

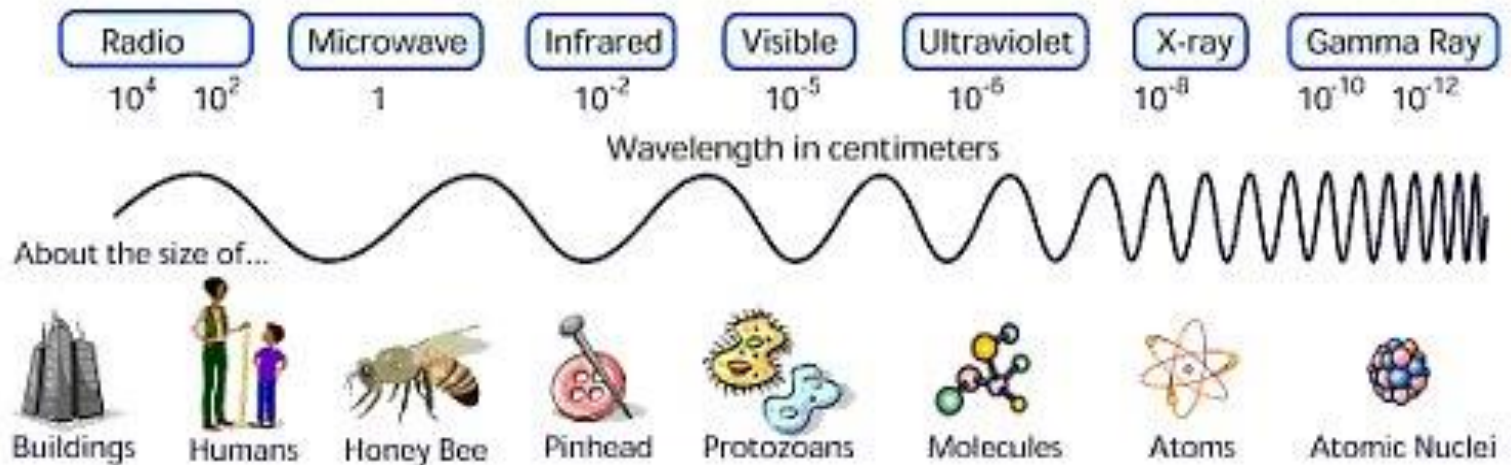
THE ELECTROMAGNETIC SPECTRUM

Class: 12th



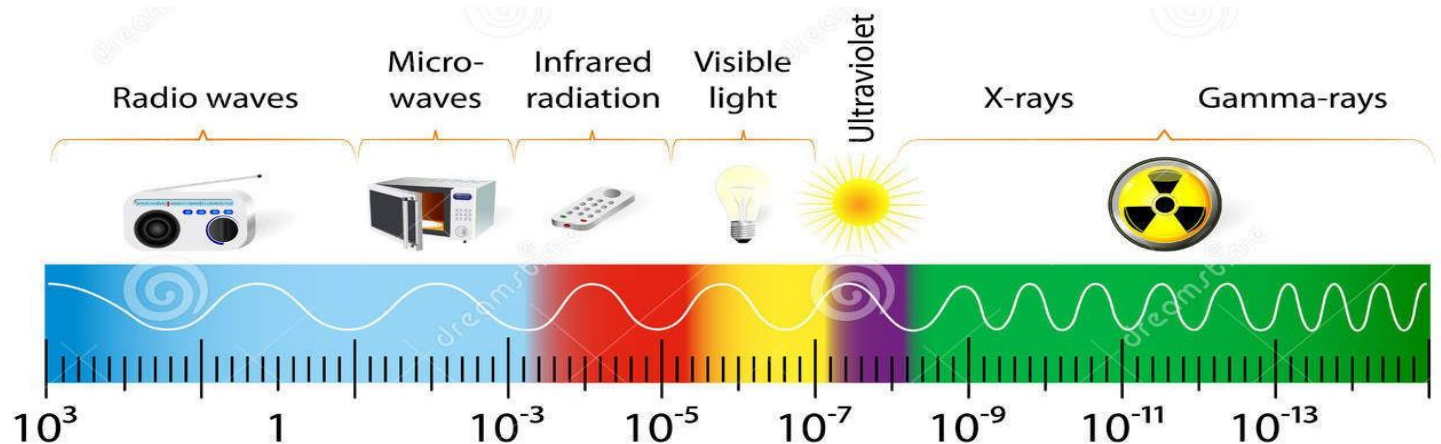
ELECTROMAGNETIC SPECTRUM

- ❑ What is the Electromagnetic Spectrum?
- ❑ The electromagnetic spectrum is the complete spectrum (or continuum) of all forms of "light"
- ❑ An electromagnetic wave consists of electric and magnetic fields which vibrate - thus making waves.



