

PHOTOCHEMISTRY

(PART 1: ELECTROMAGNETIC RADIATION)
(CHE-CC410)

BY- Dr. Madhu Rani Sinha
Associate Professor
Department of Chemistry
Patna Women's College
sinhamr@rediffmail.com

ELECTROMAGNETIC RADIATION

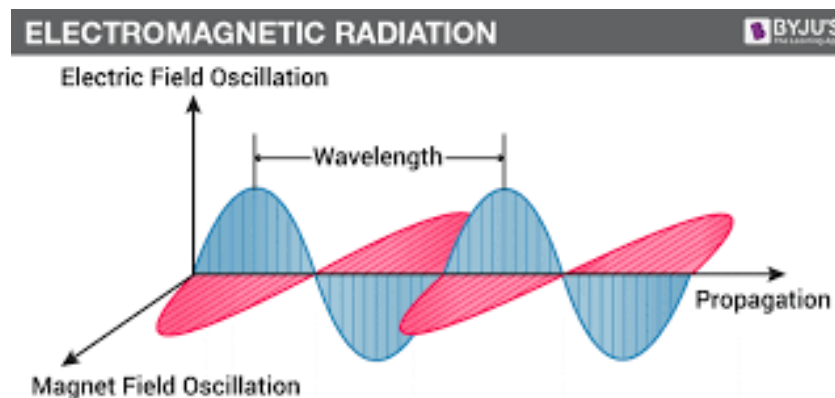
- A kind of radiation including visible light, radio waves, gamma rays, and X-rays, in which electric and magnetic fields vary simultaneously.
- **Electromagnetic waves** are produced by the motion of electrically charged particles.
- **Electromagnetic waves** that differ from each other in wavelength.
- Example of an electromagnetic radiation e.g. Radio **waves**, microwaves, visible light, and x rays.

Definition Of Electromagnetic Radiation

- Electromagnetic radiation can be defined as a form of energy that is produced by the movement of electrically charged particles traveling through a matter or vacuum or by oscillating magnetic and electric disturbance.
- The magnetic and the electric fields come at 90° to each other and the combined waves move perpendicular to both electric and magnetic oscillating fields occurring the disturbance.

Characteristics Of Electromagnetic Waves

- Characteristic of electromagnetic wave is its frequency.
- As per Maxwell, varying the electric field gives rise to a magnetic field.
- An accelerated charge produces a time-varying magnetic field which in turn produces a time-varying electric field.
- Thus, [electromagnetic wave](#) consists of sinusoidal time-varying electric and magnetic fields and both the fields are perpendicular to each other.



Properties Of Electro Magnetic Radiation

- The different types of **electromagnetic radiation** shown in the **electromagnetic spectrum** consists of radio **waves**, microwaves, infrared **waves**, visible light, ultraviolet **radiation**, X-rays, and gamma rays.
- The part of the **electromagnetic spectrum** that we are able to see is the visible light **spectrum**.

Frequency Of Electro Magnetic Wave

- **Electromagnetic waves** of different frequency are called by different names since they have different sources and effects on matter.
- In order of increasing frequency and decreasing wavelength these are: radio **waves**, microwaves, infrared **radiation**, visible light, ultraviolet **radiation**, X-rays and gamma rays.

The Electromagnetic Spectrum

- The electromagnetic (EM) spectrum is the range of all types of EM radiation.
- Radiation is energy that travels and spreads out as it goes –
 - a. Visible light that comes from a lamp
 - b. Radio waves that come from a radio station.
 - c. Other types of EM radiation that make up the electromagnetic spectrum are microwaves, infrared light, ultraviolet light, X-rays and gamma-rays.

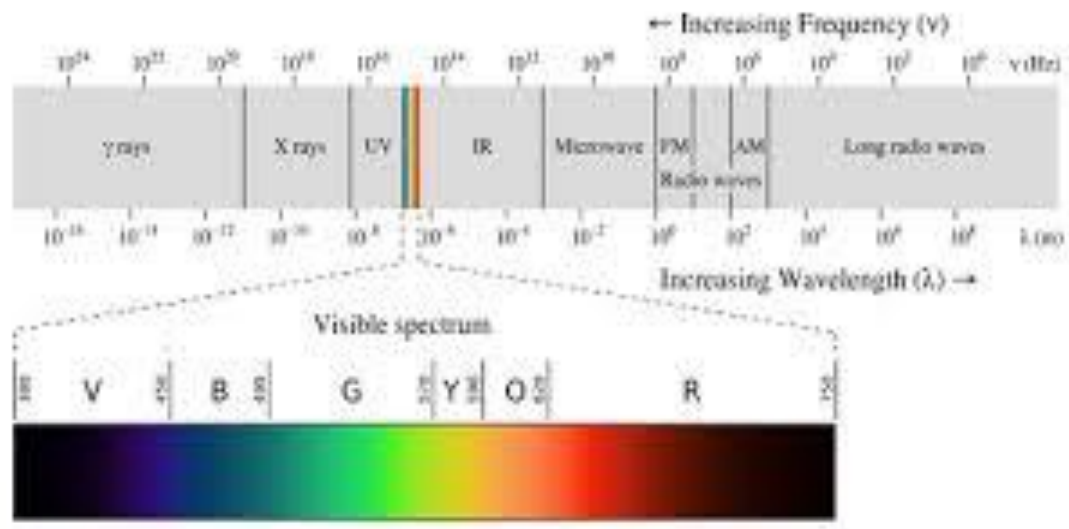
Type Of Electromagnetic Spectrum

7 types of electromagnetic radiation

- **Though the sciences generally classify EM waves into seven basic types, all are manifestations of the same phenomenon.**
- Radio Waves: Instant Communication. ...
- Microwaves: Data and Heat. ...
- Infrared Waves: Invisible Heat. ...
- Visible Light Rays. ...
- Ultraviolet Waves: Energetic Light. ...
- X-rays: Penetrating Radiation. ...
- Gamma Rays: Nuclear Energy.

Different Type Of Electromagnetic Spectrum (Uses)

- **Radio:** Your radio captures radio waves emitted by radio stations, bringing your favorite tunes. Radio waves are also emitted by stars and gases in space.
- **Microwave:** Microwave radiation will cook your popcorn in just a few minutes, but is also used by astronomers to learn about the structure of nearby galaxies.
- **Infrared:** Night vision goggles pick up the infrared light emitted by our skin and objects with heat. In space, infrared light helps us map the dust between stars.



Different Type Of Electromagnetic spectrum(contd.)

- **Visible:** Our eyes detect visible light. Fireflies, light bulbs, and stars all emit visible light.
- **Ultraviolet:** Ultraviolet radiation is emitted by the Sun and are the reason skin tans and burns. "Hot" objects in space emit UV radiation as well.
- **X-ray:** A dentist uses X-rays to image your teeth, and airport security uses them to see through your bag. Hot gases in the Universe also emit X-rays.
- **Gamma ray:** Doctors use gamma-ray imaging to see inside your body. The biggest gamma-ray generator of all is the Universe.

Electromagnetic Theory

- Magnetism and electricity were once considered as separate forces. However in the year 1873, Clerk Maxwell, a Scottish physicist developed a unified theory of electromagnetism. Its study deals with how the electrically charged particles interact among themselves and with the magnetic field. The main electromagnetic interactions are provided in the points mentioned below.
- Magnetic poles come in pairs that repel and attract each other, just like electric charges do.
- The force of repulsion or attraction between two electric charges is inversely proportional to the square of the distance between the particles.
- An electric field in motion produces a magnetic field.
- A wire with electric current produces a magnetic field whose direction depends on the direction of the **electric current**.