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Problem 3.24 (R)

The "effective mass" of a photon (*bundle of electromagnetic radiation of zero rest mass and energy* $h\nu$) *can be determined from the relation* $m = E/c^2$. *We have to compute the "effective mass" for a photon of wavelength* 5000 A^0(*visible region*) *and for a photon of wavelength* 1.0 A^0(*X-ray region*).

Solution:

Planck constant, $h = 6.63\times10^{-34}$ J s.

1.0 $A^0 = 1.0\times10^{-10}$ m.

Effective mass of a photon of wavelength λ will be $\frac{h}{\lambda c}$.

Therefore, effective mass of a photon of wavelength

5000 A^0 will be $\frac{6.63\times10^{-34}}{3\times10^8\times5000\times10^{-10}}$ kg=4.42×10^{-36} kg.

And, the effective mass of a photon of wavelength

1.0 A^0will be $\frac{6.63\times10^{-34}}{3\times10^8\times10^{-10}}$ kg $= 2.21\times10^{-32}$ kg.