Title : Radiation

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Lecture No : 3 (as per TT)

Source of information : Textbook and Online source

Radiation

- Radiation refers to the transport of energy through space by electronic space.
- Radiation differs from Conduction and Convection heat transfer mechanisms, in the sense that it does not require the presence of a material medium to occur.
- Energy transfer by radiation occurs at the speed of light and suffers no attenuation in vacuum. Radiation can occur between two bodies separated by a medium colder than both bodies.
- According to Maxwell theory, energy transfer takes place via electromagnetic waves in radiation. Electromagnetic waves transport energy like other waves and travel at the speed of light. Electromagnetic waves are characterized by their frequency ν (Hz) and wavelength λ (μm), where:

$$\lambda = c / \nu$$

where c is the speed of light in that medium;

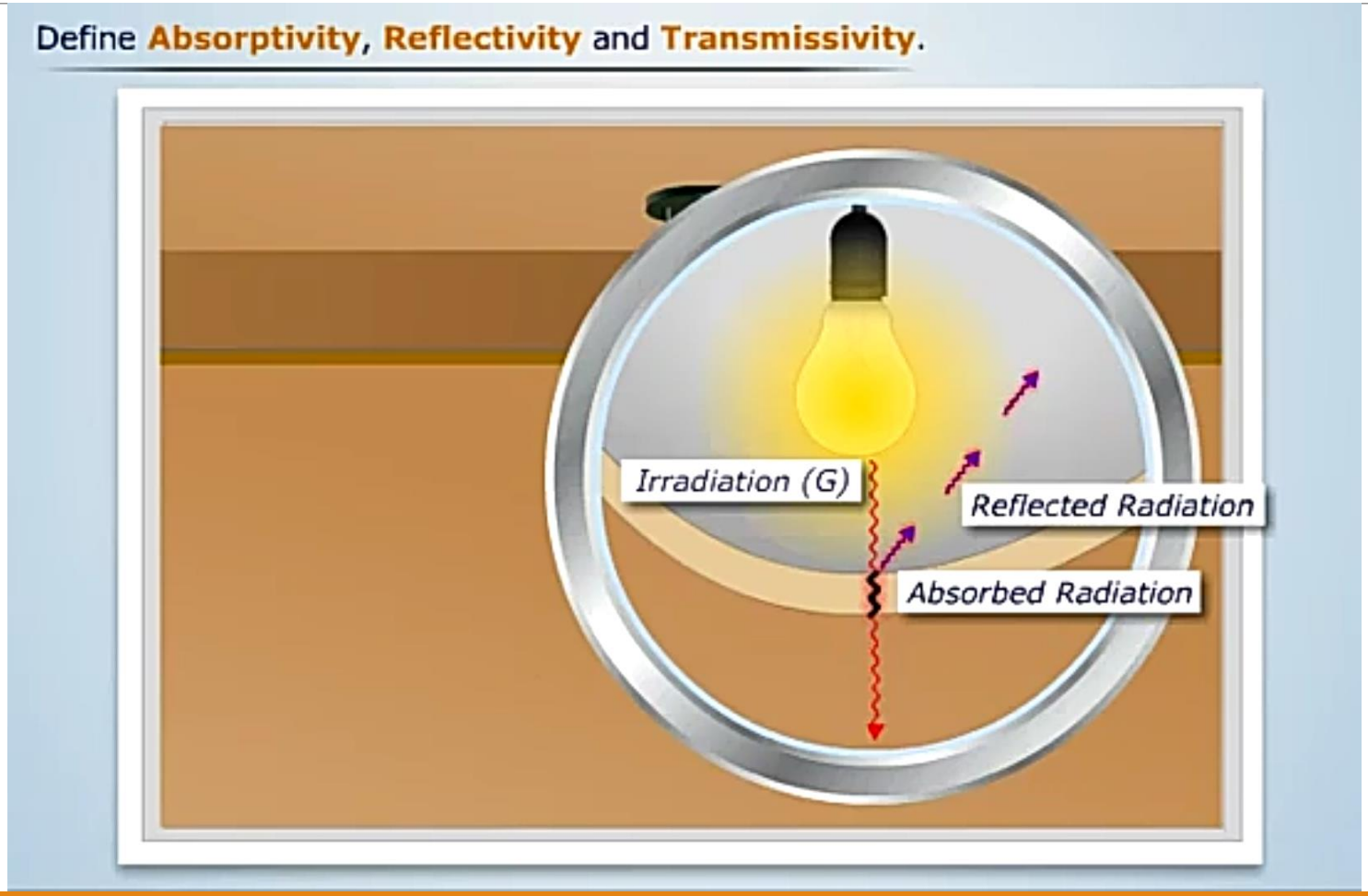
Radiation

Absorptivity

Reflectivity

Transmissivity

Radiation


Define Absorptivity, Reflectivity and Transmissivity.
Irradiation (G)
Reflected Radiation
Absorbed Radiation

