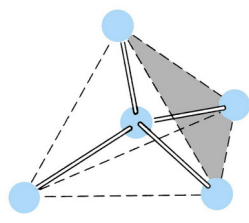
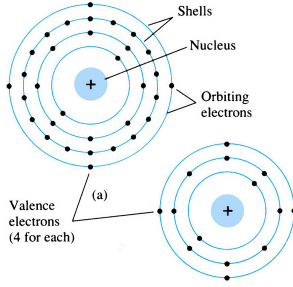


### MATERIAIS SEMICONDUTORES



Estrutura de Cristal

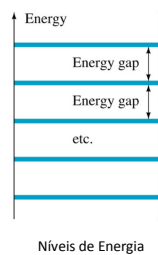


Shells  
Nucleus  
Orbiting electrons  
Valence electrons (4 for each)

Estrutura Atômica: (a) Germânio; (b) Silício

1

### MATERIAIS SEMICONDUTORES



Energy

Valence Level (outermost shell)

Energy gap

Second Level (next inner shell)

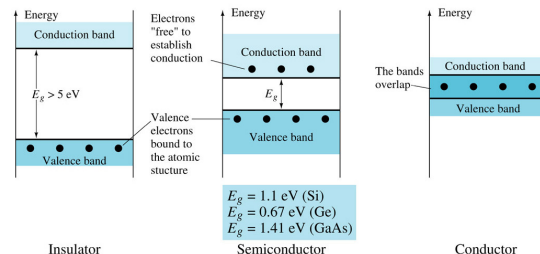
Energy gap

Third Level (etc.)

etc.

Nucleus

Níveis de Energia



Energy

Conduction band

Valence band

Electrons "free" to establish conduction

Valence electrons bound to the atomic structure

The bands overlap

Insulator

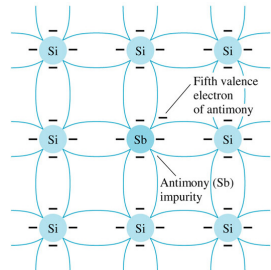
Semiconductor

Conductor

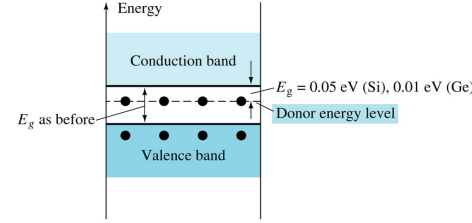
Dopagem

$E_g = 1.1 \text{ eV (Si)}$   
 $E_g = 0.67 \text{ eV (Ge)}$   
 $E_g = 1.41 \text{ eV (GaAs)}$

