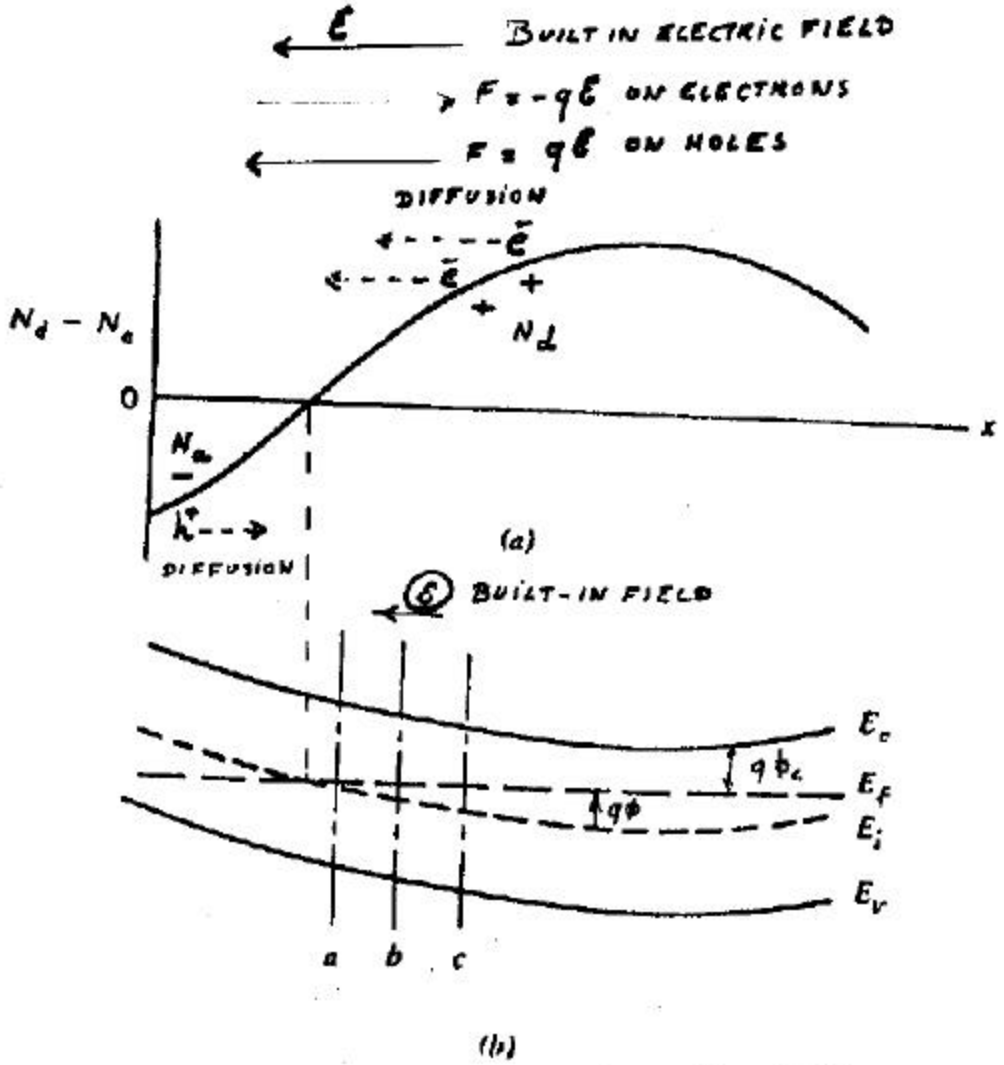
GRADED IMPURITY DISTRIBUTIONS



POTENTIAL : $-q\phi_c = E_c - E_f \quad \Rightarrow \quad \phi_c = \frac{1}{q}(E_f - E_c)$

