Since we are given N_p = N_A, and with \( \mu > \eta \), one concludes (Part 2) (Part 1) of the problem.

\[
\begin{align*}
\text{(a)} & \quad \frac{N_p}{N_A} \ll \mu \\
\text{(b)} & \quad \frac{1}{I} = d \\
\text{(c)} & \quad \frac{G_{th}}{1} = d
\end{align*}
\]

The key to the answer here is that \( \mu > \eta \) for a given material's properties, and dopant concentration.

For example, dopant materials and additionally has important implications. The more

In practice, the material is the same as the previously shown in Section 3.1.

(1) If the dopant is higher than the dopant material, the material concentration is the same as the previous seen.

(2) If the dopant is lower than the dopant material, the material concentration is the same as the previous seen.

(3) If the dopant concentration is the same as the previous seen.

(4) If the dopant concentration is the same as the previous seen.

(5) If the dopant concentration is the same as the previous seen.

(6) If the dopant concentration is the same as the previous seen.

(7) If the dopant concentration is the same as the previous seen.

(8) If the dopant concentration is the same as the previous seen.

(9) If the dopant concentration is the same as the previous seen.

(10) If the dopant concentration is the same as the previous seen.

(11) If the dopant concentration is the same as the previous seen.

(12) If the dopant concentration is the same as the previous seen.

(13) If the dopant concentration is the same as the previous seen.

(14) If the dopant concentration is the same as the previous seen.

(15) If the dopant concentration is the same as the previous seen.

(16) If the dopant concentration is the same as the previous seen.

(17) If the dopant concentration is the same as the previous seen.

(18) If the dopant concentration is the same as the previous seen.

(19) If the dopant concentration is the same as the previous seen.

(20) If the dopant concentration is the same as the previous seen.

Note: (1) \( E_F = 0 \), (2) \( E_F = 1 \), (3) \( E_F = 2 \), (4) \( E_F = 3 \), (5) \( E_F = 4 \), (6) \( E_F = 5 \), (7) \( E_F = 6 \), (8) \( E_F = 7 \), (9) \( E_F = 8 \), (10) \( E_F = 9 \), (11) \( E_F = 10 \), (12) \( E_F = 11 \), (13) \( E_F = 12 \), (14) \( E_F = 13 \), (15) \( E_F = 14 \), (16) \( E_F = 15 \), (17) \( E_F = 16 \), (18) \( E_F = 17 \), (19) \( E_F = 18 \), (20) \( E_F = 19 \).

Chapter 3
Thus, the voltage expression for the depletion region is:

\[ V = \frac{d}{x} \]

Again, invoking the Einstein relation:

\[ \frac{d}{x} = \frac{q}{kT} \]

(a) As stated in Subsection 3.1.2, for lightly doped materials, where scattering dominates and

(b) Figure 3.5 gives the inversion over the desired doping range. However, from the

<table>
<thead>
<tr>
<th>Potential (V)</th>
<th>Hole 1</th>
<th>Hole 2</th>
<th>Hole 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Also, the concentration of charge carriers is:

\[ N = \frac{1}{V} \int \frac{dV}{x} \]

(c) From Fig. 3.5, we can conclude that the concentration of charge carriers is:

\[ N = \frac{1}{V} \int \frac{dV}{x} \]

(d) Since the concentration is directly proportional to the depletion voltage, we have:

\[ N = \frac{1}{V} \int \frac{dV}{x} \]

(e) Therefore, the expression for the depletion voltage is:

\[ V = \frac{d}{x} \]

(f) For a given doping concentration, the depletion voltage is given by:

\[ V = \frac{d}{x} \]

(g) This expression is valid for a wide range of doping concentrations. However, for a very high doping concentration, the depletion voltage decreases and

(h) The depletion voltage is given by:

\[ V = \frac{d}{x} \]

(i) Thus, the depletion voltage is directly proportional to the doping concentration.

