PHY 472 - 2020

Quiz 10 - Solution

The term $H^{(1)}$ is not assumed small. Therefore one has to solve the full Schrödinger equation

$$i\hbar \frac{\partial \psi}{\partial t} = \left[H^{(0)} + H^{(1)}\right]\psi(t) \equiv \left(\frac{1}{2}\hbar\omega\sigma_z + \frac{1}{2}V\sigma_z\Theta(t)\right)\psi(t)$$

with the initial condition $\psi(0) = |\uparrow\rangle \equiv \chi_+$

For $t>0$ the Hamiltonian is $\frac{1}{2}\sigma_z(\hbar\omega + V)$, and $\chi_\pm$ are its eigenfunctions with energies $E_\pm = \pm\frac{1}{2}(\hbar\omega + V)$.

Therefore

$$\psi(t) = e^{-iE_+ t/\hbar}\psi(0) = e^{-i\frac{1}{2}(\hbar\omega+V)t/\hbar}|\uparrow\rangle$$