ELECTROMAGNETIC SPECTRUM

- ☐ The electromagnetic spectrum consists of:
- ☐ Radio waves
- ☐ Microwaves
- ☐ Infrared waves
- ☐ Visible light waves
- ☐ Ultraviolet waves
- ☐ X-ray waves
- ☐ Gamma waves



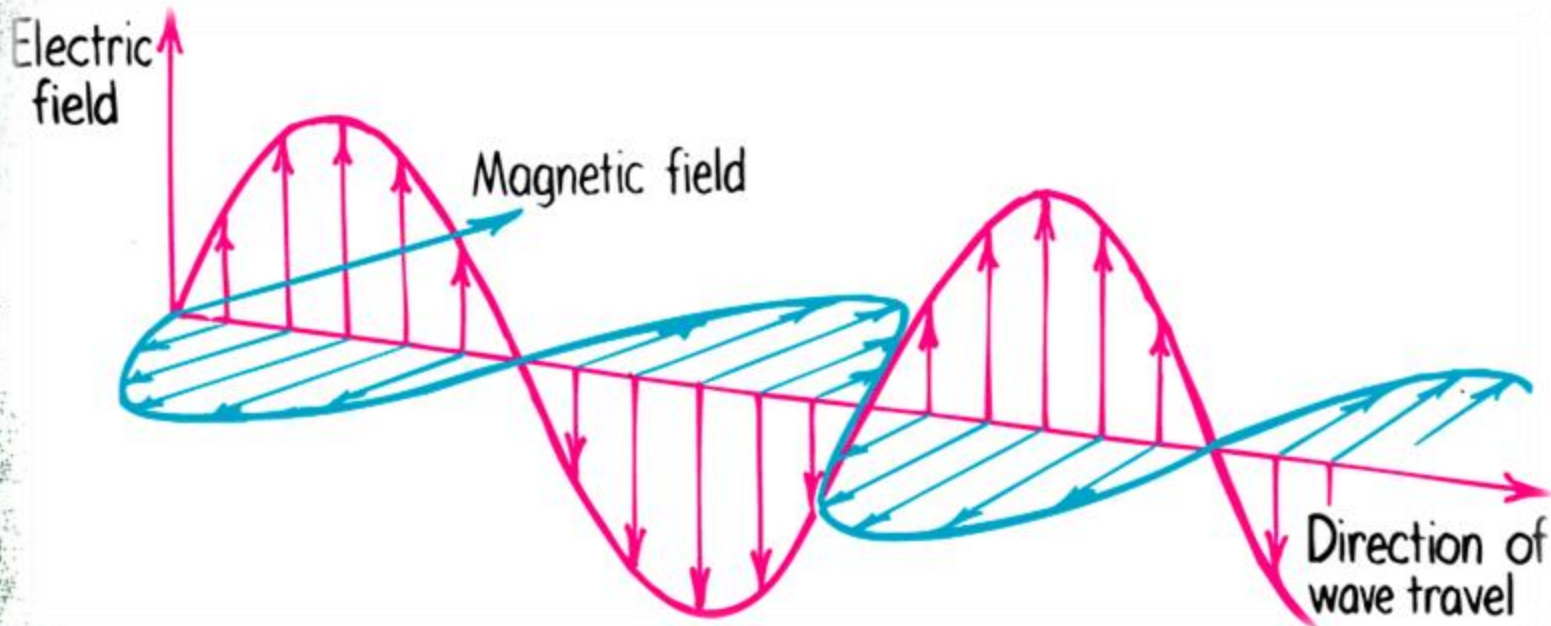
PROPERTIES OF ELECTROMAGNETIC WAVES

- ❑ Transverse in nature
- ❑ Propagate through space with speed of light.
- ❑ Energy in the electromagnetic waves is divided equally between electric field and magnetic field vectors.
- ❑ Both Electric and Magnetic fields have the same Oscillation frequency.
- ❑ Speed of Electro magnetic wave is:

$$c = \frac{1}{\sqrt{\epsilon_0 \mu_0}}$$

PROPERTIES OF ELECTROMAGNETIC WAVES

- ❑ EM waves are transverse. Field oscillates in a direction that is perpendicular to the wave direction of travel.
- ❑ Fields are also perpendicular to each other.

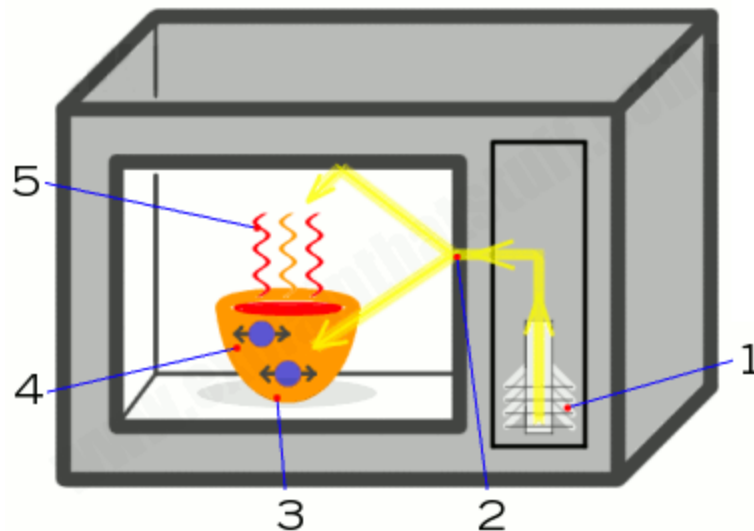


RADIO WAVES

- ❑ The basic building block of radio communications is a radio wave.
- ❑ Like waves on a pond, a radio wave is a series of repeating peaks and valleys.
- ❑ Range of the radio spectrum is considered to be 3 kilohertz up to 300 gigahertz. Low frequency
- ❑ Used in many devices such as remote control items, cell
- ❑ Phones, wireless devices, etc.
- ❑ Radio waves are divided into:-
 - Long Wave, around 1~2 km in wavelength.
 - Medium Wave, around 100m in wavelength.
 - VHF, which stands for "Very High Frequency" and has wavelengths of around 2m.
 - UHF stands for "Ultra High Frequency", and has wavelengths of less than a meter.

