

Assignment #30

- 18.28 Predict whether each of the following elements will act as a donor or an acceptor when added to the indicated semiconducting material. Assume that the impurity elements are substitutional.

Impurity	Semiconductor
P	Ge
S	AlP
In	CdTe
Al	Si
Cd	GaAs
Sb	ZnSe

- 18.30 Germanium to which $5 \times 10^{22} \text{ m}^{-3}$ Sb atoms have been added is an extrinsic semiconductor at room temperature, and virtually all the Sb atoms may be thought of as being ionized (i.e., one charge carrier exists for each Sb atom).

(a) Is this material n-type or p-type?

- 0.5 Calculate the electrical conductivity of this material, assuming electron and hole mobilities of 0.1 and $0.05 \text{ m}^2/\text{V}\cdot\text{s}$, respectively.

- 18.48 At temperatures between 775°C (1048 K) and 1100°C (1373 K), the activation energy and preexponential for the diffusion coefficient of Fe^{2+} in FeO are 102,000 J/mol and $7.3 \times 10^{-8} \text{ m}^2/\text{s}$, respectively. Compute the mobility for an Fe^{2+} ion at 1000°C (1273 K).

- 5.D4 One integrated circuit design calls for the diffusion of arsenic into silicon wafers; the background concentration of As in Si is $2.5 \times 10^{20} \text{ atoms/m}^3$. The predeposition heat treatment is to be conducted at 1000°C for 45 minutes, with a constant surface concentration of $8 \times 10^{26} \text{ As atoms/m}^3$. At a drive-in treatment temperature of 1100°C , determine the diffusion time required for a junction depth of $1.2 \text{ }\mu\text{m}$. For this system, values of Q_d and D_0 are 4.10 eV/atom and $2.29 \times 10^{-3} \text{ m}^2/\text{s}$, respectively.