1.1 PROPERTIES OF ELECTROMAGNETIC RADIATION

- Field is a physics term for a region that is under the influence of some force that can act on matter within that region. For example, the Sun produces a gravitational field that attracts the planets in the solar system and thus influences their orbits.

- Stationary electric charges produce electric fields, whereas moving electric charges produce both electric and magnetic fields. Regularly repeating changes in these fields produce what we call electromagnetic radiation. Electromagnetic radiation transports energy from point to point. This radiation propagates (moves) through space at 299,792 km per second (about 186,000 miles per second). That is, it travels at the speed of light. Indeed light is just one form of electromagnetic radiation.

- Some other forms of electromagnetic radiation are X-rays, microwaves, infrared radiation, AM and FM radio waves, and ultraviolet radiation. The properties of electromagnetic radiation depend strongly on its frequency. Frequency is the rate at which the radiating electromagnetic field is oscillating. Frequencies of electromagnetic radiation are given in Hertz (Hz), named for Heinrich Hertz (1857- 1894), the first person to generate radio waves. One Hertz is one cycle per second.

Frequency and Wavelength

- As the radiation propagates at a given frequency, it has an associated wavelength— that is, the distance between successive crests or successive troughs. Wavelengths are generally given in meters (or some decimal fraction of ameter) or Angstroms (Å, 10-10 meter).

- Since all electromagnetic radiation travels at the same speed (in a vacuum), the number of crests (or troughs) passing a given point in space in a given unit of time (say, one second), varies with the wavelength. For example, 10 waves of wavelength 10 meters will pass by a point in the same length of time it wouldtake 1 wave of wavelength 100 meters.

- Since all forms of electromagnetic energy travel at the speed of light, the wavelength equals the speed of light divided by the frequency of oscillation (moving from crest to crest or trough to trough).
- In the drawing below, electromagnetic waves are passing point B, moving to theright at the speed of light (usually represented as c, and given in km/sec). If wemeasure to the left of B a distance D equal to the distance light travels in one second (2.997 x 105 km), we arrive at point A along the wave train that will just pass point B after a period of 1 second (moving left to right). The frequency f of the wave train—that is, the number of waves between A and B—times the lengthof each, l, equals the distance D traveled in one second