UNIVERSITY OF CALIFORNIA, SANTA BARBARA
Department of Physics

Physics 115A
Prof. Rollin J. Morrison

Winter 1997

ASSIGNMENT #2

Due Tuesday, January 21, 1997

1. Consider the wave packet wave function

$$\psi(x,t) = \frac{g(k_0)}{\sqrt{s\pi}}\left\{e^{i[k_0x-\omega_0t]} + \frac{1}{2}e^{i\left[(k_0-\frac{\Delta k}{2})x-(\omega_0-\frac{\Delta\omega}{2})t\right]} + \frac{1}{2}e^{i\left[(k_0+\frac{\Delta k}{2})x-(\omega_0+\frac{\Delta\omega}{2})t\right]}\right\}$$
$$= \frac{g(k_0)}{\sqrt{s\pi}}e^{i(k_0x-\omega_0t)}\left[1+\cos(\frac{\Delta k}{2}x - \frac{\Delta\omega}{2}t)\right]$$

   (a) Sketch the real and imaginary parts of this function for an electron with a kinetic energy of 10 electron volts and $\Delta(\hbar\omega) = 2$ electron volts for $t = 0$. Consider only the region near $x = 0 \pm \frac{\Delta x_0}{2}$. Pick a convenient normalization.

   (b) At what later time will this group of waves have spread such that the new Δx is twice Δx_0

2. Problem 1 from the book, chapter 2.
3. Problem 3 from the book, chapter 2.
4. Problem 9 from the book, chapter 2.