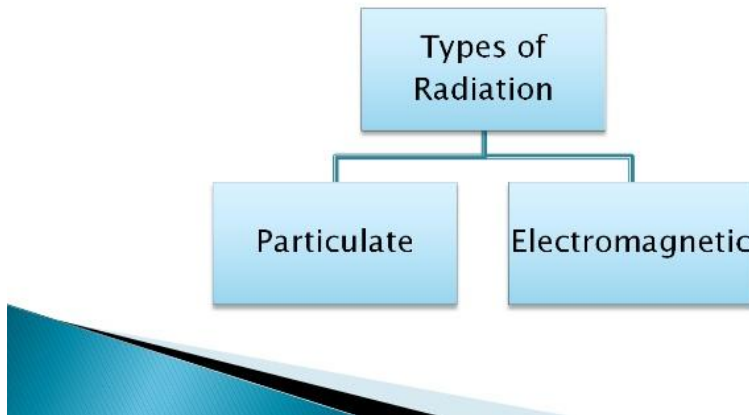


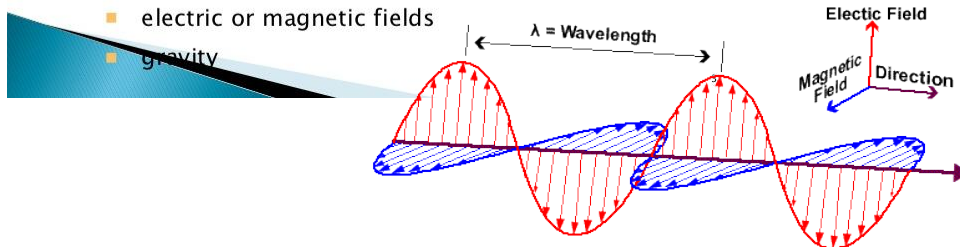
Radiation

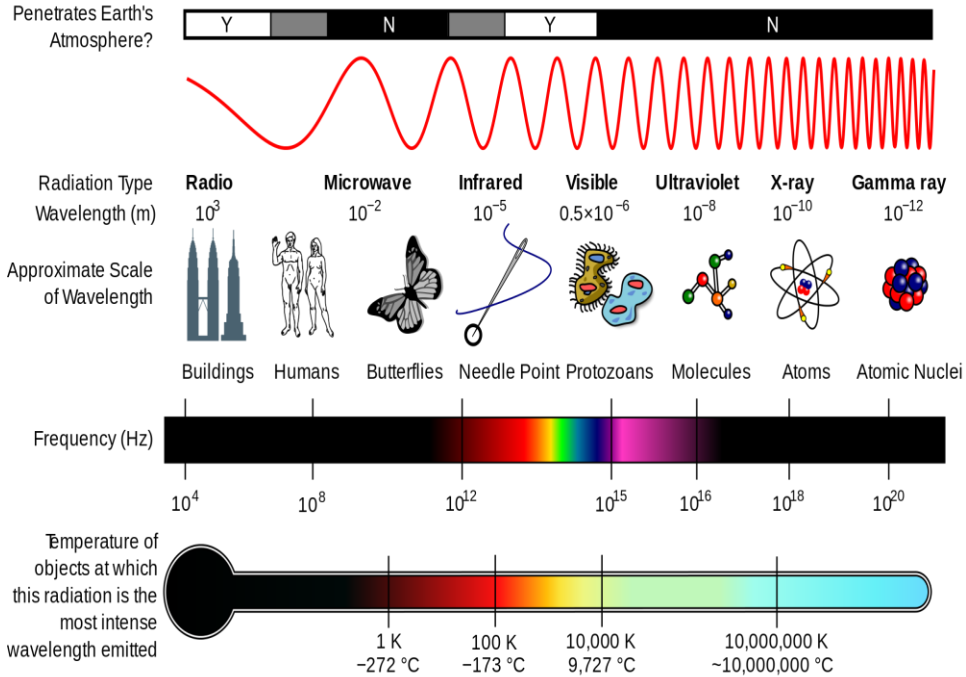
The term radiation applies to the emission and propagation of energy through space or a material.



