

HW1

Note Title

2/4/2008

Problem: Solve the time independent Sch. equ.
for free electron in space. $V(x) = 0$

$\Psi(x, t) = ?$ for free electron

Solution:

$$-\frac{\hbar^2}{2m} \frac{d^2 \Psi}{dx^2} + V(x) \Psi(x, t) = i\hbar \frac{\partial \Psi}{\partial t}$$

$$\Psi(x, t) = \Psi(x) T(t) \quad \rightarrow \quad T(t) = e^{-i\omega t}$$

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

$$\Psi'' = - \underbrace{\frac{2mE}{\hbar^2}}_{k^2} \Psi \quad E \Rightarrow \frac{\hbar^2 k^2}{2m}$$

$$\rightarrow \Psi(x) = A e^{ikx} + B e^{-ikx}$$

$$\rightarrow \Psi(x, t) = A e^{i(kx - \omega t)} + B e^{-i(kx + \omega t)}$$