Electromagnetic spectrum

The electromagnetic spectrum encompasses a wide range of electromagnetic waves, varying in frequency and wavelength. It includes:

1. **Radio Waves:**
    - **Wavelength Range:** From hundreds of meters to thousands of kilometers.
    - **Applications:** Broadcasting (AM and FM radio), television, communication (Wi-Fi, Bluetooth), radar.
2. **Microwaves:**
    - **Wavelength Range:** From one millimeter to one meter.
    - **Applications:** Microwave ovens, satellite communication, radar, certain types of wireless communication.
3. **Infrared Radiation:**
    - **Wavelength Range:** From one micrometer to one millimeter
    - **Applications:** Night vision devices, remote controls, thermal imaging, infrared spectroscopy.
4. **Visible Light:**
    - **Wavelength Range:** From around 400 to 700 nanometers
    - **Applications:** Human vision, optical communication (fiber optics), photography.
5. **Ultraviolet Radiation:**
    - **Wavelength Range:** From 10 to 400 nanometers..
    - **Applications:** UV lamps for sterilization, forensic analysis, astronomy.
6. **X-rays:**
    - **Wavelength Range:** From 0.01 to 10 nanometers.
    - **Applications:** Medical imaging (X-ray radiography), airport security scanners, material testing.
7. **Gamma Rays:**
    - **Wavelength Range:** Below 0.01 nanometers.

- **Applications:** Medical imaging (gamma-ray imaging), cancer treatment (radiotherapy), nuclear industry.

Beer-Lambert Law

The Beer-Lambert Law, also known as Beer's Law or the Beer-Lambert-Bouguer Law, describes the relationship between the absorption of light by a substance and its concentration in a solution. It is commonly used in spectrophotometry and helps to quantify the concentration of a solute in a solution based on the amount of light absorbed.

The Beer-Lambert Law is expressed by the equation:

$A=\varepsilon \cdot c \cdot l$

where:

- A is the absorbance of the solution,
- ε is the molar absorptivity (or molar extinction coefficient), a constant for a given substance at a specific wavelength,
- c is the concentration of the solute in the solution,
- l is the path length of the cuvette or container through which the light passes.

The law can also be expressed as :

$A=\log_{10}(1/T) = \varepsilon \cdot c \cdot l$

where T is the transmittance of the solution.

The Beer-Lambert Law is based on the principle that the absorbance of a solution is directly proportional to the concentration of the absorbing species and the path length of the light through the solution.