Radiation

Define **Absorptivity**, **Reflectivity** and **Transmissivity**.

Mathematically,

Absorptivity $\alpha = \frac{\text{Absorbed Radiation}}{\text{Incident Radiation}} = \frac{G_{abs}}{G}$ $0 \le \alpha \le 1$

Reflectivity $\rho = \frac{\text{Reflected Radiation}}{\text{Incident Radiation}} = \frac{G_{ref}}{G}$ $0 \le \rho \le 1$

Transmissivity $\tau = \frac{\text{Transmitted Radiation}}{\text{Incident Radiation}} = \frac{G_{tr}}{G}$ $0 \le \tau \le 1$

Where, G = Irradiation or Radiation Energy incident on the Surface of a Body
G_{abs} = Irradiation Absorbed by the Surface of a Body
G_{ref} = Irradiation Reflected by the Surface of a Body
G_{tr} = Irradiation Transmitted by the Surface of a Body

Keywords
- *Fraction*
- *Irradiation Absorbed*
- *Irradiation Reflected*
- *Irradiation Transmitted*

Fraction of *Irradiation Absorbed* by the surface of a body is called **ABSORPTIVITY**, and is denoted by α.

Fraction of *Irradiation Reflected* by the surface of a body is called **REFLECTIVITY**, and is denoted by ρ.

Fraction of *Irradiation Transmitted* by the surface of a body is called **TRANSMISSIVITY**, and is denoted by τ.

Note:

