Problem 1: 30 points
An electron is bound in a one-dimensional infinite potential well with a width of 100 Å.
1) Determine the electron energy level for a) Ground State, b) Second state from the Ground, c) Third state from the Ground.
2) Repeat for the potential well with a width of 500 Å.
3) Repeat for the potential well with a width of 1 mm.
4) Tell what happens with the separation between the different energy levels that electron may occupy when the width of the well increases.
5) In which case do we have the continuum of the allowed energy levels? What will be the ground state in this case?
6) Consider an electron that is in the 3rd state from the Ground. Make a proper drawing to determine at which values of the coordinate x there is (a) the highest and (b) the lowest probability of finding this particular electron,

Problem 2: 20 points
(1) In Problem 1 (1), if the electron drops from the second energy level to the first (to the ground state), what is (a) the energy and (b) the wavelength of a photon that might be emitted?
(2) In Problem 1 (1), if the electron jumps from the 2nd energy level to the 3rd, would it involve an emission or an absorption of a photon? Calculate the wavelength of that photon?

Problem 3*: 20 points
Imagine that the Bohr’s model of atom is a true and exact representation of the real hydrogen atom. Use a narrative or/and formulas to answer the following:
(1) What would be the solution of the Schrödinger Equation for the energy?
(2) What would be the solution of the Schrödinger Equation for the wave function Ψ(x,y,z) (or maybe better Ψ(r, θ, φ)?

Problem 4: 30 points (including 10 for the drawing)
Consider a 1D potential well having energies V as a function of position x. V is defined as flows:
V=infinity for x=-0.5nm to 0;
V=0 for x=0 to 5nm;
V=10 eV for x=5 to 6nm,
V=0 for x>6 nm and x<-0.5nm.
We put an electron with energy 7 eV in the region x, between 0 and 5 nm.
• What is the probability of finding the electron at x<0 nm?
• Is the probability of finding the electron at x>6 nm zero or nonzero?
• What is this probability of for x>6 nm if the electron was described by classical mechanics and not quantum mechanics?
(You are required to start by carefully sketching the potential energy diagram similar to Fig.2.5a or 2.6a. Make sure to schematically show |Ψ|^2 in your drawing.)