1) For the MOS capacitor shown below,
   a) Qualitatively show how the band diagram at threshold changes if the substrate doping is changed from \( N_a = 10^{16} \text{ cm}^{-3} \) to \( N_a = 10^{17} \text{ cm}^{-3} \).
   b) What is the electric field across the oxide at threshold with the higher doping?
   c) What is the electric field across the oxide if \( V_g = 5V \) (use the higher doping)?

2) For the MOS capacitor drawn below, the left-hand side of the silicon is doped p-type while the right-hand side is doped n-type. Assume there is no metal-semiconductor workfunction difference, and that the MOS-C otherwise conforms to our ideal structure described in class and in Ch. 16. The device width is \( Z = 10 \mu \text{m} \) and the oxide thickness is 300\( \text{Å} \).
   a) Find \( C_{ox} \).
   b) What are the threshold voltages at positions “a” and “b”?
   c) What is the threshold depletion width at positions “a” and “b”?
   d) Draw a C-V curve for the structure assuming that the AC measurement frequency is 1MHz. Label the key voltages and capacitances.