(j) Therefore, the depletion voltage is given by:

\[ V = \frac{d}{x} \]

(k) Since the depletion voltage is directly proportional to the doping concentration, the depletion voltage is:

\[ V = \frac{d}{x} \]

(l) Therefore, the depletion voltage is given by:

\[ V = \frac{d}{x} \]

(m) Thus, the depletion voltage is directly proportional to the doping concentration.

(n) Therefore, the depletion voltage is given by:

\[ V = \frac{d}{x} \]

(o) Thus, the depletion voltage is directly proportional to the doping concentration.

(p) Therefore, the depletion voltage is given by:

\[ V = \frac{d}{x} \]

(q) Thus, the depletion voltage is directly proportional to the doping concentration.

(r) Therefore, the depletion voltage is given by:

\[ V = \frac{d}{x} \]

(s) Thus, the depletion voltage is directly proportional to the doping concentration.

(t) Therefore, the depletion voltage is given by:

\[ V = \frac{d}{x} \]

(u) Thus, the depletion voltage is directly proportional to the doping concentration.

(v) Therefore, the depletion voltage is given by:

\[ V = \frac{d}{x} \]

(w) Thus, the depletion voltage is directly proportional to the doping concentration.

(x) Therefore, the depletion voltage is given by:

\[ V = \frac{d}{x} \]

(y) Thus, the depletion voltage is directly proportional to the doping concentration.

(z) Therefore, the depletion voltage is given by:

\[ V = \frac{d}{x} \]
\[
\frac{1.2 \times 10^{11} \times 0.6 \times 1.2}{1.2 \times 10^{12}} = \frac{9}{10} = \frac{b}{3}
\]

Note: AE = 1.2 \times 10^{12} \text{ V/cm}

Note: \( V \) versus \( x \) is just proportional to the slope of \( E \) versus \( x \).

Note: \( V \) is arbitrary to within a constant.

By inspection from Fig. P.33.
1. \( J = 0 \), and \( P = 0 \). The drift and diffusion components of the current cancel at all points. Under equilibrium conditions (EF is energy invariant on the diagram), \( J = 0 \). Under equilibrium conditions (EF is energy invariant on the diagram), \( J = 0 \).

Thus, \( J = \frac{\partial P}{\partial x} \) in the \( x \) direction. The electric field is negative at \( x = \infty \) and \( x = 0 \) in the \( x \) direction. However, electric current is positive in the \( x \) direction. From knowledge of material problems we can expect current to be non-zero at \( x = \infty \).

\[
\frac{\partial n}{\partial x} = 0 \quad \text{and} \quad \frac{\partial P}{\partial x} = 0 \quad \text{at} \quad x = 0
\]

Thus, \( \frac{\partial P}{\partial x} \) is proportional to the slope of the electric field diagram. Current \( I \) is proportional to the slope of the electric field diagram. Current \( I \) is proportional to the slope of the electric field diagram.

**Notice:** \( \Lambda \) was set equal to zero at \( x = \infty \).

**Diagram:** From the slope of the electric field diagram we conclude:

\( \Lambda \) versus \( x \) is just the "split-down" of the curve. We have \( x = \infty \) and \( x = 0 \).
\[
\frac{1}{x} \frac{d}{dx} \left( x \frac{d}{dx} \right) \varphi(x) = (\frac{1}{x} - 1) \varphi(x)
\]

So finally

\[
\frac{1}{x} \frac{d}{dx} \varphi - \frac{1}{x} \varphi = \frac{d}{dx} \frac{1}{x} \varphi = 0
\]

\[
x \varphi'(x) + \varphi(x) = 0 = (\frac{1}{x} \varphi)(x)
\]

\[
\varphi(x)(0) = \varphi(0) = \varphi(d)
\]

**General solution**

\[
x \varphi'(x) + \varphi(x) = 0 = (\frac{1}{x} \varphi)(x)
\]

Thus

\[
0 = \frac{d}{dx} \frac{1}{x} \varphi
\]

Therefore

\[
0 = \frac{d}{dx} \varphi
\]

Hence minority carrier diffusion current

\[
\frac{d}{dx} \frac{1}{x} \varphi = \frac{d}{dx} \varphi
\]

\[
A.T.
\]

Since \( \frac{L^2}{N} \) is a significant number, the excess electrons will make \( \frac{\partial}{\partial x} \) go.

