Student Number:______________________ Name: ______________________________

Quiz 1

1. A photon has a wavenumber of 10^{-7} m^{-1}. Recall h = $6.626\cdot10^{-34}$ kg·m^{2}s^{-1}

(a) What is the wavelength of the photon?

$k = \frac{2\pi}{\lambda}$

$\lambda = \frac{2\pi}{k} = 6.28\cdot10^{7}\,\mathrm{m}$

(I screwed this up because I copied down Xiao's number wrong; it should have been $k = 10^{7}$.)

(b) What is the momentum of the photon?

$$p = \frac{h}{\lambda} = \frac{6.626\cdot10^{-34}\ \frac{\mathrm{kg\cdot m^2}}{\mathrm{s}}}{6.28\cdot10^{7}\ \mathrm{m}} = 1.054\cdot10^{-41}\ \frac{\mathrm{kg\cdot m}}{\mathrm{s}}$$

(c) What is the energy of the photon?

$$E = h\nu = \frac{hc}{\lambda} = pc = 1.054\cdot10^{-41}\ \frac{\mathrm{kg\cdot m}}{\mathrm{s}}\cdot 2.998\cdot10^{8}\ \frac{\mathrm{m}}{\mathrm{s}}$$

$$= 3.162\cdot10^{-33}\ \frac{\mathrm{kg\cdot m^2}}{\mathrm{s^2}}$$

2. Write the time-dependent Schrödinger equation.

$$i\hbar\frac{\partial\psi(x,t)}{\partial t} = \hat{H}\psi(x,t)$$

BONUS: Suppose you put four electrons in a three-dimensional box. How many quantum numbers do you need to specify the state of the system?

The number of quantum numbers is equal to the number of dimensions; each electron has three spatial coordinates, and there are for electrons, so one needs *twelve* (12) quantum numbers.

However, in fact every electron has three spatial coordinates and one spin coordinate (α or β). This gives a total of *sixteen* (16) quantum numbers. I would accept either answer and give you super-bonus-points if you explained the situation.