Introduction to Molecular spectroscopy

What is Spectroscopy?

Spectroscopy is the study and measurement of interaction of radiant energy and the matter

Electromagnetic Radiation

This is radiant energy and consists of mutually perpendicularElectric and Magnetic vectors which oscillates sinusodally as wave propagates at high speed

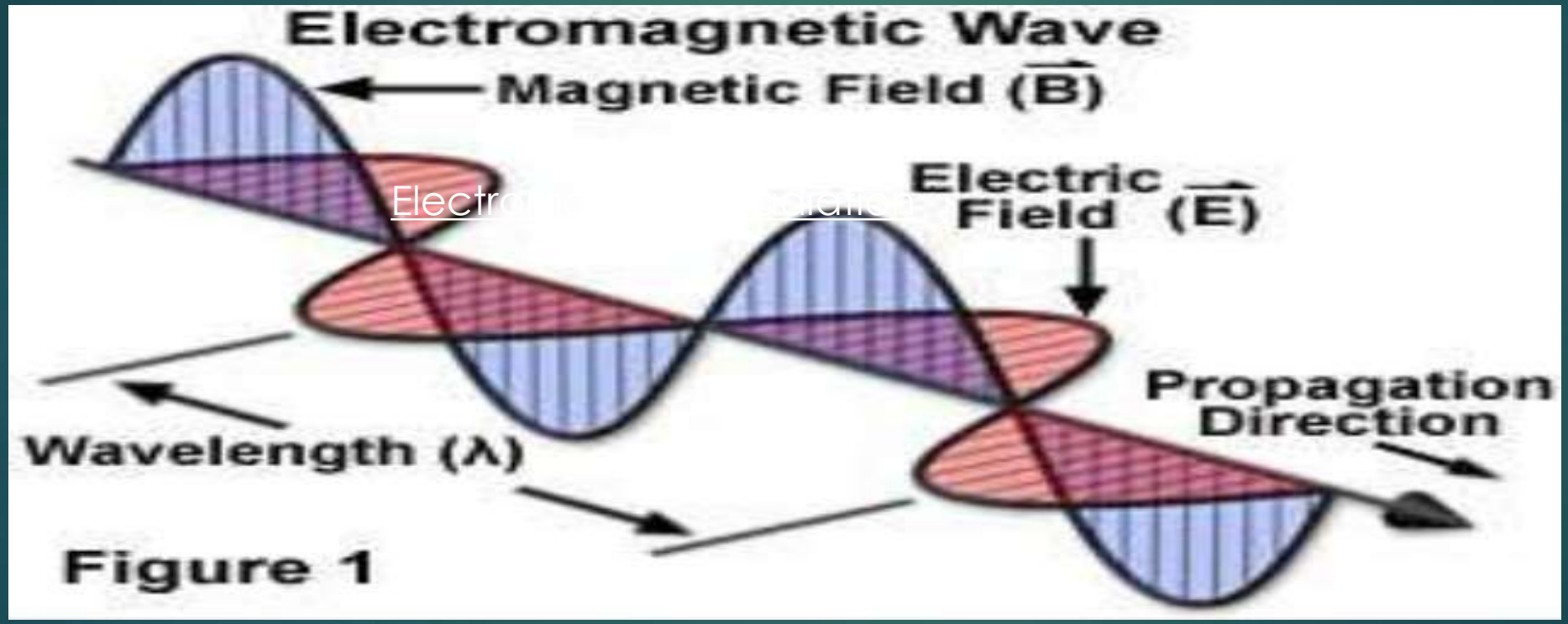


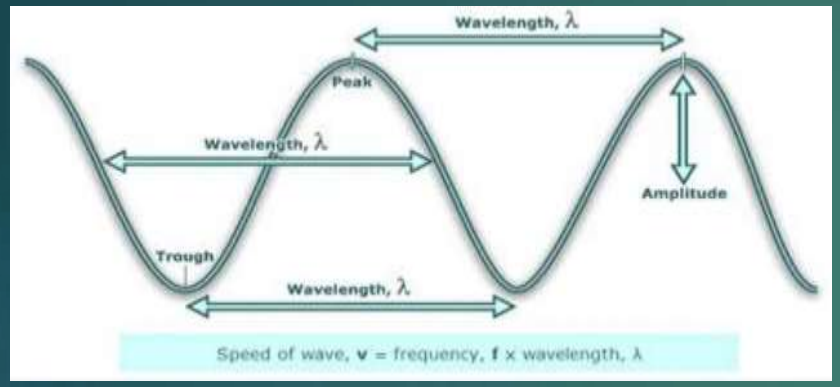
Figure 1

Electromagnetic Radiation:

When fall on matter there may be various phenomena depending on the nature of radiation and that of matter

- Reflection
- Emission
- Absorption
- Transmission
- Scattering

The characterstics of a wave



Wavelength (λ) : The distance between two successive crests or troughs is wavelength.

