

Chem 3322 homework #4, due February 16, 2024

Problem 1 – particle in a box

Consider a particle in a one-dimensional box of length L in its lowest energy (ground) stationary state. Calculate the probability that the particle is

- a) in the left half of the box
- b) in the middle third of the box.
- c) Draw a picture of the wavefunction and associated probability for each of parts a) and b) and justify that your answers make sense in terms of these pictures.

Problem 2 – particle in a box

Consider a particle in a one-dimensional box of length L in its first excited stationary state. Calculate the probability that the particle is

- a) in the left half of the box
- b) in the middle third of the box.
- c) Draw a picture of the wavefunction and associated probability for each of parts a) and b) and justify that your answers make sense in terms of these pictures.

Problem 3 – particle in a 1d box

Do problem 3-6 from your textbook (page 97)

Problem 4 – particle in a box

a) Calculate the energy levels of the π -network in octatetraene, C_8H_{10} , using the particle in the box model. To calculate the box length, assume that the molecule is linear and use the values of 135 pm and 154 pm for C=C and C-C bonds, respectively. Note: you should add 77 pm to both ends of the box length to be consistent with problem 3-6 from your textbook.

b) What is the wavelength of light required to induce a transition from the ground state to the first excited state? (Hint: make sure you use the aufbau principle to obtain the ground state electron configuration)