

## Problem Set 8

Due Wednesday, November 7.

## Problems from Taylor, Zafiratos and Dubson:

6.34, 7.11b, 7.11c, 7.13, 7.57

## Additional Problem:

In three dimensions, a plane wave takes the form

$$\Psi(\mathbf{x}, t) = A \exp [i (\mathbf{k} \cdot \mathbf{x} - \omega t)],$$

for constant amplitude  $A$ , wave vector  $\mathbf{k}$  and angular frequency  $\omega$ .Assume the de Broglie relations:  $E = \hbar\omega$ ,  $\mathbf{p} = \hbar\mathbf{k}$ , together with the energy of a nonrelativistic free particle,  $E = \mathbf{p}^2/2m$ .

Show that these relations are consistent with the three-dimensional Schrödinger equation for the free particle,

$$i\hbar \frac{\partial \Psi}{\partial t} = -\frac{\hbar^2}{2m} \nabla^2 \Psi.$$