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Department of Chemistry

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CH101

Tutorial 1; Physical Chemistry

1. Given that Planck's radiation law ; $\rho(\upsilon) = \frac{8\pi h\upsilon^3}{c^3}\frac{1}{(e^{\frac{h\upsilon}{kT}}-1)}$ **express the same as a function of wavelength i.e.** $\rho(\lambda)$ **.**

2. The radiation power per unit area per unit wavelength is defined as: $\frac{dR}{d\lambda} = \frac{c}{4}\rho(\lambda)$

Find the expression for the total power per unit area and relate that to Stefan-Boltzmann law.

Assume: $\int_0^\infty \frac{(x)^3}{(e^x-1)}dx = \frac{\pi^4}{15}$

3. Imagine that you are an astronaut. While you were in space you walked out of the capsule without space suit for 30 s. How much energy would you have radiated to space? Assume the surface area of your body is 1.5 m^2 and your skin temperature is 27 ^{o}C.

4. The amount of energy delivered to the Earth by the SUN is equal to the energy lost to space from the Earth by Blackbody (IR) radiation. Otherwise, the Earth's temperature would continually rise (or fall). Solar radiative flux at the Earth $S_o = \frac{\sigma T_{Sun}^4 \times r_{Sun}^2}{r_{s-e}^2}$**. This is the inverse squared distance law. S_o is solar constant for earth. It is determined from the flux at the surface of the Sun and by the distance between Earth (r_{s-e} = 1.5 x 10^{11} m) and the Sun's radius, r_{Sun}=2.3 x 10^9 m. S_o=1368 wm^{-2}. Calculate the temperature of the Earth. Assume Albedo (A) is 0.33.**