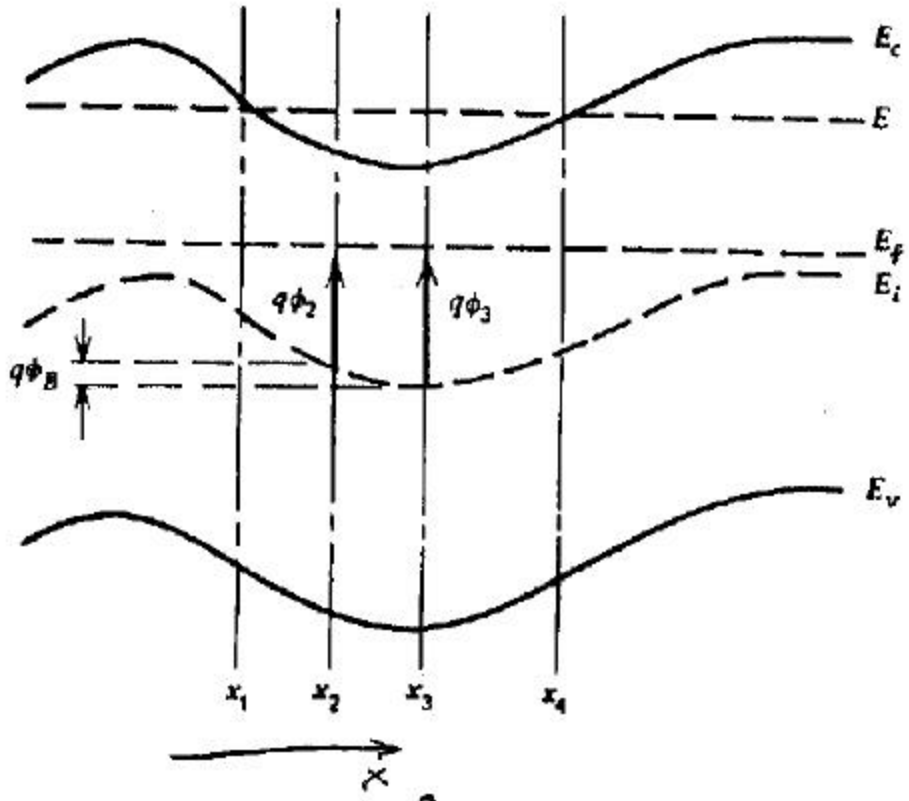
SINCE $E_c - E_i$ = CONSTANT

$$\phi = -\frac{1}{q}(E_i - E_f) = \frac{1}{q}(E_f - E_i)$$

ELECTRIC FIELD : $\mathcal{E}_x = -\frac{d\phi}{dx} = -\frac{1}{q}\frac{d}{dx}(E_f - E_i)$

$$\mathcal{E}_x = \frac{1}{q}\frac{d}{dx}E_i$$

Potential Barrier.



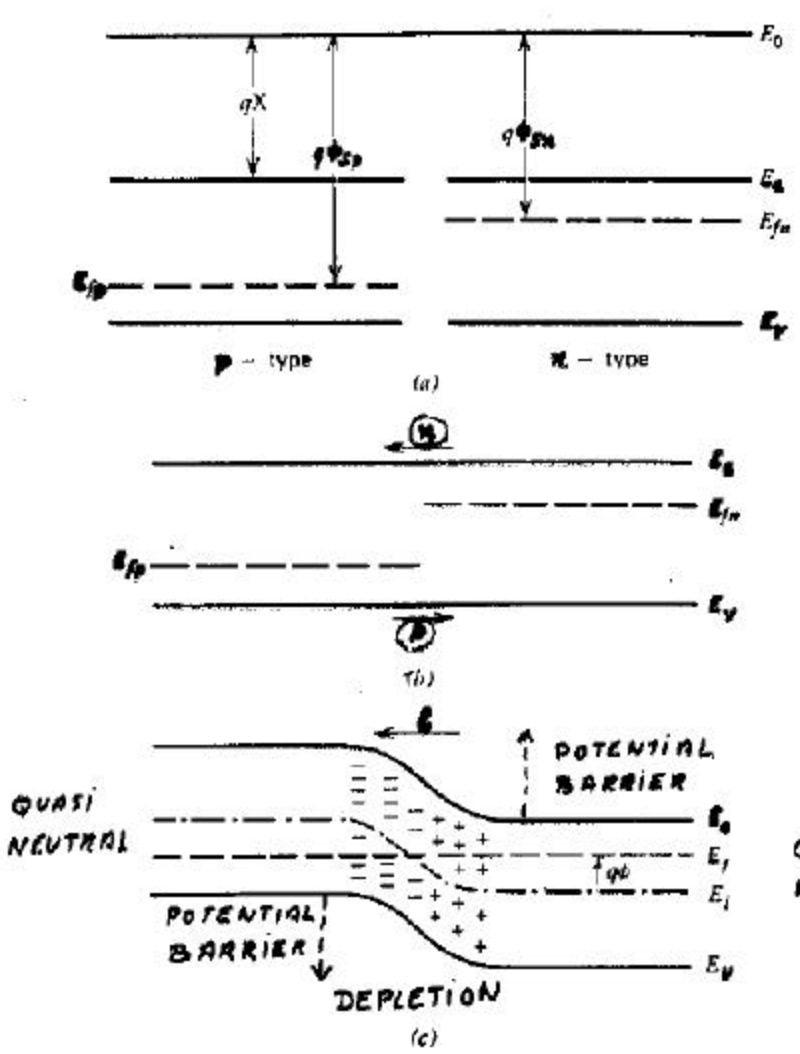
$$\frac{n_3}{n_2} = \exp\left[\frac{q}{k_B T}(\phi_3 - \phi_2)\right] > 1 \qquad n_2 < n_3$$

