Q1) A Green light has wavelength of 525nm. Determine The energy for The green light in Joules.

$\boxed{\text{The solutio}}$

to find frequancey, we know That $\boxed{c = \lambda \times \nu}$

$$\nu = \frac{c}{\lambda} = \frac{3 * 10^{8}\ \cancel{m}/s}{525 * 10^{-9}\ \cancel{m}} = 5.71 * 10^{14}/s$$

to find energy → we know That

$$E = h * \nu$$

$$= \left(6.626 * 10^{-34}\ J.s\right) * \left(5.71 * 10^{14}\ s^{-1}\right)$$

$$= 3.78 * 10^{-19}\ J/photon$$

Q_2) Power output by a radiating body as a function of Temperature is given by The function below

$\boxed{P = A\sigma e T^4}$ $\sigma = 5.67 * 10^{8} \frac{\text{Watt}}{m^2 \cdot K^4}$, $0 \leq e \leq 1$

P for The sun is equal to $3.85 * 10^{26}$ watt

$r_{sun} = 6.9 * 10^{8}$ m , $A_{surface} = 4\pi r^2$

find The following:

1. Calculate The sun's Temperature assuming it can be modeled as a perfect blackbody.
2. Calculate its wavelength of maximum emission using Wien's displacement law.

The answer from equation $P = A\sigma e T^4$

$$T = \sqrt[4]{\frac{P_{sun}}{4\pi r^2 \sigma e}} = \sqrt[4]{\frac{(3.85 * 10^{26} w)}{4\pi (6.96 * 10^{8} m)^2 (5.67 * 10^{-8} \frac{w}{m^2 K^4})(1)}}$$

$$T = 5779 K$$

$$\lambda_{max} T = 0.2898 * 10^{-2} m \cdot K$$

$$\lambda_{max} = \frac{0.2898 * 10^{-2} m.K}{5779 K}$$

$$\left[\lambda_{max} = 5.01 * 10^{-7} m = 501 \text{ nm} \right]$$

Q_3) calculate frequency for high energy dencity at a 1000K for E_ν and curve. write spectrum name:

The Solution

$\lambda_{max} \cdot T = b$

$b = 2.89 * \bar{10}$

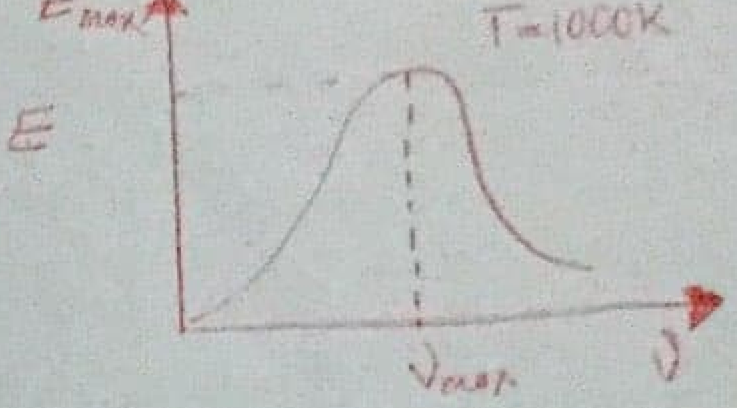
$T = 1000K$

$\therefore \frac{c}{\nu_m} \cdot T = b$

$c = 3 * 10^{8} \frac{m}{s}$

$c = \nu_m \lambda_m$

$\lambda_m = \frac{c}{\nu_m}$



$$\nu_m = \frac{Tc}{b} = \frac{1000K \cdot 3 * 10^{8}}{2.899 * 10^{-3}} = \frac{3 * 10^{14}}{2.899} = \frac{3}{2.899} * 10^{14} \text{ Hertz}$$

high Infrared

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Q_3) maximum Radiation of 2um wavelength is emitted at a 1600K, if Temperature is 2000K what is the wavelength of spectrum is given.

