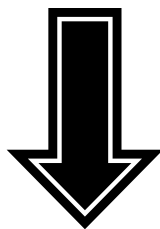


## Problem-solving Example 5:

If the frequency of a laser light is  $4.85 \times 10^{16}$  Hz, calculate the energy associated with :

- One quantum
- One particle
- One mole of particles

*Solution*



*Solution :*

$$\text{Given : } \nu = 4.85 \times 10^{16} \text{ Hz}$$

$$\begin{aligned} E &= h\nu = (6.626 \times 10^{-34} \text{ Js}) (4.85 \times 10^{16} \text{ Hz}) \\ &= 3.21 \times 10^{-17} \text{ J particle}^{-1} \text{ (Ans)} \\ &= 3.21 \times 10^{-17} \text{ J quantum}^{-1} \text{ (Ans)} \\ &= 3.21 \times 10^{-17} \times \left( \frac{6.023 \times 10^{23} \text{ particles}}{1 \text{ mole}} \right) \\ &= 1.93 \times 10^{-7} \text{ J mole}^{-1} \text{ particles (Ans)} \end{aligned}$$

$\text{J particle}^{-1}$   
OR  
 $\text{J quantum}^{-1}$

## Review Questions

Which has more energy : one quantum of red light or blue light which have wavelength of 657.8 nm and 431.7 respectively.



$$E = h\nu = \frac{hc}{\lambda} = hc\bar{\nu}$$
$$\left(\because \nu = \frac{c}{\lambda} ; \bar{\nu} = \frac{1}{\lambda}\right)$$

Note that  $E$  is proportional to  $\nu$  (frequency) and to  $\bar{\nu}$  (wave number) but inversely proportional to  $\lambda$ .

ie  $E \propto \nu$  and  $E \propto \bar{\nu}$  but  $E \propto \frac{1}{\lambda}$

unit :  $\text{J photon}^{-1}$  @  $\text{J quantum}^{-1}$  @  $\text{J particle}^{-1}$

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