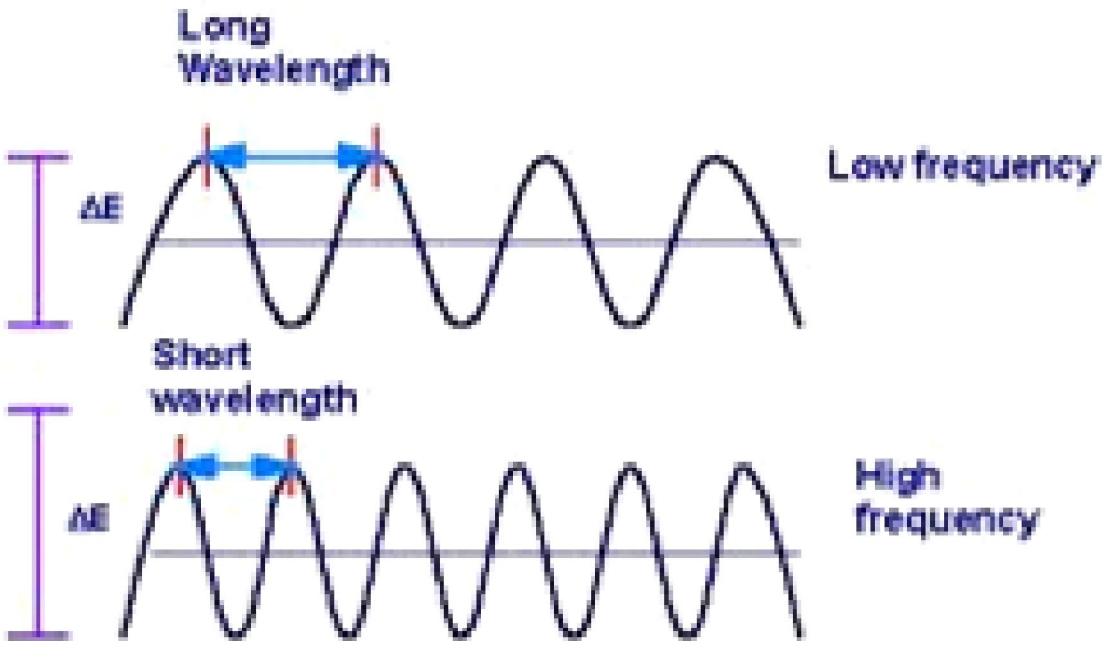
Lighting – Terms and Units

Terminology

- Light
  - Wavelength
  - Color temperature
  - Flux density
  - Orientation of polarization
  - Degree of polarization
- Light Sources
  - Energy radiated
  - Luminous Intensity
  - Luminous flux
  - Brightness
- Lighting Materials
  - Reflectance
  - Transmittance
  - Optical density

Wavelength (λ)

