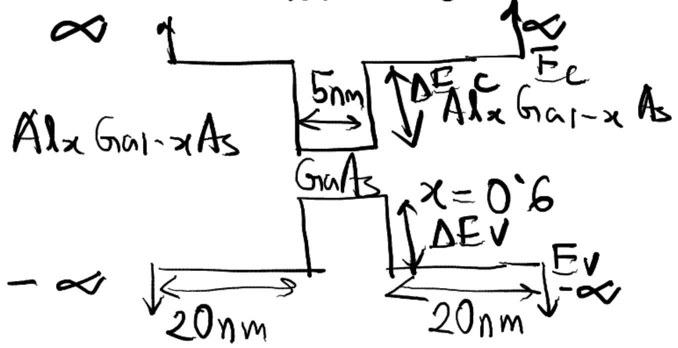
1. Consider an electron of effective mass $m^* = 0.067 m_0$ in an infinite potential well of width $W = 4$ nm.

ⓐ Find out the first two bound states E_1 and E_2 and the corresponding wave functions ψ_1 and ψ_2. Compare your results with the analytical values.

ⓑ Repeat your exercise for $W = 2$ nm.

2. Consider a finite barrier potential well in a GaAs system as shown below.



$m_e^*(GaAs) = 0.067$, $E_g(GaAs) = 1.41$

$m_e^*(AlAs) = 0.150$ $\quad E_g(AlAs) = 2.24$

$$m^*(Al_xGa_{1-x}As) = \frac{x}{m^*(AlAs)} + \frac{1-x}{m^*(GaAs)}$$

$$E_g(Al_xGa_{1-x}As) = x\,E_g(AlAs) + (1-x)\,E_g(GaAs)$$

$\Delta E_c = 0.6\,\Delta E_g$

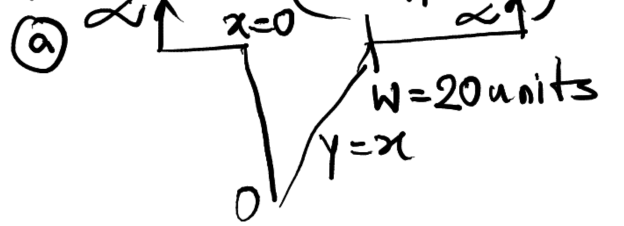
ⓐ Find out the first bound state for electrons and corresponding wave function.

ⓑ Repeat the exercise for holes. [Find out the effective mass from book or literature.]

ⓒ Assume $E_F = E_C$ [GaAs] and flat. Find out the electron and hole profile in the barrier and the well. Label all the important features appropriately.

3. Consider the following potential wells. Plot energy seperations $(E_{i+1} - E_i) = \Delta E_i$, $i = 1$ to 5, Assume $m^* = 1$, $\hbar = 0$

ⓐ



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