Date: / /

# Black body Radiation

Iron – 100°c → E.M. Radiation → ~~Improved~~ Infrared. ray

1000°c → " " → Visible red ray (dull red)

2000°c → (bright ")

4000°c → (blue white)

Kirchoff law:

$$\frac{\text{Emissive Power}}{\text{Absorptive Power}} = \text{Constant}$$

Emissive power is the amount of energy radiated through the body per unit surface area per unit time

$E = \sigma T^4$

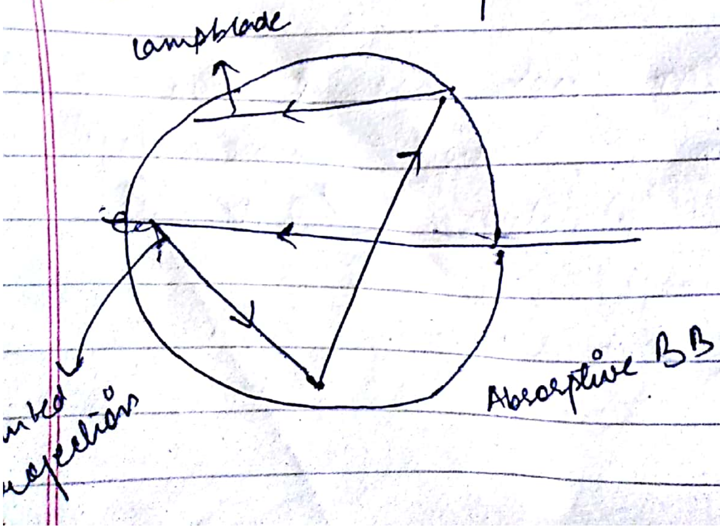
↓

$\frac{J}{m^2 \, sec} = Watt/m^2$

$A \cdot P = \frac{\text{amt of energy absorbed by the body}}{\text{Total incident in it}}$

↓

(1) → Black body



Page No:
Date:

At what speed does K.E of particle is equal to rest mass energy

$$KE = mc^2$$

$$mc^2 - m_0c^2 = m_0c^2$$

$$mc^2 = 2m_0c^2$$

$$\frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} \cdot c^2 = 2m_0c^2$$

What is the energy of a photon whose momentum is same as that of a proton whose K.E = 10 MeV

E photon = ?

P photon = P proton

K.E proton = 10 MeV

$$E^2 = P^2c^2 + m^2c^4$$ Rest mass energy

$$\therefore (948)^2 = P^2c^2 + (938)^2$$

for proton

$$PC = \sqrt{(948)^2 - (938)^2}$$

$$= 137.3 \text{ MeV}$$

$$P = \frac{137.3 \text{ MeV}}{(c)}$$

$$P_{photon} = 138.3 (\text{meV}/c)$$

$$E_{photon} = Pc$$

$$= 137.3 \text{ MeV}$$

Scanned by CamScanner

Page No:
Date: / /

$$(m_0c^2)_{e^-} = \frac{9.1\times10^{-31}\times10^{6}}{1.6\times10^{-19}\times10^{6}}\ MeV$$
$$= 0.51\ MeV$$

$$(m_0c^2)_{photon} = \frac{1.67\times10^{-27}\times}{}$$
$$= 938\ MeV$$

Energy Momentum Relation

$$p = mv$$
$$= \frac{m_0v}{\sqrt{1-\frac{v^2}{c^2}}}$$

$$p^2c^2 = \frac{m_0^2v^2c^2}{1-\frac{v^2}{c^2}}$$

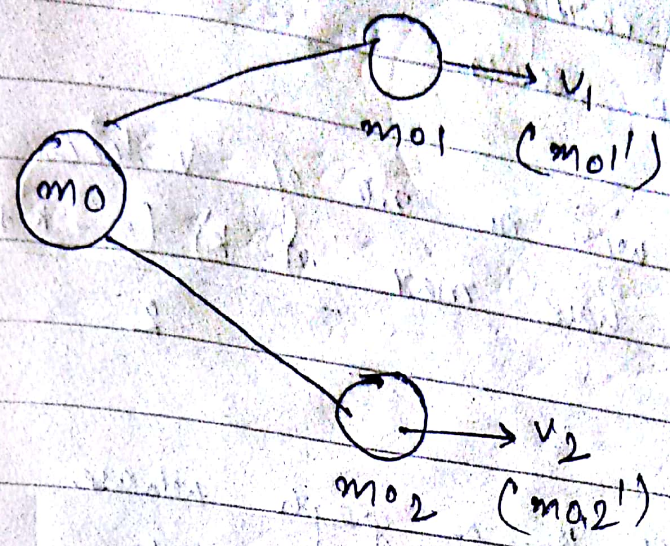
$$p^2c^2 + m_0^2c^4 = \frac{m_0^2v^2c^2}{1-\frac{v^2}{c^2}} + m_0^2c^4$$
$$= \frac{m_0^2c^4}{1-v^2/c^2} = \left(\frac{m_0c^2}{\sqrt{1-\frac{v^2}{c^2}}}\right)^2$$

$$E^2 = p^2c^2 + m_0^2c^4$$

A body of rest mass $m_0$ break up into 2 part spontaneously with rest mass with $m_{01}$ & $m_{02}$ & speed $v_1$ & $v_2$ respectively. Prove that $m_0 > m_{01} + m_{02}$