### MATERIAIS SEMICONDUTORES



Material Extrínseco do Tipo N - Antimônio



Energy

Conduction band

Valence band

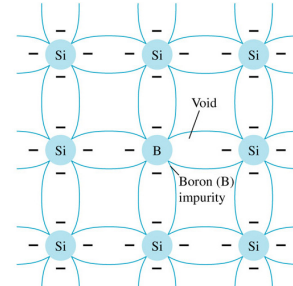
Donor energy level

$E_g = 0.05 \text{ eV (Si)}, 0.01 \text{ eV (Ge)}$

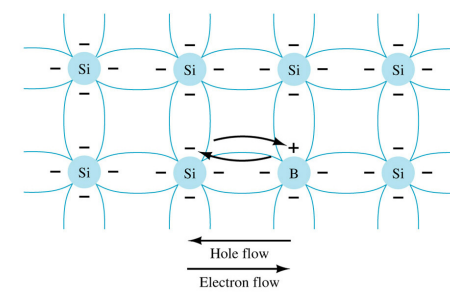
$E_g$  as before

Efeito das impurezas na banda de energia

### MATERIAIS SEMICONDUTORES



Material Extrínseco do Tipo P - Boro

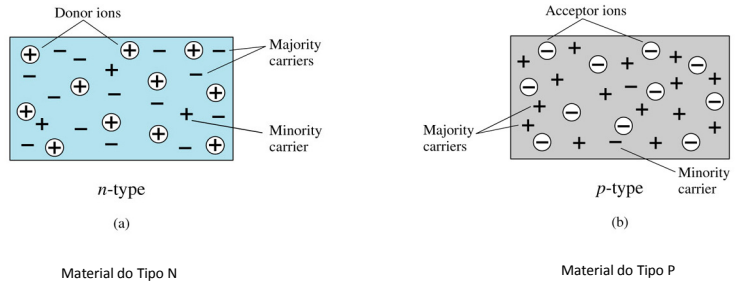


Fluxo de Elétrons e Lacunas

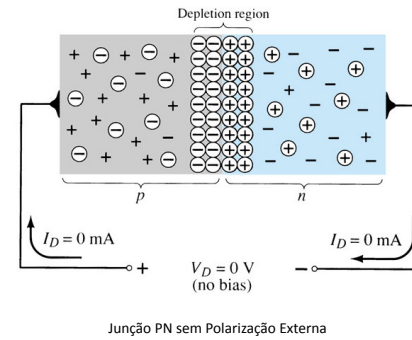
Hole flow

Electron flow

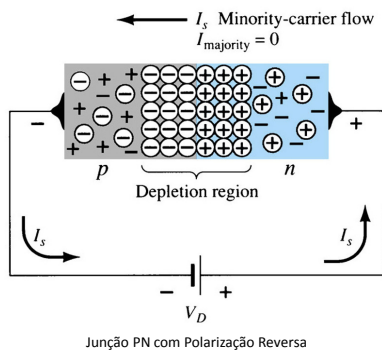
### MATERIAIS SEMICONDUTORES



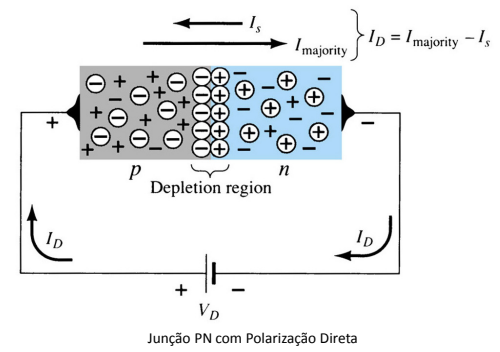
### FUNCIONAMENTO DO DIODO



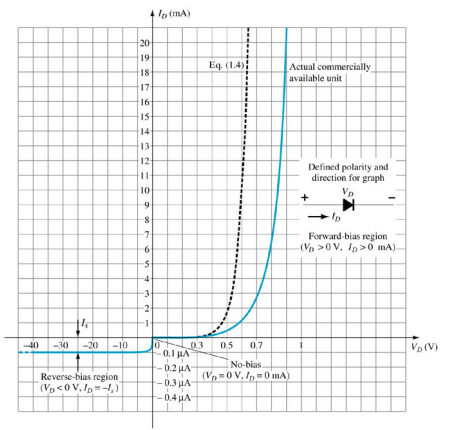
### FUNCIONAMENTO DO DIODO



### FUNCIONAMENTO DO DIODO

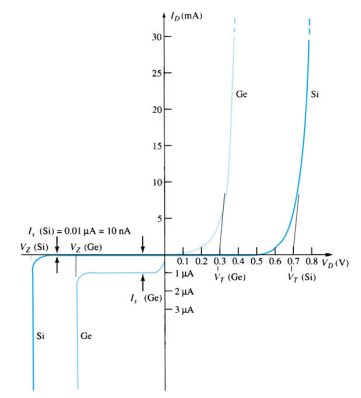


### FUNCIONAMENTO DO DIODO



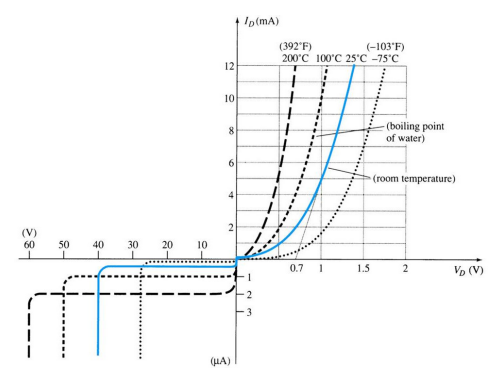
Curva Característica do Diodo de Silício