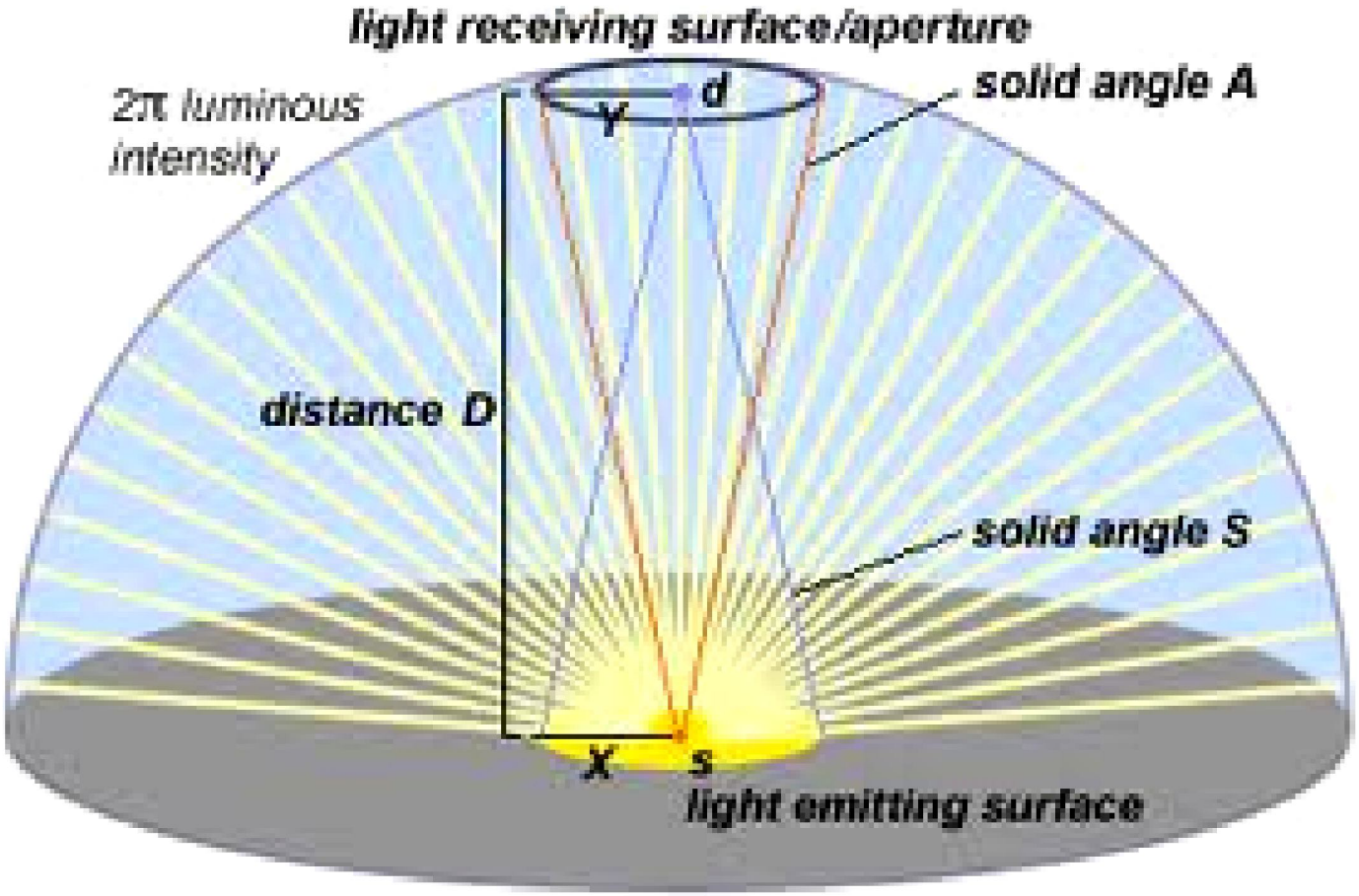
- The distance over which the wave's shape repeats or the distance between consecutive corresponding points of the same phase. Unit is Micron.



Luminous Intensity

- The quantity of visible light that is emitted by a source in unit time per unit solid angle. Unit is Candela or Candle Power.
- Solid angle - The solid angle, Ω, is the two-dimensional angle in three-dimensional space that an object subtends at a point. Unit is Steradian.