$$m_0v = m_{01}v_1 + m_{02}v_2$$
$$v = \ .$$

Scanned by CamScanner



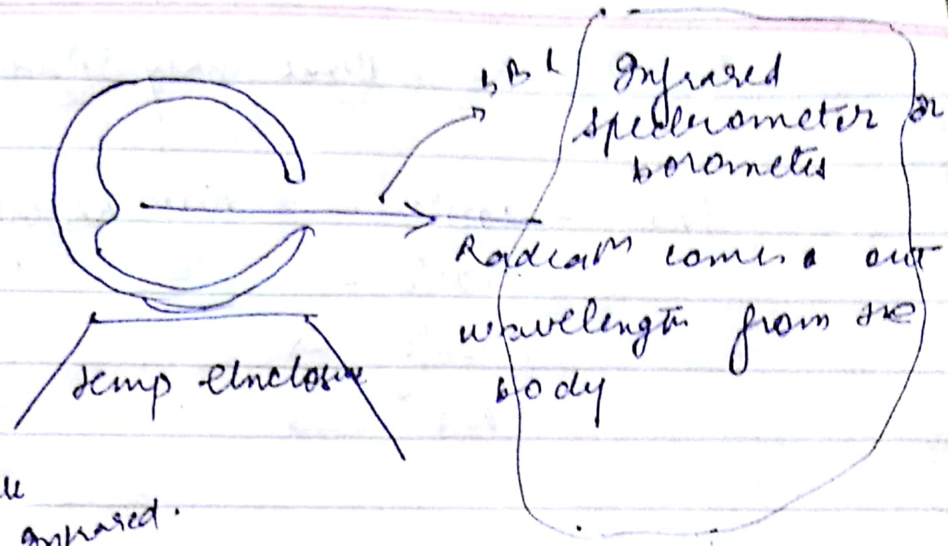

$$m_{01}' = \frac{m_{01}}{\sqrt{1 - v^2/c^2}} \qquad m_{02}' = \frac{m_{02}}{\sqrt{1 - v_2^2/c^2}}$$

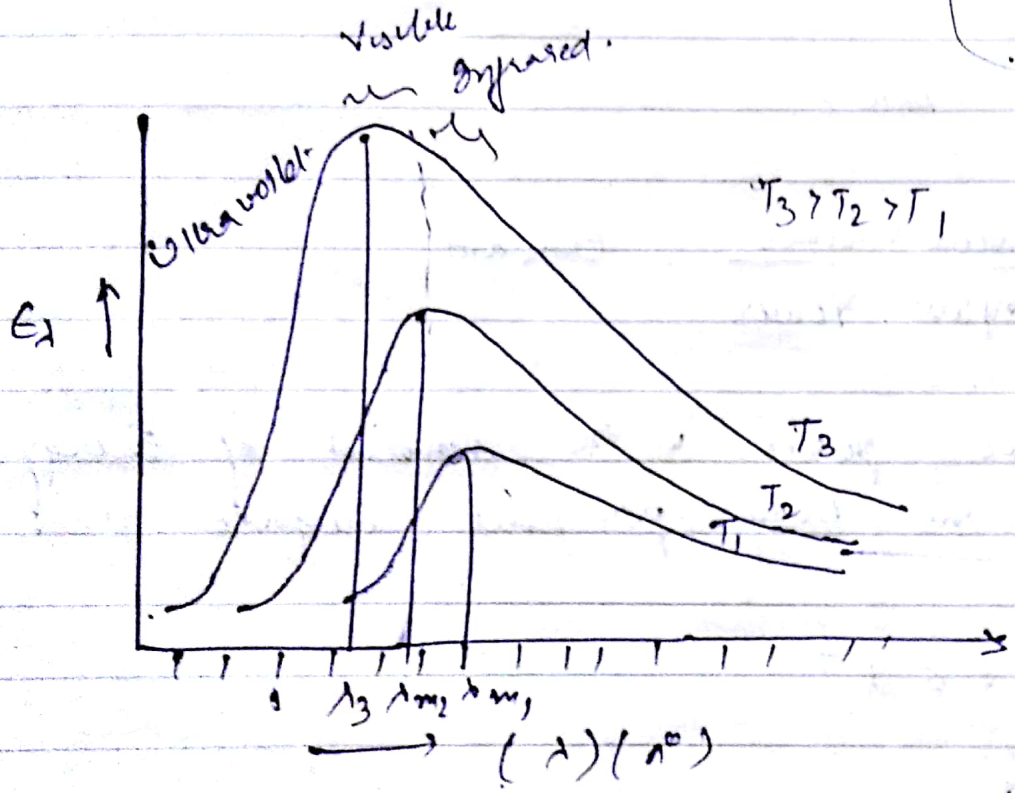
$$m_0 c^2 = m_{01}' c^2 + m_{02}' c^2$$

$$= \frac{m_{01} c^2}{\sqrt{1 - \frac{v_1^2}{c^2}}} + \frac{m_{02} c^2}{\sqrt{1 - \frac{v_2^2}{c^2}}}$$

$$m_0 = \frac{m_{01}}{\sqrt{1 - \frac{v_1^2}{c^2}}} + \frac{m_{02}}{\sqrt{1 - \frac{v_2^2}{c^2}}}$$

$$\sqrt{1 - \frac{v_1^2}{c^2}} < 1 \qquad \sqrt{1 - \frac{v_2^2}{c^2}} < 1$$




$\lambda_1 T_1 = \lambda_2 T_2$ Wein's Displacement Law:

The characteristics