Activity 6

Its Intrinsically Extrinsic!

Planar semiconductor fabrication relies on the ability to create circuit components all within the same plane of a wafer. For the following, consider an InP wafer, which has these properties:

$E_g = 1.34$ eV, $N_c = 5.2\times10^{17}$ cm^{-3}, $N_v = 1.1\times10^{19}$ cm^{-3},
$\mu_e = 4600$ cm^2 V^{-1} s^{-1}, $\mu_h = 190$ cm^2 V^{-1} s^{-1}, $m_e^* = 0.079m_e$, and $m_h^* = 0.58m_e$.

a. What is its intrinsic resistivity at 300K, and what is its resistivity at 300 K when doped with Si to be n-type with $N_d = 5\times10^{13}$ cm^{-3}?
b. Are there any holes left at the doping concentration of part (a)?
c. Which element does Si replace to create an n-type semiconductor?
d. So, if I need a wafer that has very insulating regions and very conductive regions, can I use an InP wafer in planar fabrication?