Frequency (ν) : This is the number of waves or complete cycles passing through a point per second. The unit is cycles per second or Hz

Wavenumber ($\bar{\nu}$): It is the number of cycles or wavelengths per unit distance. It is the reciprocal of wavelength.

Amplitude (a) : The maximum displacement of wave from the mean position is called as amplitude.

Velocity (C): It is distance travelled by wave in unit time. The velocity of radiation I vacuum is 3.0×10^8 m/s.

Energy of radiation (E) :The radiation carries energy in the form of energy packets called as photons or quanta.Each photon has a discrete amount of energy given by Planck equation

$$E = h\nu$$

Where h is plank's constant and ν is frequency of radiation.

$$E \alpha \nu$$

Hence higher the frequency,more energetic is the radiation and lower the frequency, less energetic the radiation.

Velocity of radiartion is given by formula,

$$C = \nu\lambda$$

$$\nu = C/\lambda$$

So energy of radiation is given by formula,

$$E = hC/\lambda$$

$$E \alpha \ 1/\lambda$$

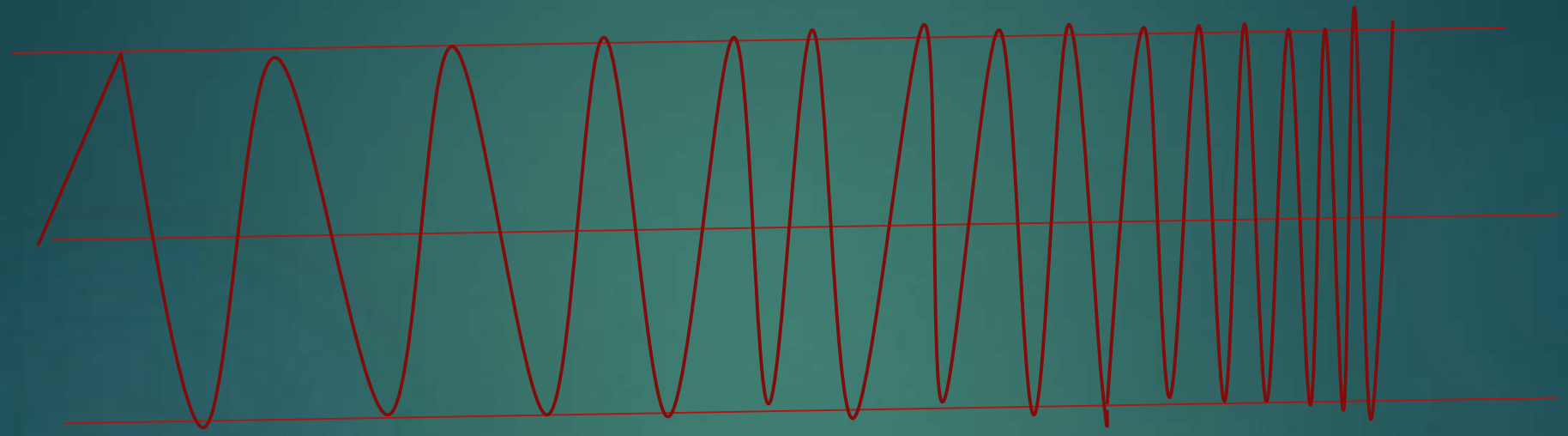
Energy is having inverse relationship with wavelength.Longer the wavelength,lower the energy of radiation and shorter the wavelength higher the frequency of radiation.

Electromagnetic Spectrum :Different Regions

- Radio wave region
- Microwave region
- Infrared region
- Visible region
- Ultraviolet region
- X-ray region
- Gamma ray region

λ decreases

Increases ν



As wavelength goes on decreasing, frequency goes on increasing and also energy goes on increasing.

Some Interconversions