### FUNCIONAMENTO DO DIODO



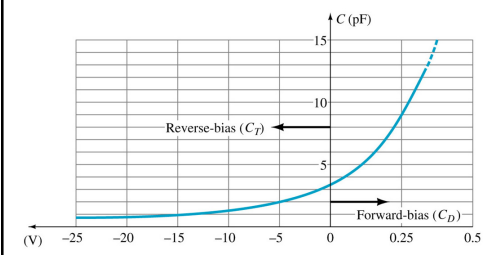
Comparação dos Diodos de Germânio e Silício

### FUNCIONAMENTO DO DIODO

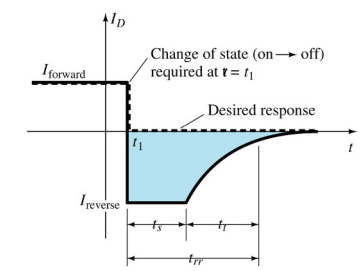


Efeito da Temperatura

### CAPACITÂNCIA DO DIODO



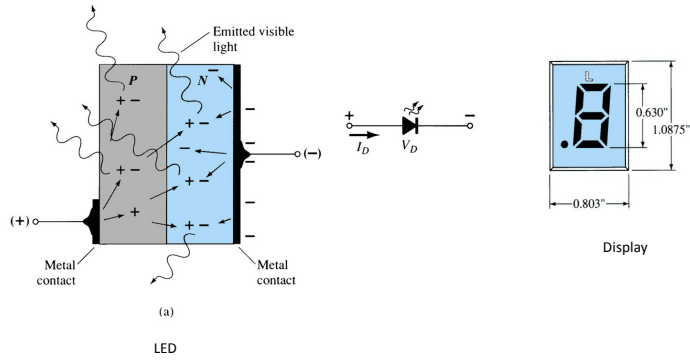
Capacitância de Transição e Difusão



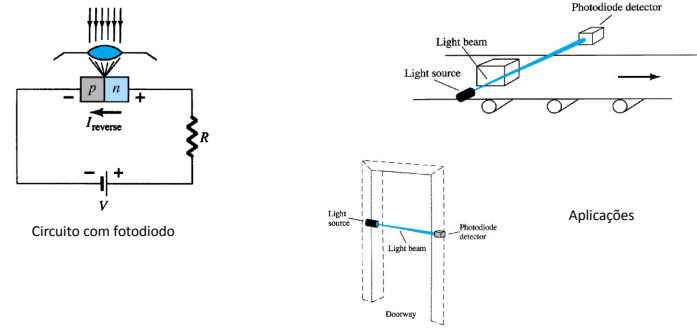
Tempo de Recuperação Reversa



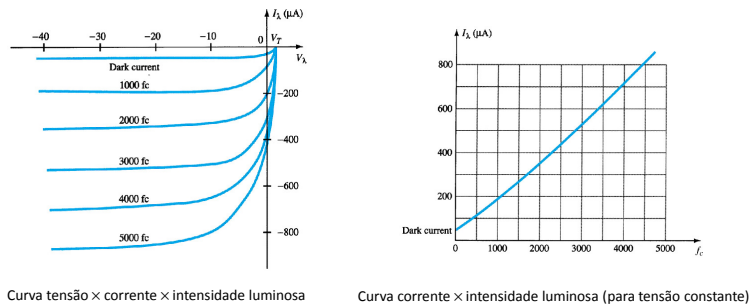
### DIODOS EMISSORES DE LUZ



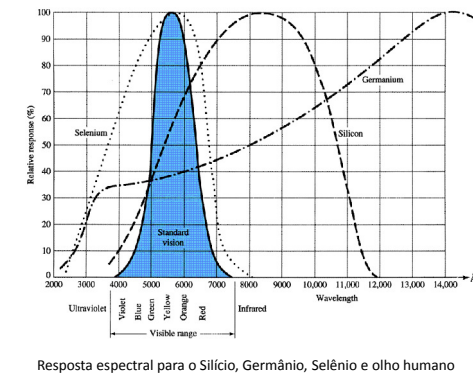
### FOTODIODOS



### FOTODIODOS



### FOTODIODOS



# FOTODIODOS

