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# NOTES CLUB

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Trend Writers

CHAPTER - 8

# Electromagnetic Waves.

**Displacement Current** - The rate of change of electric displacement field is known as displacement current.

**Determination of displace current.**

let $+q$ and $-q$ charges on the left hand right plate of capicator respectively the surface charge density

$$\sigma = \frac{q}{A}$$

Electric field btw the plates

$$E = \frac{\sigma}{\varepsilon_0} = \frac{q}{A\varepsilon_0}$$

the electric flux through surface $S_2$ is

$$\phi_E = E \cdot A = \frac{q}{\varepsilon_0}$$

$$\therefore \frac{d\phi_E}{dt} = \frac{1}{\varepsilon_0}\frac{dq}{dt} = \frac{I_d}{\varepsilon_0}$$

$$I_d = \frac{\varepsilon_0 \, d\phi_E}{dt}$$

* **Electromagnetic Waves** - Waves that are created as a result of vibration betw and electric field and a magnetic field

**Properties of Electromagnetic Wave** -

- These waves do not required any medium to travel.
- In these wave electric and magnetic field remains perpendicular to each other.
- These are produce due to oscillating and accelerating charge.
- Electromagnetic wave move with same velocity ($3 \times 10^8$ m/s) in free space.
- The electromagnetic waves are polarized.

**Difference betw Electromagnetic wave and mechanical wave.**

| | |
|---|---|
| They do not require any medium for travel | They require medium for travel. |
| They are formed due to varying electric and magnetic field | They are form due to vibration of particles of medium |

They are transverse wave

In these wave maximum velocity is $(3 \times 10^8 \ m\text{-}s^{-1})$.

They can be transverse or logitunal waves.

These wave have very small velocity $(0 \text{ to } 332 \ ms^{-1})$

## Difference between Electromagnetic wave and sound wave.

These waves are transvers in nature.

They do not requare any medium to travel

There velocity is very high $(3 \times 10^8 \ m\text{-}s^{-1})$

There velocity does not depend upon the temperature

There waves show polarization

These waves are logitudnal in nature.

They require medium to travel

There velocity is very less (0 to 332 $ms^{-1}$)

There velocity depend upon the temp.

These wave do not show polarization.

## Electromagnetic spectrum.

An orderly arrangment of radiation according to wave length is called Electromagnetic spectrum.

Name of rays in decreasing frequency and increasing wave length.

Gamma ray

X-rays

Uv rays

Visible rays

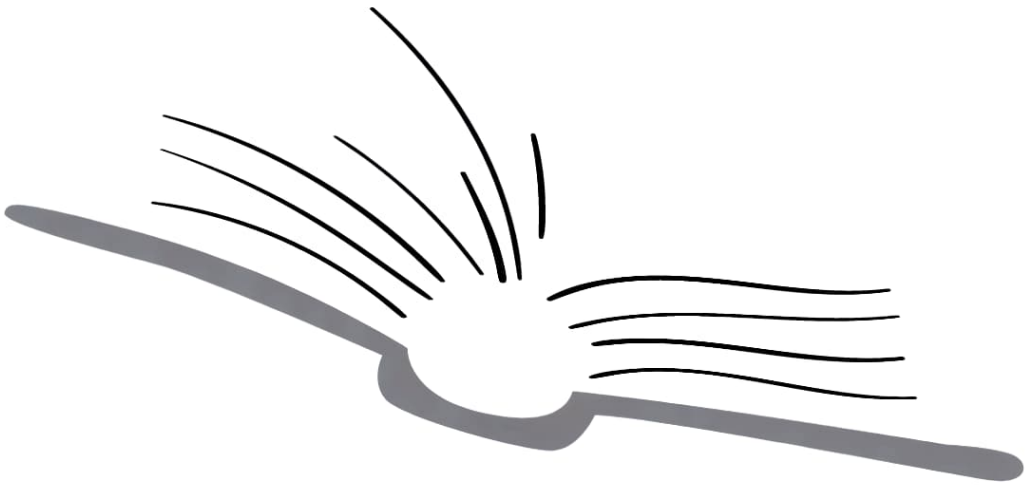
IR rays

micro rays

radio rays.

S.No.

| | Name | wavelength range | frequency | Discoverer | Source | main properties | application |
|---|---|---|---|---|---|---|---|
| one | Gamma rays | $10^{-4}$ m to $10^{-10}$ m<br>$10^{-3}$ Å to 1 Å | $10^{18}$ Hz to $10^{22}$ Hz | Henery Becquerel (1896) | Nuclear reaction | high penetration power. | In destroying unwanted cells; treatment of cancer. |
| two | X-Rays | $10^{-13}$ m to $10^{-8}$ m<br>$10^{-3}$ Å to 100 Å | $10^{16}$ Hz to $10^{20}$ Hz | Rontegen (1895) | Bombarding of fast moving electrons on | Affects the Photographic plate kept under photo-electric rays are there visible | medical detection engineering work |
| three | UV-rays | $6 \times 10^{-10}$ m to $4 \times 10^{-7}$ m<br>6 Å to 4000 Å | $7.5 \times 10^{14}$ Hz to $5 \times 10^{17}$ Hz | Ritter (1801) | Discharge tube, sun | able in chemical change in comparision to visible light. Producing sight sensitiveness | Preservation of food finger print detection |
| four | visible light | $4 \times 10^{-7}$ m to $7.8 \times 10^{-7}$ m<br>4000 Å to 7800 Å | $4 \times 10^{14}$ Hz to $7 \times 10^{19}$ Hz | Newton (1666) | Excited atoms sun | ~~Thermal effect~~ Producing sight sensitiveness | In photography in dark.<br>In achachigh diffent things |
| five | Infrared rays | $7.8 \times 10^{-7}$ m to $10^{-3}$ m<br>7800 Å to $10^{7}$ Å | $3 \times 10^{11}$ Hz to $4 \times 10^{14}$ Hz | William Herschell (1800) | Hot bodies | ~~propagation in form of narrow beam diffraction.~~ hot thermal effect | Radar systems, remote communication |
| six | micro waves | $10^{-3}$ m to 0.3 m | $10^{9}$ Hz to $10^{12}$ Hz | Heartz (1888) | special type of Vacuume tube | propergation in form of narrow beam. | Radar-system or remote communication. |
| seven | radio wave | 0.1 m to 6000 m | 5000 KHz to 1000 MHz | ~~Marconi~~ Marconi (1899) | oscillating circuit accelerating charge | Diffraction | Radio communication and in Tvs. |



# THANKYOU

# FOR READIN