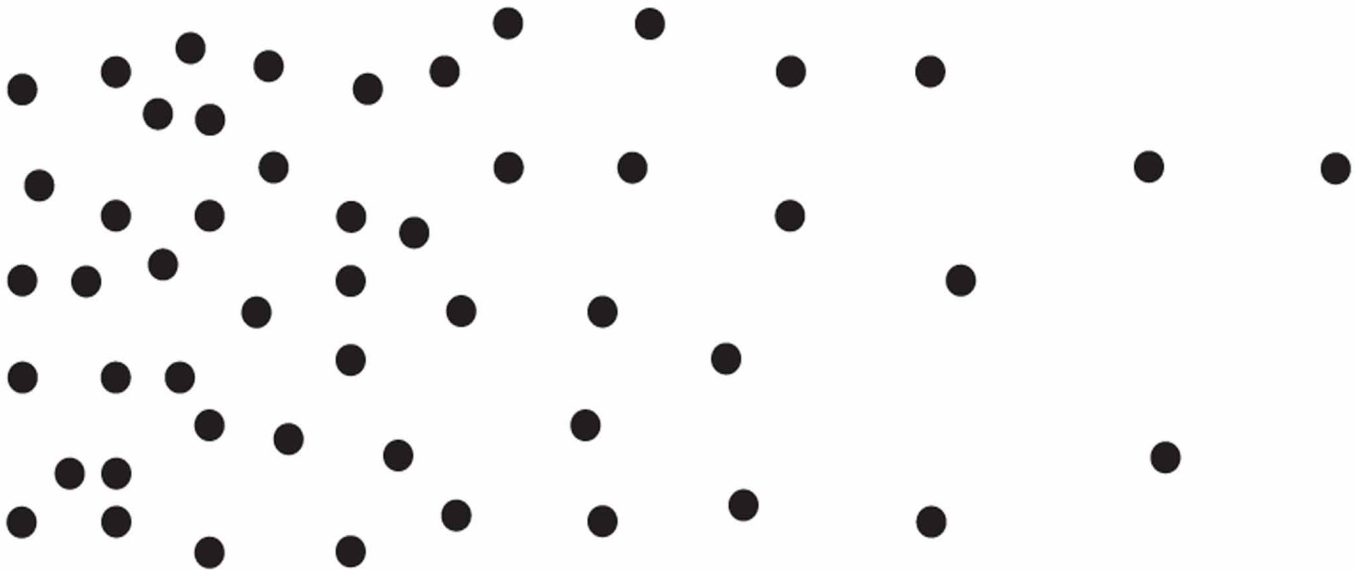


Higher particle concentration

Lower particle concentration



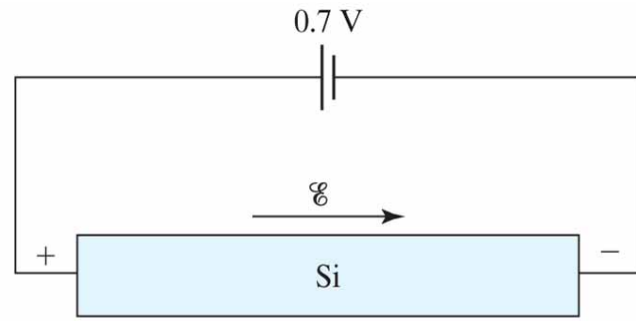
Direction of diffusion

Fråga 51

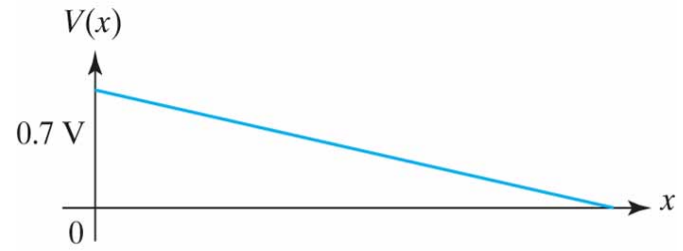
- En Si kristall är dopad $N_d=10^{17} \text{ cm}^{-3}$. Vad är D_n och D_p ? $T=300 \text{ K}$
- A) $D_n \approx 700$, $D_p \approx 300$.
- B) $D_n \approx 8 \text{ cm}^2/\text{s}$, $D_p \approx 18 \text{ cm}^2/\text{s}$.
- C) $D_n \approx 18 \text{ cm}^2/\text{s}$, D_p ej definierat ty donatordopning
- D) $D_n \approx 18 \text{ cm}^2/\text{s}$, $D_p \approx 8 \text{ cm}^2/\text{s}$.
-