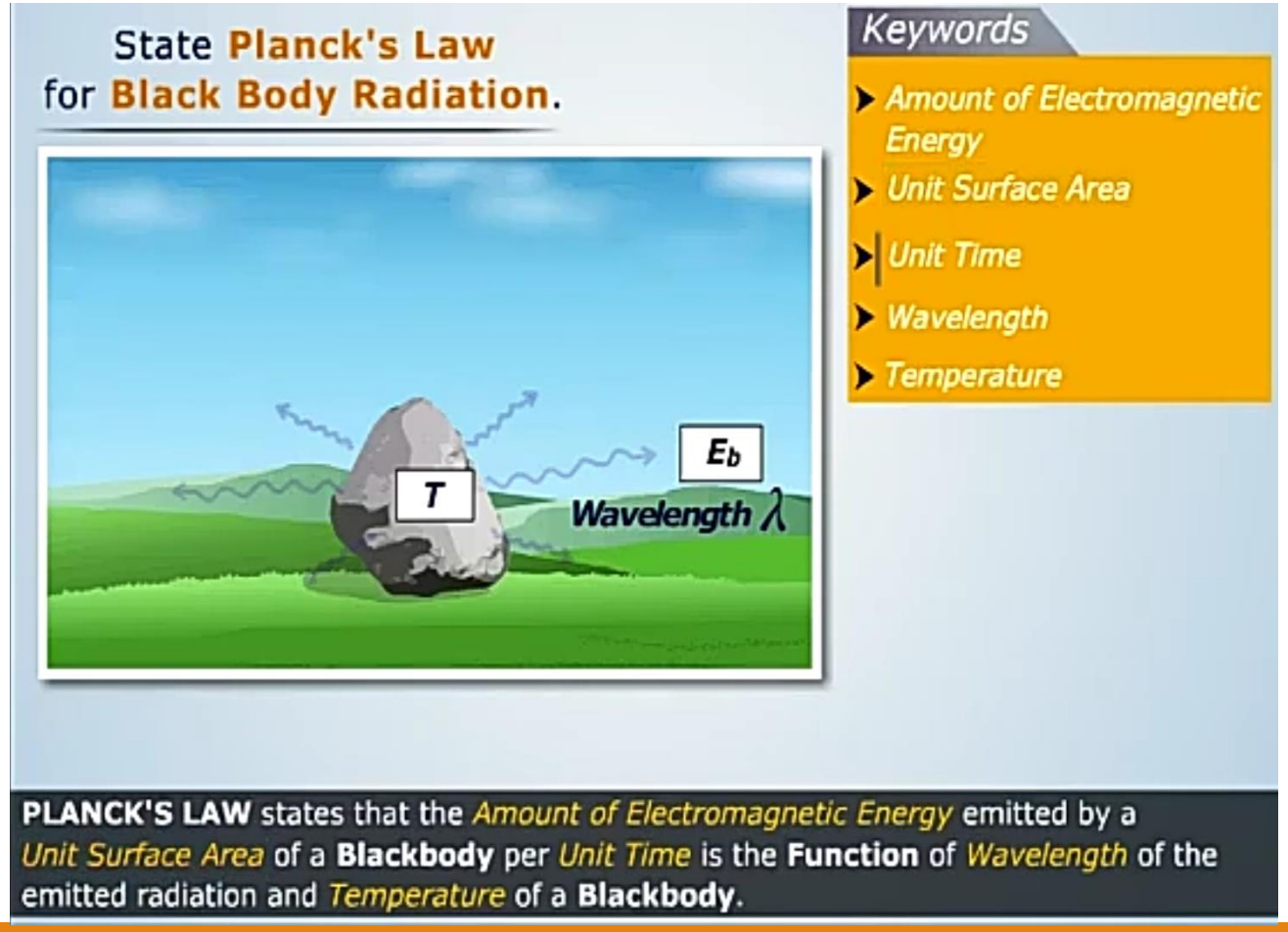
1. Relation Between **Absorptivity**, **Reflectivity**, and **Transmissivity** is given by: $\alpha + \rho + \tau = 1$
2. For **Opaque Surface** like **Mirrors**, **Trasmissivity** is zero, $\tau = 0$ Thus, $\alpha + \rho = 1$

