A linearly-graded Si pn junction with a linear doping gradient is at equilibrium, as shown below, where the gradient “m” is $7 \times 10^{14} \text{ cm}^{-4}$.

a) The built in voltage of this junction is measured to be 0.65V. If the electron density at the edges of the depletion zone are: $p_p = qm(W/2)$ and $p_n = n_i^2/[q(m(W/2))]$, calculate the depletion width. (1.25pt)

b) Calculate the electric field across the junction as a function of distance. ($\varepsilon_0 = 8.85 \times 10^{-14} \text{F/cm}$) (1.25pt)

c) Quantitatively plot equilibrium values for the following vs distance: (0.5 each)
   i) electric field
   ii) voltage
   iii) energy bands

Make sure to label the axes with numbers showing calculated values of $W$, and max values of each quantity above) and titles (including units) in each case.