

CH 107 Tutorial-1

Answers

1. Eigenvalues of operator \hat{c} are ± 1 ;

2. i) $\psi = \exp(aiq)$
Eigen value $\rightarrow a\hbar$

ii) $\psi = \exp[\pm i(ax+by+cz)]$
Eigen value = $\pm (a^2+b^2+c^2)$

iii) $\psi = a \cos \theta$ [$a \rightarrow \text{constant}$]
Eigen value = $(-2a)$

3. i) $y = x \sin x \rightarrow$ Not an acceptable wavefunction

ii) $y = \frac{1}{x} \sin x \rightarrow$ Acceptable wavefunction

iii) $y = e^{-x^2} \rightarrow$ Acceptable wavefunction

iv) $y = 1 - e^{-x} \rightarrow$ Not an acceptable wavefunction

4. A linear combination of two or more ^{eigen} wavefunctions will also be an eigenfunction of a quantum mechanical operator \hat{A} under the condition \Rightarrow when all the eigenvalues are equal.

5. (a) $\Psi(x)$ is not normalized.

(b) Possible values of kinetic energy :- $E_1, 3E_1$ and $7E_1$;

(c) i) $\langle K.E \rangle = \frac{45}{7} E_1$

ii) Most probable value of K.E = $7E_1$;

Probability of occurring = $\frac{44}{49}$;

A linear combination of two or more wavefunctions will also be an eigenfunction of a quantum mechanical operator \hat{A} under the condition \Rightarrow when all the eigenvalues are equal.

(a) Possible values of kinetic energy: $E_1, 3E_1$ and $4E_1$;
 $\psi(x)$ is not normalized.