Radiation

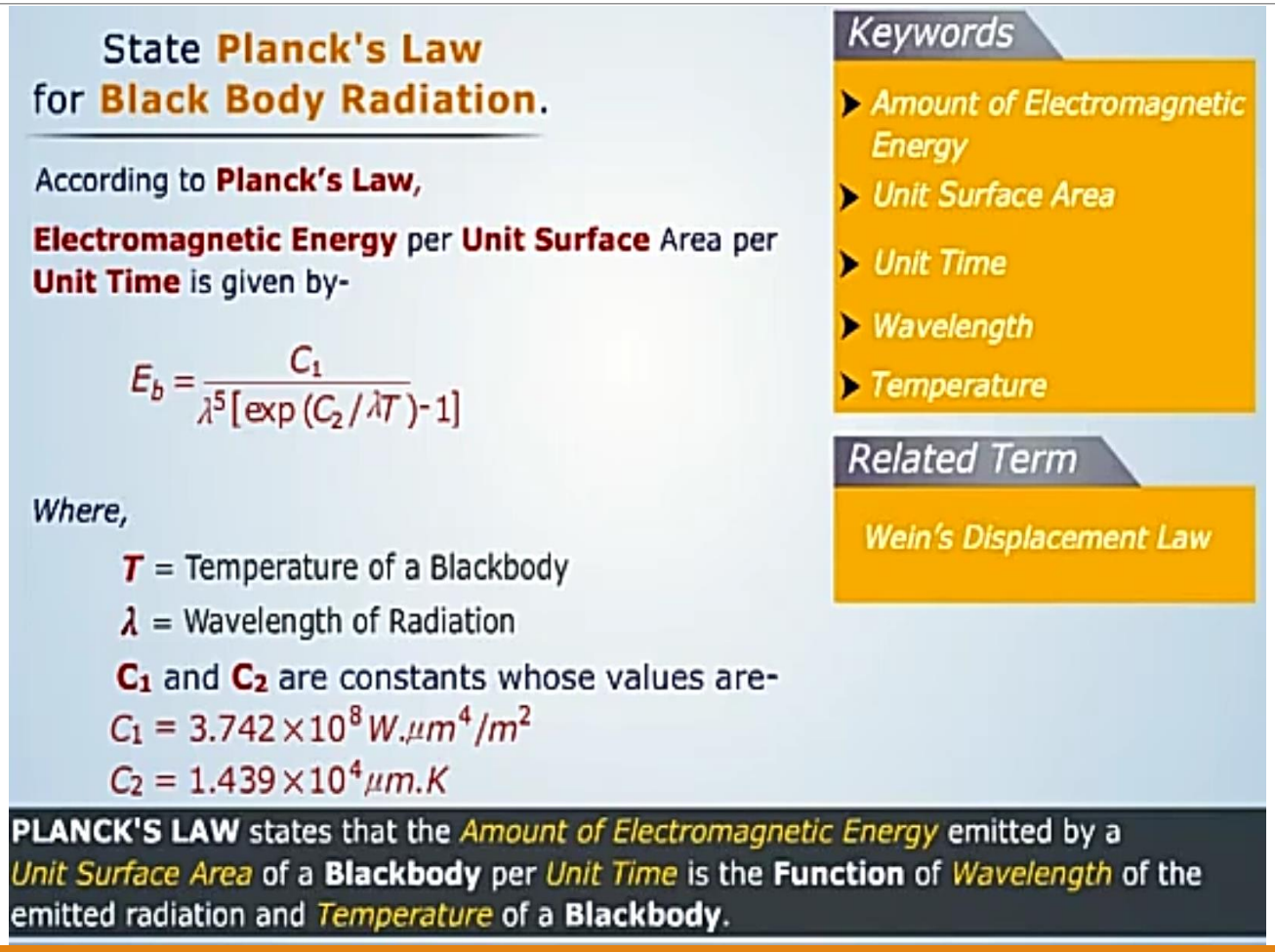
Black body:

A body which a =1. r=ζ=0. i.e., which absorbs all incident energy, is called a black body.

Radiation


State Planck's Law
for Black Body Radiation.
Keywords
Amount of Electromagnetic Energy
Unit Surface Area
Unit Time
Wavelength
Temperature
T
Eb
Wavelength λ
PLANCK'S LAW states that the Amount of Electromagnetic Energy emitted by a Unit Surface Area of a Blackbody per Unit Time is the Function of Wavelength of the emitted radiation and Temperature of a Blackbody.

Radiation


State Planck's Law for Black Body Radiation.
According to Planck's Law,
Electromagnetic Energy per Unit Surface Area per Unit Time is given by-
$E_b = \frac{C_1}{\lambda^5[\exp(C_2/\lambda T)-1]}$
Where,
T = Temperature of a Blackbody
λ = Wavelength of Radiation
C1 and C2 are constants whose values are-
$C_1 = 3.742 \times 10^8 W.\mu m^4/m^2$
$C_2 = 1.439 \times 10^4 \mu m.K$
Keywords
Amount of Electromagnetic Energy
Unit Surface Area
Unit Time
Wavelength
Temperature
Related Term
Wein's Displacement Law
PLANCK'S LAW states that the Amount of Electromagnetic Energy emitted by a Unit Surface Area of a Blackbody per Unit Time is the Function of Wavelength of the emitted radiation and Temperature of a Blackbody.

- Assignment: No assignment
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