CHAPTERs 5-9 REVIEW

DeBroglie Wavelength $\lambda = h/p$

Uncertainty Principle $\Delta x\, \Delta p \geq \hbar$

Wave Function, Probability, Expectation Value

$\Psi = a\ \psi 1 + b\ \psi 2 + c\ \psi 3$
$|\Psi|^2 \dashrightarrow |a|^2 + |b|^2 + |c|^2 = 1$ *Normalization Condition*
$P1 = |a|^2 \quad P2 = |b|^2 \quad P3 = |c|^2$ *Probabilities*

$\langle Q \rangle = = P1\ q1 + P2\ q2 + P3\ q3$ *Expectation value*
$\langle E \rangle = = P1\ E1 + P2\ E2 + P3\ E3$ *Expectation value of energy*

Quantum Numbers of the Hydrogen Atom $\Psi\, n\, \ell\, m_\ell$

<u>Quantum #</u>
n = principle = 1,2,3,4,....
ℓ = angular momentum = 0,1,2,..n-1 $\quad |L| = \sqrt{\ell(\ell+1)}\ \hbar$
m_ℓ =magnetic quantum number $\quad -\ell \ldots \leq m_\ell \leq \ldots +\ell \quad L_z = m_\ell\ \hbar$

Energy Levels of the Hydrogen Atom $En = -13/6\ eV\ Z^2/n^2 \quad n = 1,2,3,4,\ldots$

Barrier Penetration *see Quiz*
$T = \exp[-2\kappa a]$ *Tunneling Probability*
$R = f\,T$ *Tunneling Rate*
$T = 1/\tau$ *Tunneling Lifetime*

Angular Momentum $\ell = 0,1,2,3,4,5,\ldots \quad |L| = \sqrt{\ell(\ell+1)}\ \hbar$
$-\ell \ldots \leq m_\ell \leq \ldots +\ell$

Spin $s = 1/2 \quad |S|\ \sqrt{s(s+1)}\ \hbar$
m_S =magnetic quantum number $\pm 1/2$

Total Angular Momentum $\vec{J} = \vec{L} + \vec{S} \quad J = |L+S| \ldots\ldots |L-S|$
$-J \leq M_J \leq +J$

Sodium Doublet and J states *Example 9.4*

Moseley's Law and Zeff = Z -1 *9.7*