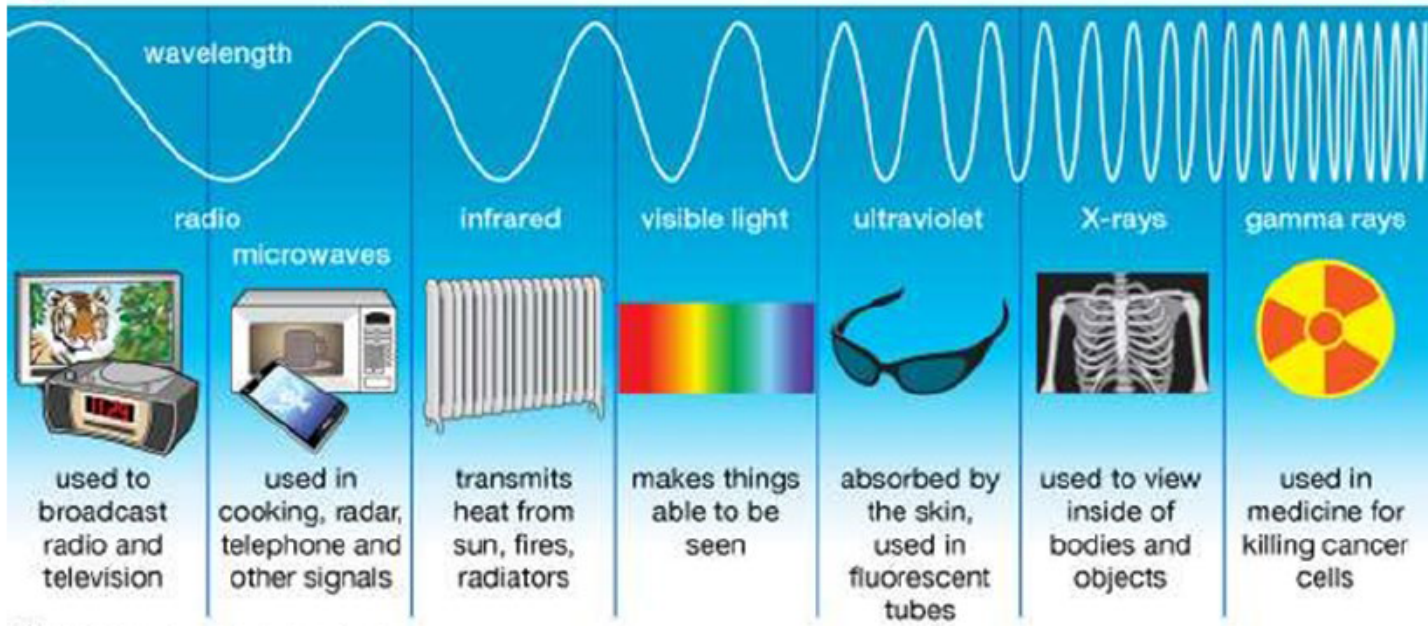


Types of Electromagnetic Radiation



Electromagnetic Radiation and Waves

Region	Wavelength range (approx.)	Frequency range (approx.)	Comments
Long-wave radio	>10 m	$<3 \times 10^7$ hz	Includes traditional AM radio region. These frequencies can travel long distances by multiple reflections between the surface of the earth and its ionosphere.
Short-wave radio	10 cm - 10 m	$3 \times 10^7 - 3 \times 10^9$	Used for TV, FM, and other communication purposes. Generally travels only relatively short distances because the ionosphere is transparent to it.
Microwave	1 mm - 10 cm	$3 \times 10^9 - 3 \times 10^{11}$	Present limit of radio technology for most purposes.
Far infrared	30 mm - 1 mm	$3 \times 10^{11} - 10^{13}$	3 K radiation fills universe.
Thermal infrared	3 mm - 30 mm	$10^{13} - 10^{14}$	Thermal emission of earth and planets.
Near infrared	700 nm - 3mm	$10^{14} - 4 \times 10^{14}$	Solar and stellar emission.
Visible	400 nm -700nm (1.7 - 3 eV)	$4 \times 10^{14} - 7 \times 10^{14}$	Peak of solar radiation. Visible to human eye, standard photographic film and CCD video detectors.
Ultraviolet	200 nm -400nm (3 - 6 eV)	$7 \times 10^{14} - 1.5 \times 10^{15}$	Divided at 300 nm by atmospheric (ozone) cutoff. Appreciable solar flux causes sunburn.
Vacuum UV (EUV)	10 nm - 200 nm (6 - 120 eV)	$1.5 \times 10^{15} - 3 \times 10^{16}$	Very strong absorption in matter, hence very difficult to observe.
X-rays	120 eV-100keV	$3 \times 10^{16} - 3 \times 10^{19}$	Produced by electron beams in X-ray tubes, and by inner atomic transitions. Progressively more penetrating as E increases, up to many centimeters in water.
γ -rays	100 keV	3×10^{19}	Produced by nuclear and other high energy processes. Can penetrate up to meters in water.