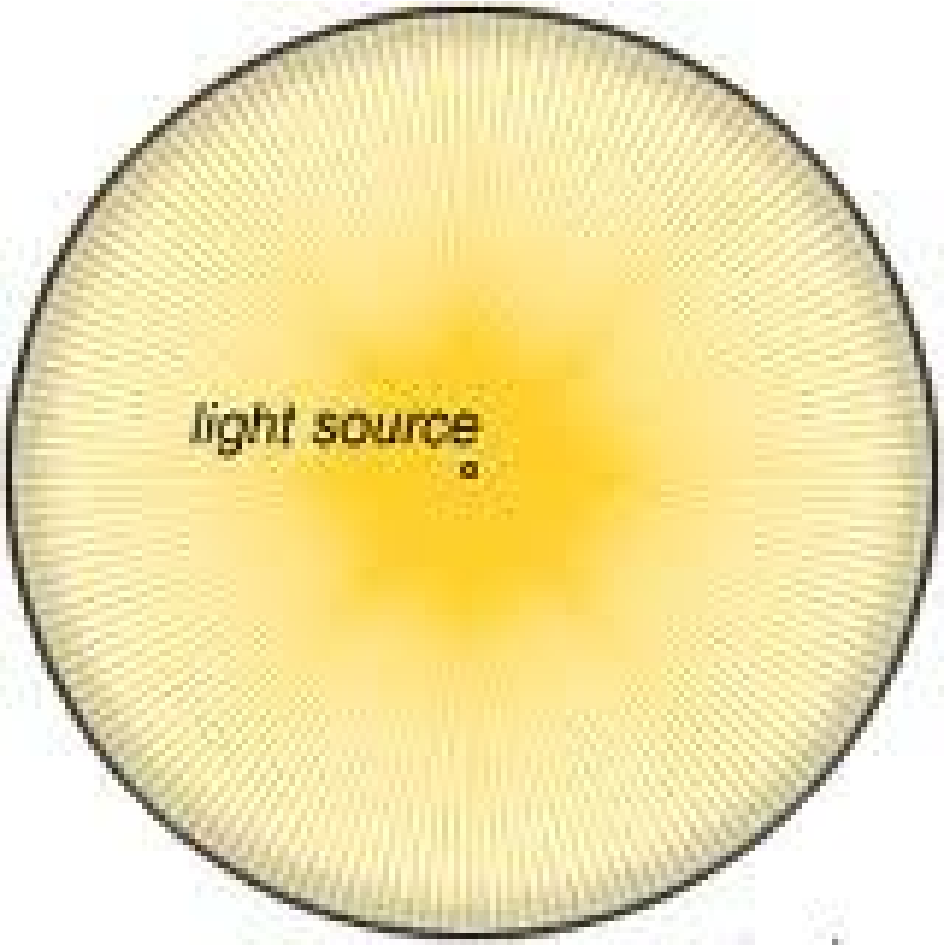
Luminous Intensity



Luminous Flux

- The total amount of light energy radiated from a light source in all directions. Unit is Lumens.
- Lumen – The total amount of light energy emitted into one solid angle or steradian by a point source having a luminous intensity of 1 candela.

