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Atomic structere

Energy of photon $\propto$ Frequency

$E \propto \nu$

$E = h\nu$ h = Planck's Const

Ques:- The wavelengh of visible region exceeds from 400 nm to 7^5 onm then find in terms of frequency.

$$\frac{Kc}{\lambda} = K\nu$$

$$\nu\lambda = c$$

$$\lambda = \frac{c}{\nu}$$

$$\lambda = \frac{c}{\nu_1} \Rightarrow \nu_1 = \frac{c}{\lambda_1} \Rightarrow \nu_1 = \frac{3\times10^8}{400\times10^{-9}}$$

$$\Rightarrow \frac{3}{400} \times 10^{17} = \frac{3}{4}10^{15}$$

$$7.5\times10^{14}\,Hz = \nu_1 = 0.75\times10^{15}\,Hz$$

$$\nu_2 = \frac{c}{\lambda_2} \Rightarrow \nu_2 = \frac{3\times10^8}{750\times10^{-9}} = \frac{1000}{250}\times10^{14}$$

$$= 4\times10^{14}\,Hz$$

In case of light, these packets are c/a photon.

Energy of photon $\propto$ Frequency

$E \propto \nu$

$E = h\nu$ $\quad h$ = Planck's Const

$h = 6.62 \times 10^{-34}$ Js

$$E = \frac{hc}{\lambda} = \text{Energy of 1 photon}$$

Energy of n photon

$$E = n \times h\nu = \frac{nhc}{\lambda}$$

$E = h\nu, 2h\nu, 3h\nu$ ----

$E = 1.5\, h\nu$ x

$$E = \frac{hc}{\lambda} = \frac{6.62 \times 10^{-34} \times 3 \times 10^{8}}{\lambda}$$

$$E = \frac{19.86 \times 10^{-26}}{\lambda}$$

$$E = \frac{2 \times 10^{-25}}{\lambda (m)}$$

$$E = \frac{12400}{\lambda (A^\circ)} \text{ eV}$$

$1 \text{ eV} = 1.6 \times 10^{-19}$ J

$E = E_1 + E_2$ ✓

$\lambda = \lambda_1 + \lambda_2$ x

$\nu = \nu_1 + \nu_2$ ✓

$E = E_1 + E_2$

$h\nu = h\nu_1 + h\nu_2$

$\frac{hc}{\lambda} = \frac{hc}{\lambda_1} + \frac{hc}{\lambda_2}$

$\frac{1}{\lambda} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$

Ques $\lambda = 250\,A^\circ$ Calculate.

① ν ② $\bar{\nu}$ ③ E (J) ④ E (in eV)

① $\nu = \frac{c}{\lambda} = \frac{3\times10^8}{250\times10^{-10}} = \frac{6}{5}\times10^{16} = 1.2\times10^{16}$

② $\bar{\nu} = \frac{1}{\lambda} = \frac{1}{250\times10^{-10}} = \frac{10^{10}}{250} = \frac{2}{5}\times10^8 = \frac{20}{5}\times10^7 = 4\times10^7$

③ $E = \frac{12400}{250}\times1.6\times10^{-19}\ J = 49.6\times1.6\times10^{-19} = 79.36\times10^{-19}\ J$

④ $E = \frac{248}{5}\ eV = 49.6\ eV$

Ques The wavelength of visible region exceeds from 400 nm to 750 nm then find in terms of frequency.

Ques $E = 2.5\ eV$ Calculate

① E(J) ② λ ③ ν ④ $\bar{\nu}$

$2.5 \times 1.6 = 150 + 25x = 400$

$E = 2.5\ eV$

$E = 2.5\times1.6\times10^{-19}\ J = 4\times10^{-19}\ J$

$E = \frac{hc}{\lambda} \Rightarrow \lambda = \frac{hc}{E} = \frac{2\times10^{-25}}{4\times10^{-19}} = 0.5\times10^{-25+19} = 0.5\times10^{-6} = 5\times10^{-7}\ m$

$\nu = \frac{c}{\lambda} = \frac{3\times10^8}{5\times10^{-7}} = \frac{30\times10^{7+7}}{5} = 6\times10^{14}\ Hz$

$\bar{\nu} = \frac{1}{\lambda} = \frac{1}{5\times10^{-7}} = \frac{10^7}{5} = \frac{10\times10^6}{5} = 2\times10^6$

Ques Two radiation of wavelength 2000Å & 4000Å are given then Calculate & Compare their Energy?

$$E = \frac{12400}{\lambda(\text{Å})} \qquad \frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1}$$

$$E_1 = \frac{12400}{2000} = 6.2 \text{ eV}$$

$$E_2 = \frac{12400}{4000} = 3.1 \text{ eV}$$

$$\therefore E_1 > E_2$$

Ques Find energy of one mole proton if λ for photon is 331Å

$$E = \frac{hc}{\lambda} = \frac{6.62 \times 10^{-34} \times 3 \times 10^{8}}{3.31 \times 10^{-10}}$$

Energy of one photon $= E = 0.06 \times 10^{-16} \text{ J}$

Energy of one mole photon $= 6 \times 10^{-18} \times 6.022 \times 10^{23} \text{ J}$

$= 36.132 \times 10^{23-18} = 36.132 \times 10^{5}$ J