The answer

$\lambda_{m_1} = 2um$

$T_1 = 1600K$

$T_2 = 2000K$

$\lambda_{m2} = ?$

$\lambda_{m_1} T = b$

$\lambda_{m_2} T_2 = b$

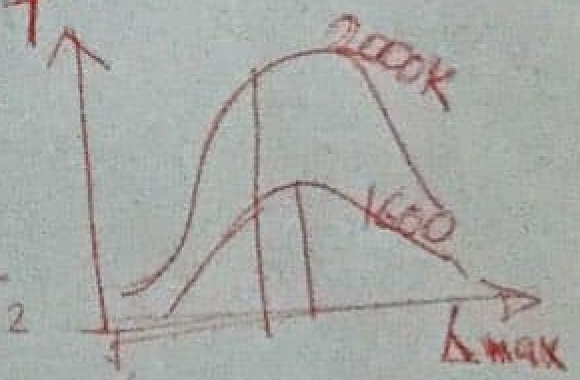
$\lambda_1 T_1 = \lambda_{m_2} T_2$

$2 * 10^{-6} * 1600 = \lambda_{m_2} \cdot 2000$

$\therefore \lambda_{m2} = \frac{\overset{1}{\cancel{2}} * 10^{-6} * 1600}{\cancel{2000}}$

$\lambda_{m2} = 1.6^{10} * 10^{-6}$ m

$\boxed{\lambda_{m_2} = 1.6 \mu m}$



Q4)

1- The wavelength of Radiation emitted by a body depends upon

a- The nature of its surface

b- The area of its surface

[✓ c.] The Temperature of its surface

d- all The above factors

$\lambda_m T =$ constant

$\lambda_m \propto \frac{1}{T}$

$\lambda_{max} \propto \frac{1}{T}$

2. if wavelengths of maximum intensity of Radiations emitted by The sun and moon are $0.5 * 10^{-6}$ m and 10^{-4} m respectively, the Ratio of Their Temperatures is :

a. 1/100

b. 1/200

c. 100

[✓ d. 200]

$\lambda_{max} T =$ const

$\lambda_1 T_1 = \lambda_2 T_2 \Rightarrow \frac{T_1}{T_2} = \frac{\lambda_2}{\lambda_1}$

$\therefore \frac{T_1}{T_2} = \frac{10^{-4}}{0.5 * 10^{-6}} = \frac{1}{0.5 * 10^{-2}} = 2 * 10^{2}$

$= 200$

3. if black wire of platinum is heated, Then its colour first appear red Then yellow and finally white. It can be understood on The basis of ________

[✓ a. Wien's displacement law]

b. prevost Theory of heat exchange

c. Newton's law of cooling

d. None of The above

Q4)

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$T_1 \lambda_1$ $T_2 \lambda_2$

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4. The wavelength of maximum emitted energy of a body at 700K is 4.08 μm. if The Temperature of The body is raised to 1400K The wavelength of maximum emitted energy will be

a. 1.02 μm
b. 16.32 μm
c. 8.16 μm
[✓ d. 2.04 μm]

$T_1 = 700k$ $\quad$ $T_2 = 1400\,K$

$\lambda_{m_1} = 4.08\,\mu m$ $\quad$ $\lambda_{m_2} = ?$

$$\lambda_{m_1}T_1 = \lambda_{m_2}T_2 \Rightarrow \lambda_{m_2} = \frac{\lambda_{m_1}T_1}{T_2}$$

$$= \frac{4.08 * 700}{1400} = 2.04\,\mu m$$

5. A black body at 200K is found to exit maximum energy at a wavelength of 14 μm. when its Temperature is raised to 1000K, The wavelength at which maximum energy is emitted is

a. 14 μm
b. 70 μF
[✓ c. 2.8 μm]
d. 2.8 mm

6. if a Black body is heated at a high Temperature, it seem to be ——— ——

a. Blue
[✓ b. While]
c. Red
d. Black

7. The rate of Radiation of a black Body at 0°C is E J/sec. The rate of radiation of This black body at 273°C will be

[✓ a. 16E]
b. 8E
c. 4E
d. E

$$E = \sigma T^4 \Rightarrow E \propto T^4$$

$T_1 = 0°C = 273\,K$

$T_2 = 273°C = 546\,K$

$$\frac{E_1}{E_2} = \left[\frac{T_1}{T_2}\right]^4$$

$$\frac{E_1}{E_2} = \left[\frac{273}{546}\right]^4 = \left[\frac{1}{2}\right]^4 = \frac{1}{16}$$

$$\frac{E_1}{E_2} = \frac{1}{16} \Rightarrow \boxed{E_2 = 16E_1}$$