$\phi_B = \phi_3 - \phi_2$: POTENTIAL BARRIER

$$n_2 = n_3 e^{-\frac{q\phi_B}{k_B T}}$$

P-N JUNCTION

BAND DIAGRAM

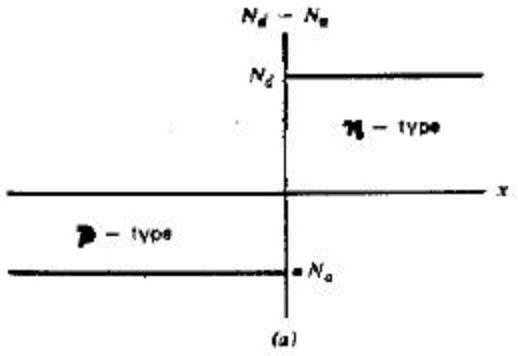


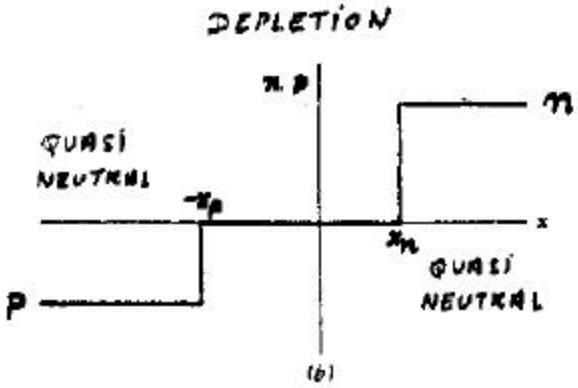
ELECTRON AFFINITY

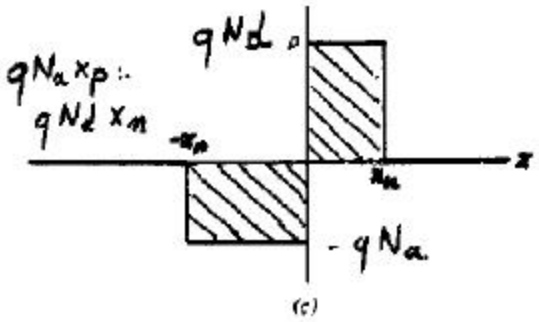
$$q\chi = q\phi_s - (E_c - E_F)$$

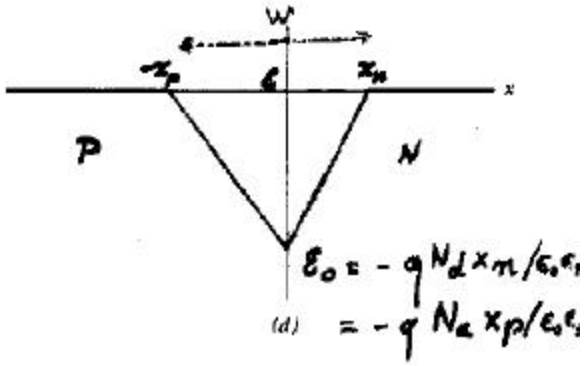
↑ WORK FUNCTION

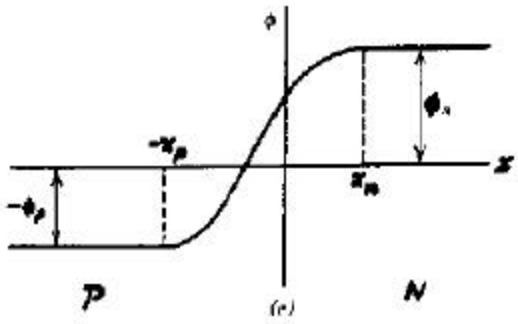
ABRUPT JUNCTION: DEPLETION APPROKIMATION







