Name: ______________________________ Student Number: _________

7. In the Mitel 1.5 μm CMOS technology, n-channel transistors are formed in p-well regions created by implanting boron into 5 Ωcm n-type substrates, and then driving in the boron at 1150°C. After the drive-in the boron concentration at the surface of the p-well is 10^{16} cm^{-3} and depth of the p-well - substrate metallurgical junction is 4 μm.

   a) Determine the duration of the p-well drive-in and dose of the p-well implant. *10 marks*

   b) The gate oxide thickness in the Mitel technology is 27 nm. Both n- and p-channel transistors have polysilicon gates heavily doped with phosphorus. The threshold voltage of the n-channel transistors is set to V_{Tn} = 0.7 V using a threshold adjust implant carried out after gate oxidation. Determine the element required for the threshold adjust implant (arsenic or boron) and the dose needed for the implant. Suggest a suitable implant energy, and justify your choice of energy. *15 marks*