Information for the Quiz on Ch. Q6 and Q7

Things You Must Know

(1) Superposition Principle
(2) Boundary conditions for standing waves
(3) Conditions for constructive and destructive interference
(4) Rayleigh criterion
(5) Photon model of light
(6) Wave nature of matter
(7) Predicting spin (Stern-Gerlach) experiments
(8) "The Rules"

Potential Useful Information

$v = \lambda f$ $\qquad$ $f = 1/T$

path difference = $d \sin\theta$ $\qquad$ $a \sin\theta_{1d} = \begin{cases} \lambda & \text{single slit} \\ 1.22\lambda & \text{circular opening} \end{cases}$

$E = hf = \dfrac{hc}{\lambda}$ $\qquad$ $\lambda = \dfrac{h}{p}$

$p \approx mv$ $\qquad$ $K \approx p^2/2m$

$$|+x\rangle = \begin{bmatrix} \sqrt{1/2} \\ \sqrt{1/2} \end{bmatrix} \quad |-x\rangle = \begin{bmatrix} \sqrt{1/2} \\ -\sqrt{1/2} \end{bmatrix} \quad |+y\rangle = \begin{bmatrix} \sqrt{1/2} \\ i\sqrt{1/2} \end{bmatrix} \quad |-y\rangle = \begin{bmatrix} i\sqrt{1/2} \\ \sqrt{1/2} \end{bmatrix}$$

$$|+z\rangle = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \quad |-z\rangle = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad |+\theta\rangle = \begin{bmatrix} \cos\frac{1}{2}\theta \\ i\sin\frac{1}{2}\theta \end{bmatrix} \quad |-\theta\rangle = \begin{bmatrix} i\sin\frac{1}{2}\theta \\ \cos\frac{1}{2}\theta \end{bmatrix}$$

$E_n = \dfrac{h^2 n^2}{8mL^2}$ for a quanton in a box $\qquad$ $E_n = -\dfrac{13.6 \text{ eV}}{n^2}$ for the Bohr model

$E_n = \dfrac{h\omega}{2\pi}\left(n + \frac{1}{2}\right)$, where $\omega = \sqrt{\dfrac{k_s}{m}}$ for a simple harmonic oscillator

Physical Constants

$c = 3 \times 10^8$ m/s $\qquad$ 1 eV = 1.602×10^{-19} J

$h = 6.63 \times 10^{-34}$ J·s $\qquad$ $hc = 1240$ eV·nm

$m_{\text{proton}} = 1.7 \times 10^{-27}$ kg $\qquad$ $m_{\text{proton}}c^2 = 938.27$ MeV

$m_{\text{electron}} = 9 \times 10^{-31}$ kg $\qquad$ $m_{\text{electron}}c^2 = 0.511$ MeV