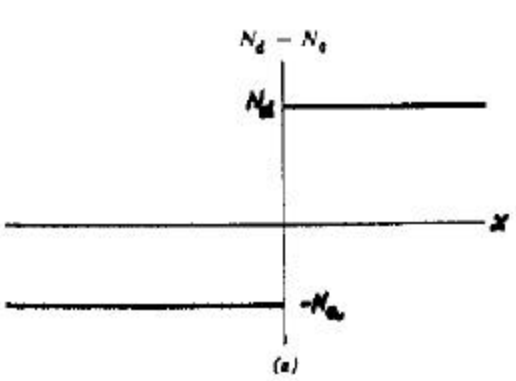


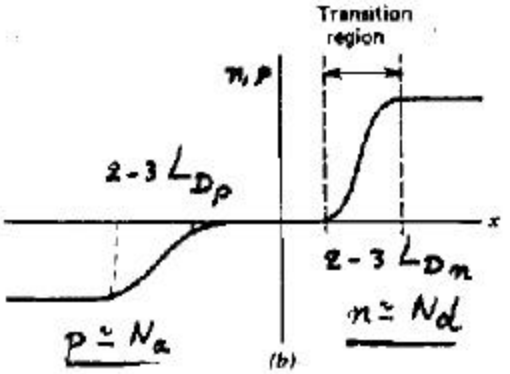


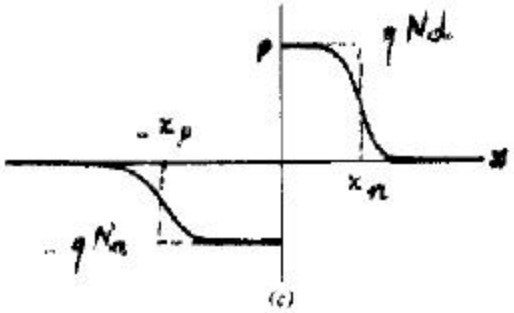
$$\phi_i = \phi_n - \phi_p = \frac{kT}{q} \ln \frac{N_d N_a}{n_i^2}$$

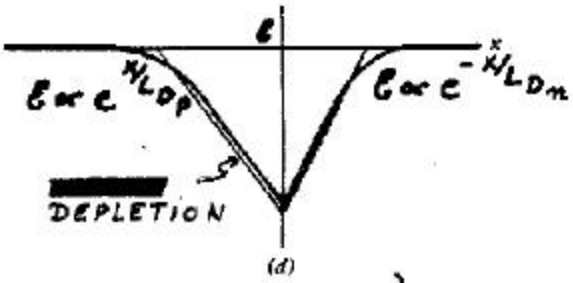
$$x_n + x_p = \sqrt{\frac{2\epsilon_0\epsilon_s}{q} \phi_i \left(\frac{1}{N_a} + \frac{1}{N_d}\right)}$$

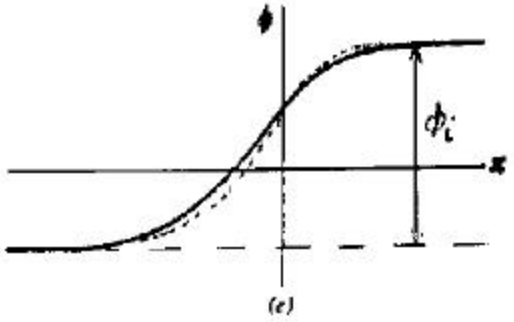
ABRUPT JUNCTION GENERAL MODEL











$$L_{D_n} = \sqrt{\frac{\epsilon_0 \epsilon_s kT}{q^2 N_d}}$$

$$L_{D_p} = \sqrt{\frac{\epsilon_0 \epsilon_s kT}{q^2 N_a}}$$

EXTRINSIC DEBYE LENGTH

INTRINSIC DEBYE LENGTH: $L_{D_i} = \sqrt{\frac{\epsilon_0 \epsilon_s kT}{2 q^2 n_i}}$