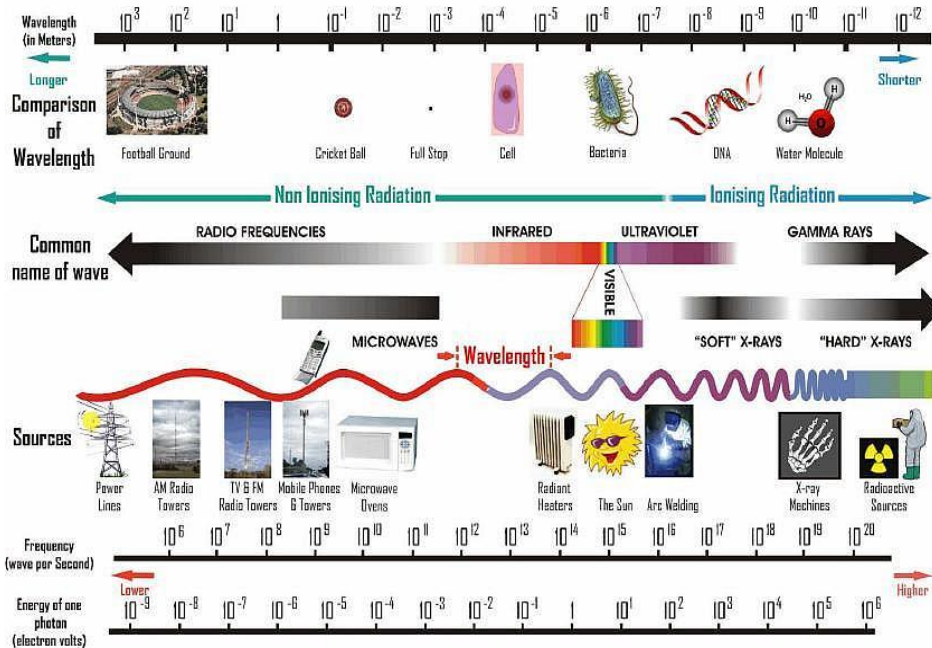
General Characteristics of EMR

- no mass or physical form
- travel at **speed of light (c)** in a vacuum (or air)
 - $c = 3 \times 10^8 \text{ m/s}$
- travel in a linear path (until interaction occurs)
- unaffected by
 - electric or magnetic fields
 - gravity

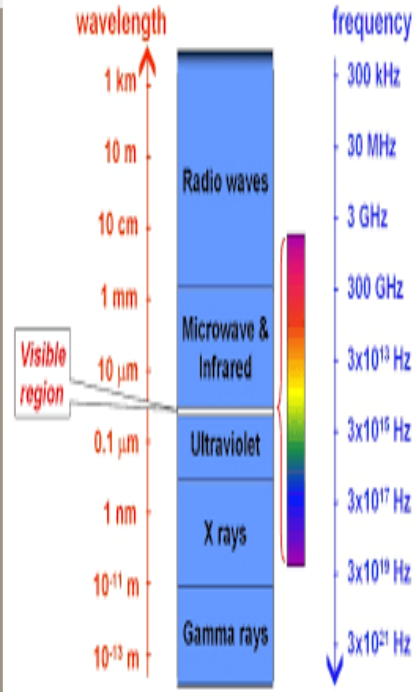




THE ELECTROMAGNETIC SPECTRUM



| Region | Wavelength (m) | Frequency (Hz) |
|------------------|--|--|
| Electricity | 5×10^5 | 60 Hz |
| Long Wave, TV | 10^5 to 10^2 | $< 3 \times 10^9$ |
| Short Wave Radio | 10^2 to 0.1 | 10^8 to 3×10^9 |
| Microwave | 0.1 to 10^{-3} | 3×10^9 to 3×10^{12} |
| Infrared | 10^{-3} to 7×10^{-7} | 3×10^{12} to 4.3×10^{14} |
| Visible | 7×10^{-7} to 4×10^{-7} | 4.3×10^{14} to 7.5×10^{14} |
| Ultraviolet | 4×10^{-7} to 10^{-9} | 7.5×10^{14} to 3×10^{17} |
| X-Rays | 10^{-9} to 10^{-11} | 3×10^{17} to 3×10^{19} |
| Gamma Rays | 10^{-11} to 10^{-15} | 3×10^{19} to 10^{20} |
| Cosmic Rays | 10^{-15} to 10^{-20} | 10^{20} to 10^{22} |