Luminous Flux



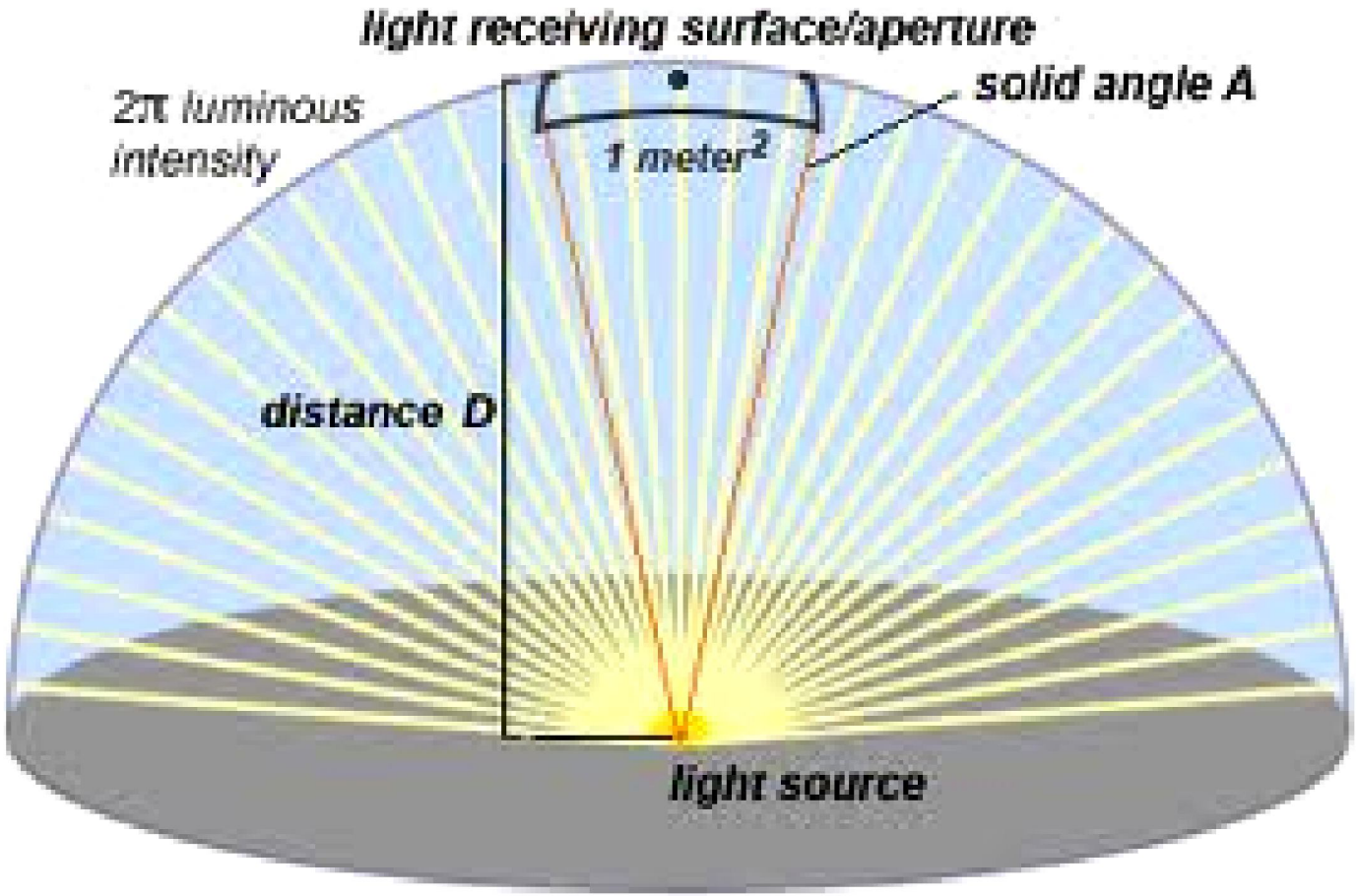
Illuminance or Flux density (LUX)

- The amount of light energy reaching a given point on a defined surface area or the luminous flux per square meter. Unit is Footcandle. 10 footcandles = 100 Lux.
- Inverse Square law:

