CARE PHYS 214 Final Worksheet

Please note, worksheets are a guide to practice and are not a guarantee of what will be on your exam!

Tunneling:
The next two questions pertain to the following situation:
The work function (energy needed to remove an electron) of gold is 5.1 eV. Two pieces of gold (at the same potential) are separated by a distance, L.

1. For what value of L will the transmission probability for an electron to cross from one to the other be \( T = 10^{-6} \)? Assume that \( G = 1 \) in the formula for the tunneling probability.
   a. \( L = 0.002 \text{ nm} \)
   b. \( L = 0.04 \text{ nm} \)
   c. \( L = 0.2 \text{ nm} \)
   d. \( L = 0.6 \text{ nm} \)
   e. \( L = 8 \text{ nm} \)

2. Suppose we increase L by a factor of two from the value required for the transmission probability, \( T \), to be \( = 10^{-6} \). What is the new value of \( T \)?
   a. \( T \approx 10^{-12} \)
   b. \( T \approx 0.5 \times 10^{-6} \)
   c. \( T \approx 1 \times 10^{-6} \)
   d. \( T \approx 2 \times 10^{-6} \)
   e. \( T \approx 0.06 \)

Hydrogen Atom:
3. A hydrogen atom undergoes a transition from an excited state \( n=8 \) to a state with \( n=7 \). What is the wavelength of the emitted photon?
   a. 190 μm
   b. 19 μm
   c. 1.9 μm
   d. 0.19 μm
   e. 1.9x10^{-9} μm
4. Which of the following \((n, l, m, m_s)\) combinations is impossible for an electron in a hydrogen atom?
   a. \((3, 2, 1, 1/2)\)
   b. \((6, 2, 2, 1/2)\)
   c. \((8, 6, -6, -1/2)\)
   d. \((4, 2, 0, 1/2)\)
   e. \((3, 3, -1, -1/2)\)

Wave Function:

A particle is confined in the potential well of width \(L\) shown above, and is in its third allowed energy level, i.e., has an energy \(E_3\).

16. Which of the following wavefunctions best describes the particle in the third energy level of the potential above?

a. 

b. 

c. 

d. 

e. 