1- Having solved the Schrödinger equation for a particle in the infinitely deep square-well potential, we are able to examine the results in more detail. Considering Figure 1, explain:

a) Why are the energies sketched as lines?

b) Why is the energy called ‘a constant of motion’?

c) For the three cases in Figure 1, explain the difference in the spacing between the allowed energy levels.

d) Explain the zero-point energy for the system (a) and the relation with the Heisenberg uncertainty principle.

e) Considering Figure 2, make a plot of $|\psi|^2$. Explain the meaning of $\psi^2$.

f) What does the plot of $\psi^2$ predict?
2- Hydrogen atom:
a) Which are the quantum numbers characterizing each solution of the Schrödinger equation?
b) Which of these numbers enters in the energy formula?
c) According to the previous answer. Are the solutions having the same values of n but different values of l and m degenerated? Explain.
d) Are the quantum numbers related in their allowed values? Explain.

3- According to the rules for the quantum numbers. Find the quantum numbers l and m for: n=1 and n=2 and refer l and m according to the convention from atomic spectroscopy.

4- Which is the z component of the angular momentum and the square of the total angular momentum associated with the states s and p?

5- Test the 2p₀ eigenfunction to see if it is an eigenfunction for $L_z$ or $L_y$. 