NANO 705
Quiz 2

1) Please indicate answers by clearly *circling* the letter of your selection.

a) The function ψ is an eigenfunction of the operator $\hat{X}$ if:

i) $\hat{X}\psi^2 = 2\psi$ ii) $\hat{X}\psi = 1$ iii) $\hat{X}\psi = \psi^*$

iv) $\hat{X}\psi = e^{i\psi}$ v) $\hat{X}\psi = |\psi|^2$ vi) $\hat{X}\psi = 2\psi$

vii) $\hat{X}\psi = \psi - 1$ viii) none of the above

b) A quantum-mechanical state of constant energy is an eigenfunction of the following operator:

i) gregorian ii) hamiltonian iii) jacobian

iv) lagrangian v) smithsonian vi) laplacian

vii) kevorkian viii) none of the above

c) A particle of mass m in the following wave function does *not* have kinetic energy $E = \hbar^2 k^2 / 2m$:

i) $A \cdot \sin(kx)$ ii) $A \cdot e^{ikx}$ iii) $A \cdot e^{-ikx}$

iv) $A \cdot \tan(kx)$ v) $A \cdot \cos(kx)$ vi) $A \cdot \cos(kx + \phi)$

vii) $A \cdot \sin(kx - \phi)$ viii) none of the above

2) Identify the following statements as true or false (T/F):
Additional justification may be added to clarify your answers.

a) ___ The finite difference method can be used to solve the Schrodinger equation by computer.

b) ___ Separation of variables can allow reducing an *N*-dimensional problem into *N* separate problems.

c) ___ The ground-state binding energy of an He^+ ion is *twice* that of a neutral H atom.

d) ___ It is impossible to normalize the wave function for a particle in a box, because of the uncertainty in the particle's position.

e) ___ The Bohr model of atoms explains why atoms of different elements have discrete, characteristic optical absorption and emission spectra.

f) ___ The self-consistent-field method can be used to estimate shifts in the electron energy levels of a nanomaterial, due to their mutual, electrostatic repulsion, as the number of electrons changes.