

Theory and Technology of Semiconductor Devices  
Assignment 2

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Due: Dec 22

**Problem 1** Doing an Arsenic diffusion on a p-type wafer with background doping of  $10^{17} \text{cm}^{-3}$  with limited amount of Arsenic (constant-total-dopant) of  $10^{14} \text{cm}^{-2}$  at  $1100^\circ\text{C}$  for 1.5 hours, find the surface concentration and junction depth.

Note:  $D = 2.07 \times 10^{-14} \text{ cm}^2/\text{s}$  for Arsenic at  $1100^\circ\text{C}$

**Problem 2** A two-step Boron diffusion is used on an n-type wafer to form a p-type region; first 30 minutes with constant surface concentration of  $1.1 \times 10^{20} \text{cm}^{-3}$  at  $900^\circ\text{C}$  followed by 4 hours (the constant-total step) at  $1100^\circ\text{C}$ . find (a) junction depth (b) the gradient of concentration for  $x = x_j$  at the end of each step (c) the surface concentration at the end of step 2

Note:  $900^\circ\text{C} \rightarrow D = 1.45 \times 10^{-15} \text{ cm}^2/\text{s}$

$1100^\circ\text{C} \rightarrow D = 2.96 \times 10^{-13} \text{ cm}^2/\text{s}$

Note: solving step 2 has Bonus mark (not required)