Related Problems

Question 11.

A 25 watt bulb emits monochromatic yellow light of wavelength 0.57 μm. Calculate the rate of emission of quanta per second.

Answer:

Energy of one photon (E) $= h\nu = hc/\lambda$

$h = 6{\cdot}626 \times 10^{-34}$ J s ; $c = 3 \times 10^{8}$ m s^{-1} ; $\lambda = 0{\cdot}57 \times 10^{-6}$ m

$$E = \frac{(6{\cdot}626 \times 10^{-34}\ \text{J s}) \times (3 \times 10^{8}\ \text{m s}^{-1})}{(0{\cdot}57 \times 10^{-6}\ \text{m})} = \mathbf{3{\cdot}48 \times 10^{-19}\ J}$$

$$\text{Rate of emission of quanta per second} = \frac{\text{Power}}{\text{Energy}}$$

Power (P) $= 25$ watt $= 25$ Js^{-1} ; E $= 3{\cdot}48 \times 10^{-19}$ J

$$= \frac{(25\ \text{watt})}{(3{\cdot}48 \times 10^{-19}\ \text{J})} = \frac{(25\ \text{Js}^{-1})}{(3{\cdot}48 \times 10^{-19}\ \text{J})} = \mathbf{7{\cdot}18 \times 10^{19}\ s^{-1}.}$$