MICROWAVES

- ❑ **Microwaves** are a form of electromagnetic radiation with wavelengths ranging from about one meter to one millimeter.
- ❑ With frequencies between 300 MHz (1 m) and 300 GHz (1 mm). Different sources define different frequency ranges as microwaves;
- ❑ Used for communication, medicine and consumer use (microwave ovens)





INFRARED WAVES

- ❑ Invisible electromagnetic waves that are detected as heat can be detected with special devices such as night goggles
- ❑ Infra-Red waves are also given off by stars, lamps, flames and anything else that's warm.
- ❑ Used in heat lamps, remote controls for TVs and video recorders, and physiotherapists use heat lamps to help heal sports injuries.

VISIBLE LIGHT



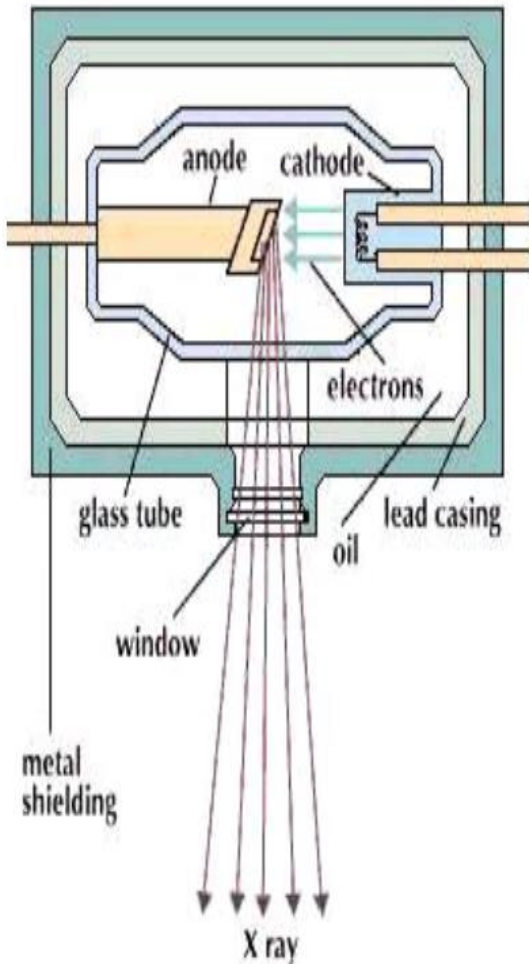
- ☐ Visible light waves are the only electromagnetic waves we can see.
- ☐ Portion of the electromagnetic spectrum that human eyes can detect
- ☐ ROY G BIV (red, orange, yellow, green, blue, indigo, violet)
- ☐ Red has the lowest frequency –violet the highest



ULTRAVIOLET WAVES

- ❑ **Ultraviolet (UV)** is electromagnetic radiation with wavelength from 10 nm (with a corresponding frequency of approximately 30 PHz) to 400 nm (750 THz),
- ❑ Shorter than that of visible light but longer than X-rays.
- ❑ UV radiation is present in sunlight, and constitutes about 10% of the total electromagnetic radiation output from the Sun
- ❑ Can cause skin cancer and blindness in humans
- ❑ Used in tanning beds and sterilizing equipment

X-RAYS



- ❑ **X-rays** make up **X-radiation**, a form of high-energy electromagnetic radiation.
- ❑ X-ray wavelengths are shorter than those of UV rays and typically longer than those of gamma rays.
- ❑ When we use X-rays, we make them by firing a beam of electrons at a "target". If we fire the electrons with enough energy, X-rays will be produced
- ❑ Used in medicine, industry and astronomy
- ❑ X Ray Can cause cancer if exposed to living cell.



GAMMA RAYS

- ❑ A **gamma ray**, or **gamma radiation** (symbol γ), is a penetrating electromagnetic **radiation** arising from the radioactive decay of atomic nuclei.
- ❑ Consists of the shortest wavelength electromagnetic waves and so imparts the highest photon energy.
- ❑ Blocked from Earth's surface by atmosphere.
- ❑ Extremely high frequency waves, and carry a large amount of energy.
- ❑ Used in "Radiotherapy", and works because cancer cells when damaged by gamma rays.

The background is a green chalkboard. Two pieces of pink chalk are lying on the left side. There are some faint white chalk marks on the board, including a large 'C' on the left and some scribbles in the center and bottom.

THANK YOU

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