As least \( \lambda = 0.07 \) of the electrons will make \( \frac{\partial}{\partial x} \) Answer

\[
5.9 \times 10^{-7} \text{ cm}^2 = \frac{L^2}{N} = \frac{L^2}{N} = \frac{L^2}{N} = \frac{L^2}{N}
\]

In the dependence of \( x = \exp(x/L) \), where we expect the electron diffusion in all limit in number as they diffuse toward \( x \).

We expect the electron diffusion in all limit in number as they diffuse toward \( x \).

\[
A.E. = 0.8 \text{ eV} = \frac{E}{\text{eV}} = \frac{E}{\text{eV}} = \frac{E}{\text{eV}}
\]

\[ (i) \]

\[
\text{we must have}
\]

\[ (\text{def}) = \text{def}
\]

\[ (\text{def}) = \text{def}
\]

\[ (\text{def}) = \text{def}
\]

\[ (\text{def}) = \text{def}
\]

\[ (\text{def}) = \text{def}
\]

\[ (\text{def}) = \text{def}
\]
\[ (N-1/x \cdot e - e \cdot 0) = C \cdot \ln(x) \]

\[ a = C \cdot \ln(x) \]

\[ a + C \cdot \ln(x) = 0 \]

Boundary conditions:

\[ \frac{\partial u}{\partial N} \bigg|_{\text{boundary}} = 0 \]

\[ \frac{\partial u}{\partial N} \bigg|_{\text{initial}} = 0 \]

\[ \frac{\partial u}{\partial N} \bigg|_{\text{final}} = 0 \]

Solving...

\[ \frac{\partial u}{\partial N} + \frac{a}{2} + \frac{\partial^2 a}{\partial N^2} = 0 \]

\[ \text{Steady state:} \quad 0 = \frac{\partial u}{\partial N} \]

Simplifying...

\[ \frac{\partial u}{\partial N} + \frac{a}{2} + \frac{\partial^2 a}{\partial N^2} = 0 \]

Assuming \( C \equiv 0 \), we can write the equation of motion and the distribution of minority carriers to give rise to a steady state field. This equation is subject to the boundary condition, which is derived from the initial and final conditions. Since \( \frac{\partial u}{\partial N} \gg 0 \), we have low level injection in the minority band. All conditions for use of the minority carrier diffusion equation have been met. Thus, we need to solve the equation for all cases where the low level injection condition is met. Note that since the injection is reduced at \( x = 0 \), any \( \frac{\partial u}{\partial N} \) and \( \frac{\partial^2 u}{\partial N^2} \) are zero. Since \( C \) is applied for a line \( 1 < x < 2 \), steady state conditions will prevail prior to \( x = 0 \).
Using the above information one concludes

(1) $E = (C, E) \equiv \frac{\partial}{\partial x}$

(2) $E = (C, E) \equiv \frac{1}{1.2 \, V}$

at room temperature:

$E = I = \frac{0.93}{0.26(1.5)} = \frac{q}{q + x}$

Moreover:

Thus:

(2)

$E = I = \frac{0.93}{0.26(1.5)} = \frac{q}{q + x}$

$h = \frac{E}{E}$

(1) We know $E = I$ and since $E = I$, we find

$E = I = \frac{0.93}{0.26(1.5)} = \frac{q}{q + x}$

(2) We have assumed $E = I$, $E = I$

(1) $E = (C, E) \equiv \frac{\partial}{\partial x} + (\partial, E) \equiv \frac{\partial}{\partial x}$

So finally,

$E = I = \frac{0.93}{0.26(1.5)} = \frac{q}{q + x}$

(2) First solve the minority carrier diffusion equation for $\phi(x)$ we find

$E = I = \frac{0.93}{0.26(1.5)} = \frac{q}{q + x}$

High is inside, all conductive.

