Mid Theory Assignment

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Section: U

Problem: 1

Here, $\lambda = 400nm = 400 \times 10^{-9} m$

$C = 3 \times 10^8 m\,sec^{-1}$

Now, $\nu = \frac{C}{\lambda} = \frac{3 \times 10^8}{400 \times 10^{-9}} = 7.5 \times 10^{14}\ sec^{-1}$

$\bar{\nu} = \frac{1}{\lambda} = \frac{1}{400 \times 10^{-9}} = 25 \times 10^5\ m^{-1}$

(Answer)

Problem: 2

Here, $\nu = 5.09 \times 10^{14}\ sec^{-1}$

$c = 3 \times 10^{8}\ m\,sec^{-1}$

Now, $\lambda = \frac{c}{\nu} = \frac{3 \times 10^{8}}{5.09 \times 10^{14}}$

$= 5.89 \times 10^{-7}\ m$

$= 589\ nm$ (Answer)

Example: 1

Here, $h = 6.6 \times 10^{-34}\ kg\,m^{2}\,sec^{-1}$

$m = 6.6 \times 10^{-27}\ kg$

$c = 1 \times 10^{5}\ cm\,sec^{-1} = 1 \times 10^{3}\ m\,sec^{-1}$

Now, $\lambda = \frac{6.6 \times 10^{-34}}{6.6 \times 10^{-27} \times 10^{3}}$

$= 1 \times 10^{-10}\ m$ (Answer)

Example: 2

Here, $\Delta v = 5.7 \times 10^{5}\ m\,sec^{-1}$

$h = 6.6 \times 10^{-34}\ kg\,m^2\,sec^{-1}$

$m = 9.1 \times 10^{-31}\ kg$

Now, $\Delta x = \dfrac{h}{4\pi m \Delta v}$

$= \dfrac{6.6 \times 10^{-34}}{4 \times 3.14 \times 9.1 \times 10^{-31} \times 5.7 \times 10^{5}}$

$= 1 \times 10^{-10}\ m$ (Answer)

Number: 1

Here, $h = 6.63 \times 10^{-34}\ kg\,m^2\,sec^{-1}$

$m = 70\ kg$

$v = 15\ m/s$

Now, $\lambda = \dfrac{h}{mv} = \dfrac{6.63 \times 10^{-34}}{70 \times 15}$

$= 6.31 \times 10^{-37}\ m$

(Answer)

Number: 2

Here, $Z = 1$

$n_1 = 1$

$n_2 = \infty$

Now, $\Delta E = E_{n_2} - E_{n_1} = \frac{2\pi^2 me^4}{h^2}\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

$= 2.178 \times 10^{-18}\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right]$

$= 2.178 \times 10^{-18}$ J (Answer)

Number: 3

Here, $c = 1 \times 10^6 \text{ m sec}^{-1}$

$m = 9.1 \times 10^{-31}$ kg

Now, $E = mc^2 = 9.1 \times 10^{-31} \times (1 \times 10^6)^2$

$= 9.1 \times 10^{-19}$ J

$\lambda = \frac{hc}{E} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{9.1 \times 10^{-19}}$

$= 2.185 \times 10^{-7}$ m (Answer)

Number: 4

Here, $\Delta v = 5.27 \times 10^{-24}\ m\,sec^{-1}$

$h = 6.6 \times 10^{-34}\ kg\,m^2\,sec^{-1}$

$\Delta x = 10^{-10} m$

Now, $m = \dfrac{6.6 \times 10^{-34}}{4 \times 3.14 \times 5.27 \times 10^{-24} \times 10^{-10}}$

$= 9.971 \times 10^{-3}\ kg$

$= 99.711\ g$ (Answer)

Problem: 2

Here, $\lambda = 589\ nm = 589 \times 10^{-9} m$

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

$C = 3 \times 10^{8}\ ms^{-1}$

Now, $\Delta E = \dfrac{hC}{\lambda} = \dfrac{6.62 \times 10^{-34} \times 3 \times 10^{8}}{589 \times 10^{-9}}$

$= 3.3718 \times 10^{-19}\ J$ (Answer)

Problem: 3

Here,

$c = 3 \times 10^8$ m

$\lambda = 535$ nm $= 535 \times 10^{-9}$ m

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

Now, $E = \frac{hc}{\lambda}$

$= \frac{6.62 \times 10^{-34} \times 3 \times 10^8}{535 \times 10^{-9}}$

$= 3.712 \times 10^{-19}$ J

(Answer)