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PHYSICS 212.01(002)

Third Major Examination (Ch. 5 & 6) – Closed Book

Name: Key ID. # _____

1. Explain briefly what is meant by the following, stating any relevant mathematical relations, and defining symbols used.

(a) Probability density for a particle whose wave function is $\Psi(x,t)$.

$$P(x,t) = |\Psi(x,t)|^2 = \Psi^*(x,t) \Psi(x,t)$$

$P(x,t) dx$ = probability that a particle constrained to move along the x -axis will be found in an interval dx , around point x , at time t .

(b) Expectation value of an observable Q if the wave function is $\Psi(x,t)$.

The expectation value of an observable Q is the average value of the observable Q , at time $t = \langle Q \rangle$

$$\langle Q \rangle = \int_{-\infty}^{\infty} \Psi^*(x,t) [Q] \Psi(x,t) dx$$

where $[Q]$ is the associated operator, for the observable

(c) Time-independent Schrodinger equation.

Separable solutions of the Schrodinger Equation that are of the form $\Psi(x,t) = \psi(x) e^{-iEt/\hbar}$, with $\psi(x)$ a time-independent wavefunction satisfying the Time-independent Schrodinger equation:

$$-\frac{\hbar^2}{2m} \frac{d^2\psi}{dx^2} + U(x)\psi(x) = E\psi(x)$$