(2) $d_y = \frac{\partial}{\partial x} + (\partial, E) \equiv \frac{\partial}{\partial x}$

Low level injection conditions prevail at all times.

(2) $d_y = \frac{\partial}{\partial x} + (\partial, E) \equiv \frac{\partial}{\partial x}$
\[ I = \frac{1.85 \, \text{mA}}{\text{cm}^2} = \frac{(1 \times 10^{17} \times 1.5 \times 10^3 \times 1.5 \times 10^3 \times 1.3 \times 10^4 \times 1 \times 6 \times 10^3)}{1} = \frac{1}{\text{ohm-cm}} \]

\[ \text{ohm-cm} = \frac{(1 \times 10^{17} \times 1.5 \times 10^3 \times 1.5 \times 10^3 \times 1.3 \times 10^4 \times 1 \times 6 \times 10^3)}{1} = \frac{1}{\text{ohm-cm}} \]

\[ \text{ohm-cm} \]

**Problem**

Under illumination \( \phi > 0 \), no and p differences significantly from No. For low levels:

\[ N_D \times 10^{16} \times \text{cm}^{-3} = 1.0 \times 10^6 \times 10^{15} \times \text{cm}^{-3} \]

\[ N_D \times 10^{16} \times \text{cm}^{-3} = 1.0 \times 10^6 \times 10^{15} \times \text{cm}^{-3} \]

\[ N_D \times 10^{16} \times \text{cm}^{-3} = 1.0 \times 10^6 \times 10^{15} \times \text{cm}^{-3} \]

\[ N_D \times 10^{16} \times \text{cm}^{-3} = 1.0 \times 10^6 \times 10^{15} \times \text{cm}^{-3} \]

**NOTE**

Because \( N_D \) appears in an exponential, it is best to use the highest accuracy at 1/6.

**Diagram**

- Electron current
- Hole current
- Diffusion
- Electrons to the left
- Holes to the right

\[ \frac{d^2 n}{d^2 x} - \frac{x}{d^2 p + dp} = 0 \]

\[ \frac{d^2 n}{d^2 x} - \frac{x}{d^2 p + dp} = 0 \]

\[ \frac{d^2 n}{d^2 x} - \frac{x}{d^2 p + dp} = 0 \]

\[ \frac{d^2 n}{d^2 x} - \frac{x}{d^2 p + dp} = 0 \]

\[ \frac{d^2 n}{d^2 x} - \frac{x}{d^2 p + dp} = 0 \]

**Yields**

\[ \text{Current density difference at } E = \text{expression obtained in part } a \]

The above \( E \) versus \( x \) plot can be deduced by inspection from the slope of the energy band.
From the calculations note that $E_F$ stays fairly close to $E_L$ until $x \equiv L$.

$$
E_L = 0.026 \text{ eV} \\
E_F - E_L = 0.0186 \text{ eV} \\
E_F - E_L = 0.0272 \text{ eV}
$$

and

$$(\frac{1}{x} - 1)_{10} = (\frac{1}{x} - 1)_{10} = u_{EF} \text{ and } \frac{dN}{dx} = 0 \text{ cm}^{-1} \text{ eV}^{-1}
$$

and

$$A_{0.3} \text{ eV} = \left(\frac{u_{EF}}{u_{EF}}\right)_{10} = \left(\frac{u_{EF}}{u_{EF}}\right)_{10} \text{ eV cm}^{-1} \text{ eV}^{-1} \text{ and } E_F - E_L \equiv E_F - E_L \equiv \text{ given } u \equiv N \text{ D}
$$

Since $E \equiv 0.026$ eV and $E_F$ will be position independent