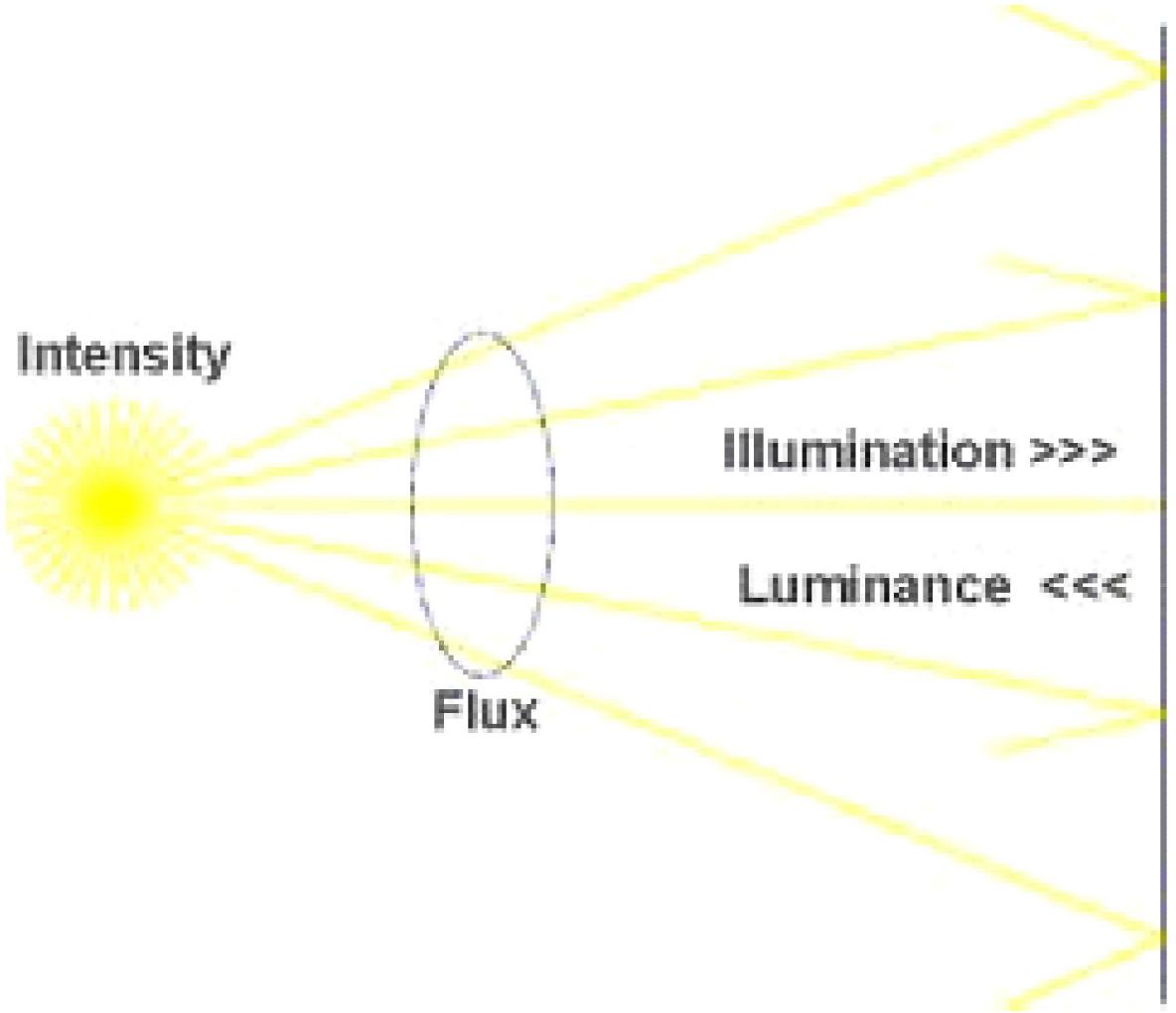
  $E = \text{Candle power}/D^2$ (lm/m^2)

  where D is the distance between the source and the surface.

Illuminance or Flux density (LUX)