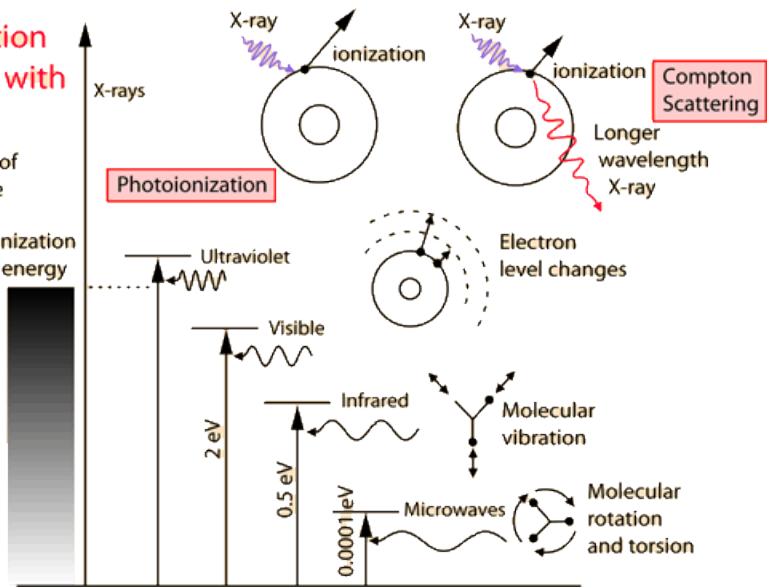


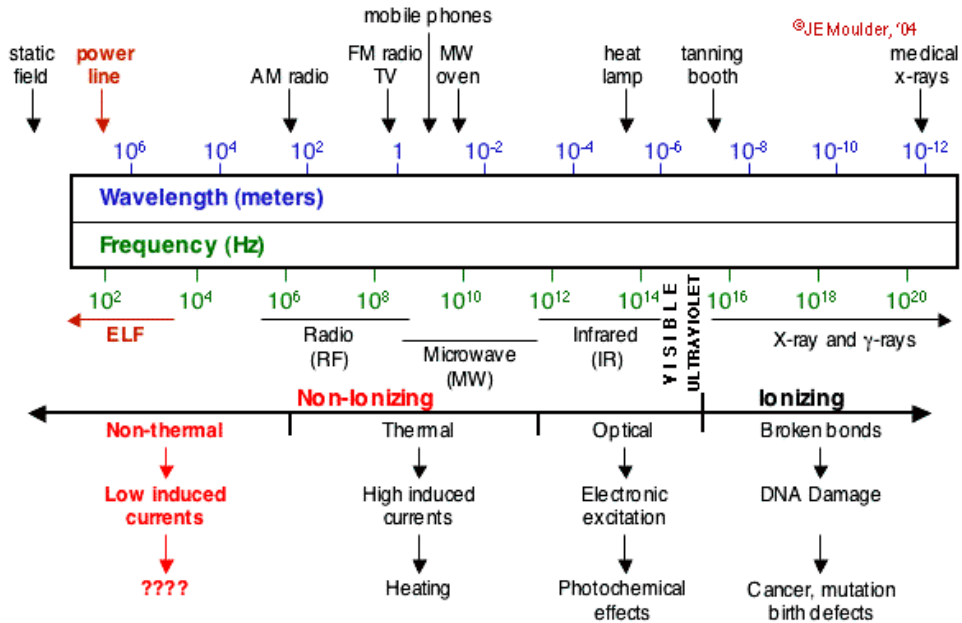
The interaction of radiation with matter.

Click on any type of radiation for more information.

Large number of available energy states, strongly absorbed.

Small number of available energy states, almost transparent.





Electromagnetic Waves Interaction with Matter

Type of Interaction

- Rayleigh Scattering
- Photoelectric Absorption
- Compton Absorption/Scatter
- Pair Production
- Photonuclear Activation

Photons

- Radio
- Microwave
- Infrared
- Light
- UV
- X-Rays
- Gamma Rays

Photon-beam Interactions

| Process | Definition |
|---------------------|---|
| Attenuation | Removal of radiation from the beam by the matter. Attenuation may occur due to scattering and absorption |
| Absorption | The taking up of the energy from the beam by the irradiated material. It is absorbed energy, which is important in producing the radiobiological effects in material or soft tissues. |
| Scattering | refers to a change in the direction of the photons and its contributes to both attenuation and absorption |
| Transmission | Any photon, which does not suffer the above processes is transmitted. |

