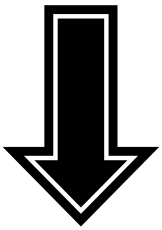
Problem-solving Example 6

How many photons of light which have wavelength 4000Å required to give energy of 20 kJ.

Solution



Solution :

$$E_{photon} = h\nu = \frac{hc}{\lambda}$$

$$= \frac{(6.626 \times 10^{-34}\ Js)(2.998 \times 10^{8}\ ms^{-1})}{(4000 \times 10^{-10})\ m}$$

E_{photon} : energy for one photon

$\because 1\text{Å} = 10^{-10}\ m$

$$= 5.0 \times 10^{-19}\ J\ photon^{-1}$$

Energy of one photon, $E_{photon} = 5.0 \times 10^{-19}\ J\ photon^{-1}$

$5.0 \times 10^{-19}\ J \equiv 1$ photons

$\therefore\ 20 \times 10^{3}\ J \equiv \left(\frac{20 \times 10^{3} \times 1}{5.0 \times 10^{-19}}\right)$ photons

$= 4.0 \times 10^{22}$ photons . (Ans)

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