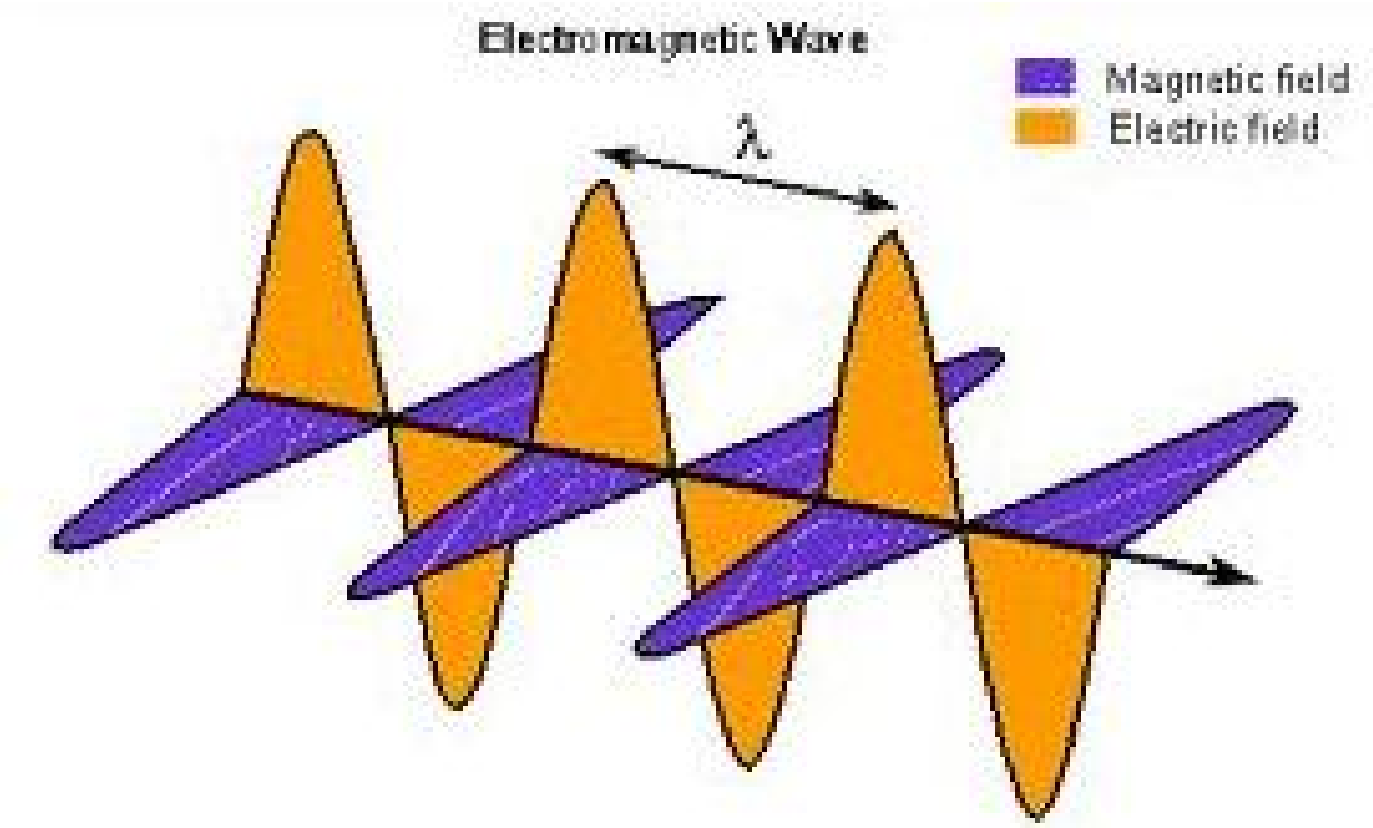


All parameters



Polarization

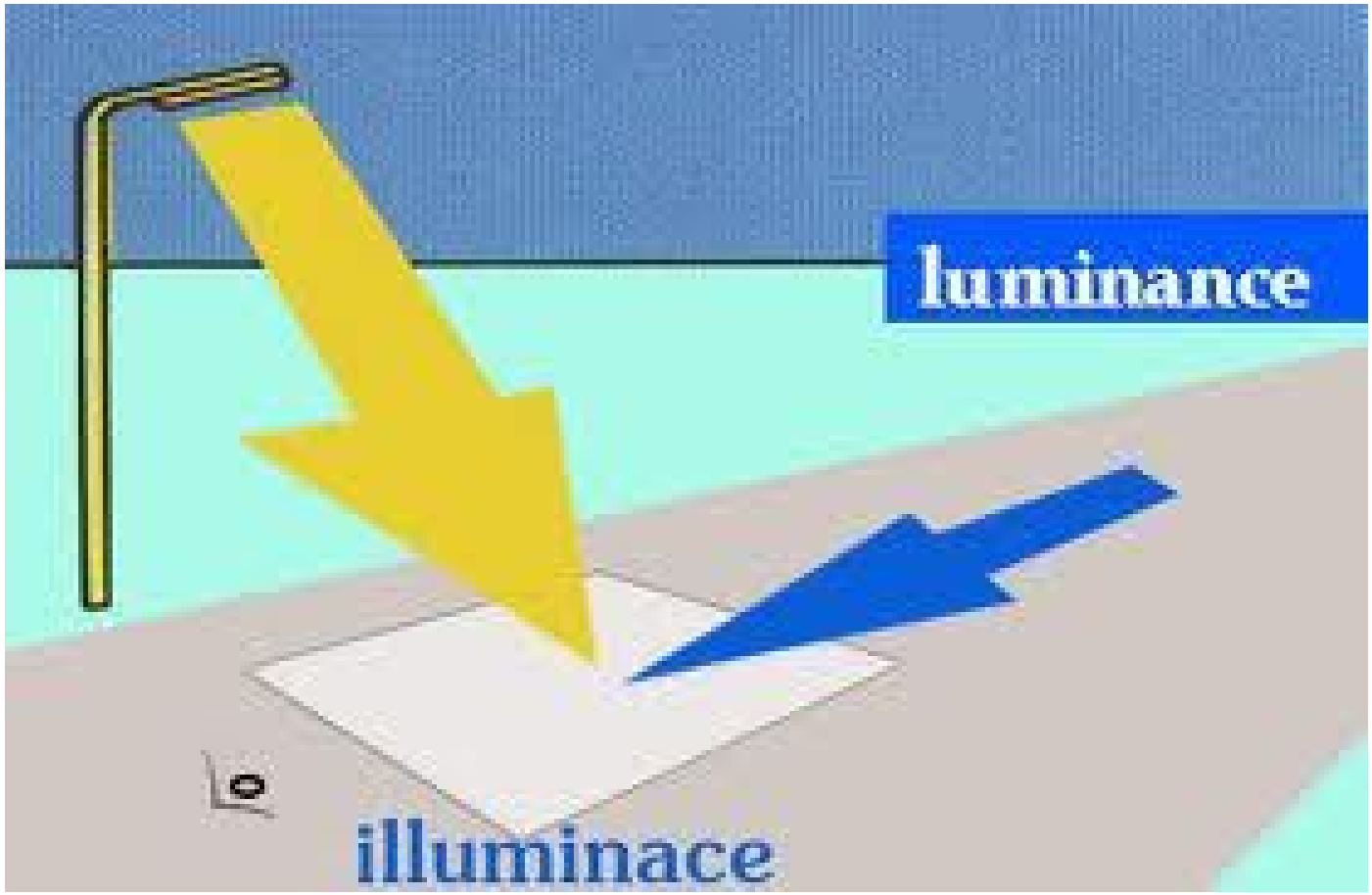
- Degree of polarization - Quantity used to describe the portion of an electromagnetic wave which is polarized. A perfectly polarized wave has a DOP of 100%, whereas an unpolarized wave has a DOP of 0%.
- Orientation of polarization – angle at which they are polarized. Unit is degree.


Electromagnetic Wave
Magnetic field
Electric field
λ

Terminology

- Energy radiated – Amount of light energy radiated per square inch. Unit is ergs/sq.in. 1 ergs = 10^{-7} J.
- Luminance or Brightness – Measure of light exiting a surface. Unit is Footlambert.
- Footlambert – One lumen of light emitted by one square foot of surface area.

Luminance



Terminology

- Reflectance - The ratio of the total amount of radiation reflected by a surface to the total amount of radiation incident on the surface.
- Transmittance - The ratio of the radiant energy transmitted to the total radiant energy incident on a given body.
- Optical Density – It is the base 10 logarithm of opacity. Opacity is the reciprocal of transmittance.

$$OD = \log(1/T)$$