imaging is generally quick and convenient, providing immediate results that can aid in prompt diagnosis and treatment decisions.

Disadvantages of X-rays

- **Ionizing Radiation:** Prolonged or repeated exposure to X-rays can increase the risk of developing cancer, particularly in sensitive tissues such as the skin, breast, and thyroid.
- **Environmental Impact:** The production and disposal of X-ray equipment and related materials can have environmental consequences, including energy consumption, waste generation, and potential contamination from radioactive materials used in certain imaging procedures.
- **Overutilization:** There's a risk of overutilization of X-ray imaging, leading to unnecessary exposure to ionizing radiation for patients