Fråga 52

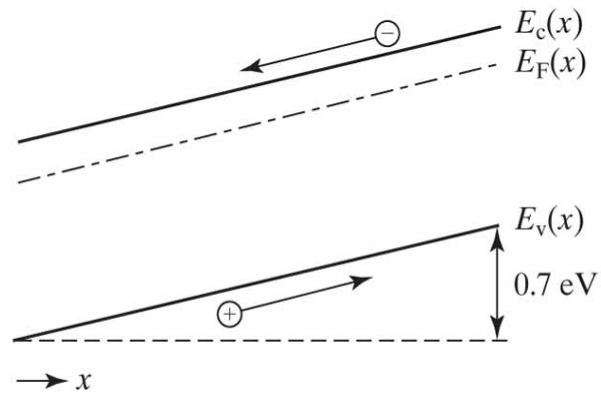
- Vilken minnesregel är korrekt
 - A) Elektroner bubblar upp i banddiagrammet
 - B) Hål bubblar upp i banddiagrammet
 - C) En positiv potential höjer energi för en positiv laddning
 - D) En positiv potential höjer energi för en negativ laddning
-



(a)



(b)



(c)

**Poisson's
equation**

$$\frac{d^2V}{dx^2} = -\frac{dE}{dx} = -\frac{\rho}{\epsilon_S}$$

V: Potential [V]

E: Electric field [V/cm]

ρ : Charge density [C/cm³]

ϵ_S : Semiconductor permittivity [F/cm]

**Continuity
equation for
electrons**

$$\frac{\partial n}{\partial t} = \frac{1}{q} \frac{\partial J_n}{\partial x} - \frac{n - n_o}{\tau_n} + G$$

n: Electron carrier concentration [cm⁻³]

J_n: Electron current density [A/cm²]

τ_n : Electron recombination lifetime [s]

G: External electron generation rate [cm⁻³s⁻¹]

**Continuity
equation for
holes**

$$\frac{\partial p}{\partial t} = -\frac{1}{q} \frac{\partial J_p}{\partial x} - \frac{p - p_o}{\tau_p} + G$$

p: Hole carrier concentration [cm⁻³]

J_p: Hole current density [A/cm²]

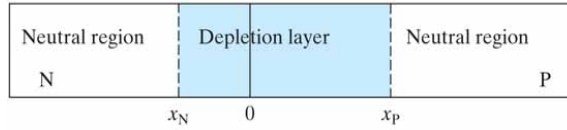
τ_p : Hole recombination lifetime [s]

G: External hole generation rate [cm⁻³s⁻¹]

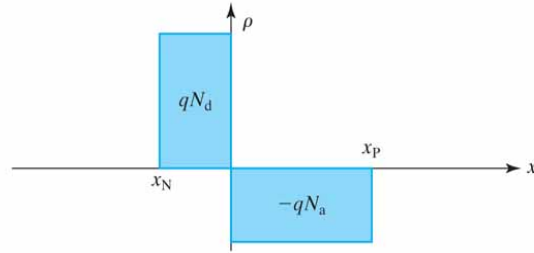
1. qualitatively describe the electronic energy band structure of insulators, semiconductors and metals
 2. calculate the electron and hole concentration in the conduction and valence band using Fermi-Dirac statistics and the energy band model.
 3. describe the constituents of the current density in semiconductors and derive analytical expressions for the current density in the case of low-level injection, electron-hole recombination, externally applied voltage and external generation by light using the drift-diffusion model.
-



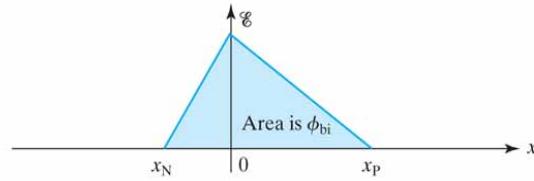
(a)



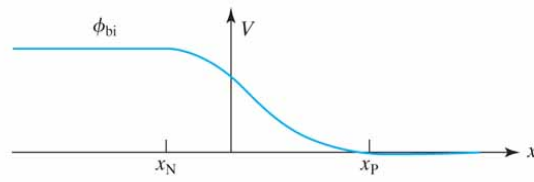
(b)



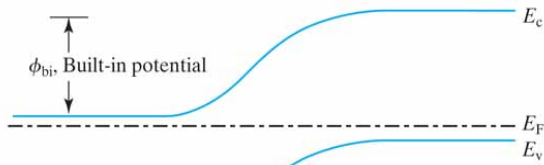
(c)



(d)



(e)



(f)

