

# Analytical X-Ray Safety Training

## 3. Sources and Uses of X-Rays

# Training Outline

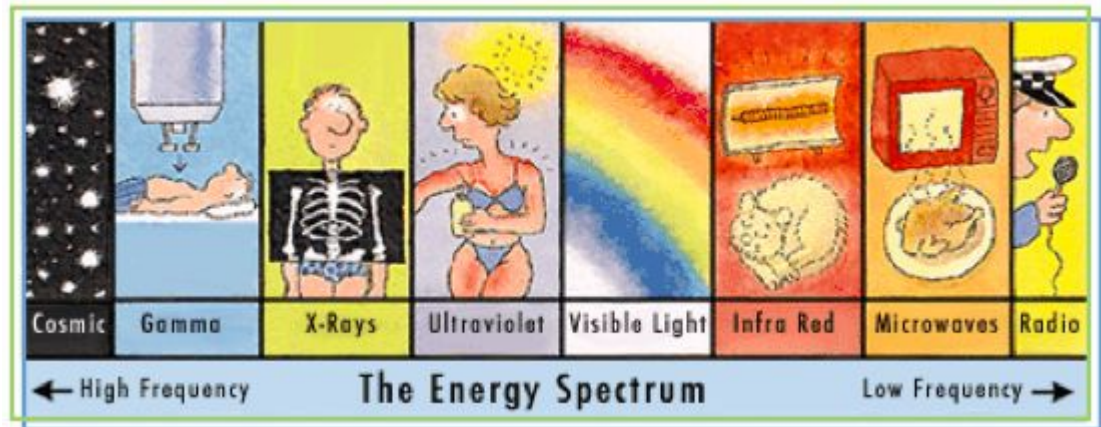
- history
- **sources and uses of X-Rays**
- legislation
- biological and health effects
- X-Ray safety in the lab
  - exposure
  - SOPs
  - security
  - emergencies
  - summary
- references
- quiz

# Sources and Uses - Outlines

- how are X-Rays produced?
- atomic properties and interaction with matter
- description of a X-Ray machine
- types of Laboratory X-Rays machines

# Sources and Uses - What are X-Rays?

- X-Rays are part of electromagnetic spectrum (energy range of 10eV – 120KeV)
- type of ionizing radiation (made of photons) **originating from the electron shell**
- produced by machines



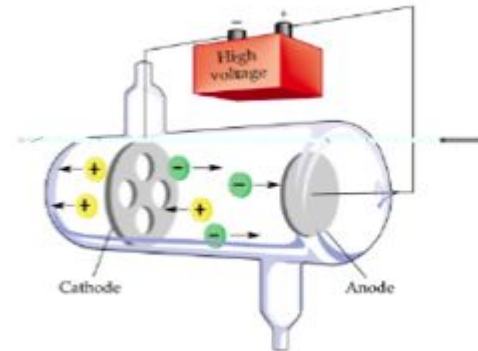
# X-Ray Production - Bremsstrahlung



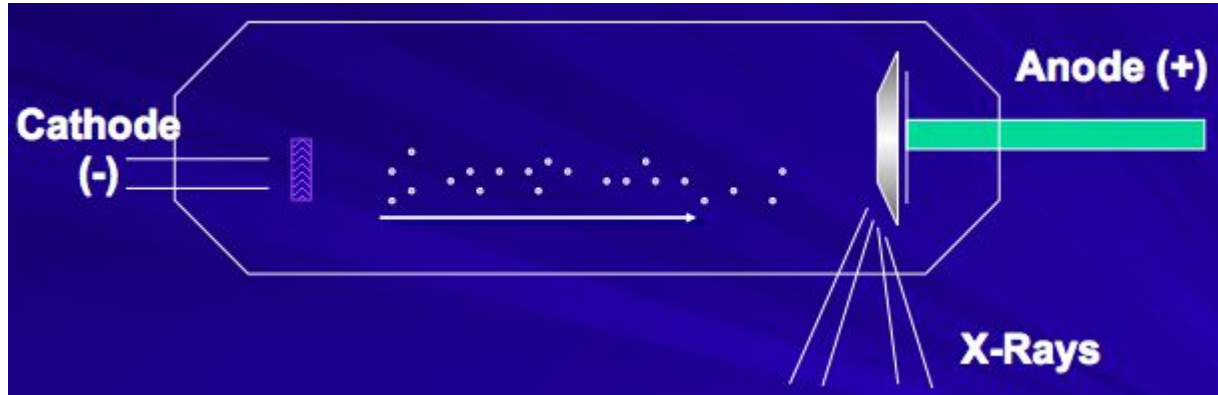
Example of electromagnetic radiation which comes from electrons which are deflected from their original paths or inner orbital electrons change their orbital levels around nucleus

# How Are X-Rays Produced?

- produced whenever a high voltage, a vacuum and a source of electrons present
- most X-Ray devices emit electrons from a cathode, accelerate them with a voltage and hit the anode (target)
- emits X-Rays



# X-Ray Machine



# Source and Uses

Consists of a X-Ray tube, an electrical source of high voltage, tube filament current, and radiation shielding to shape the beam

- principle Types of Diagnostic X-Rays: Radiographic, Fluoroscopic, and Photo-Fluorographic
- industrial X-Rays: Nondestructive examination of metal parts
- therapeutic X-Rays



# Sources and Uses

## X-Ray machine

- electrically powered device with a **primary** purpose of producing X-Rays
- analyzes structures or materials

## X-Ray source

- any part of a device that emits X-Rays, whether or not the device is an X-Ray machine (i.e., electron microscope)

# Sources and Uses

## X-Ray Diffraction (XRD)

- commonly used in chemical analysis
- studies arrangements of atoms in solids by studying scattered X-Ray beam from atomic arrangement

## X-Ray Fluorescence (XRF)

- observes fluorescent emissions of X-Ray and UV as atoms hit by X-Rays
- structure of material examines atomic absorption



# Continue on to: Legislation