

SEMICONDUCTORS ELECTRONICS

1. Intrinsic Semiconductor (Pure semiconductor)

$$(I) \quad n_e = n_h = n_i$$

$n_e \rightarrow$ no. of free electrons

$n_h \rightarrow$ no. of holes

$n_i \rightarrow$ intrinsic carrier concentration

(II) Total current

$$I = I_e + I_h$$

$I_e \rightarrow$ electron current

$I_h \rightarrow$ hole current

2. Extrinsic Semiconductor

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n -type

p -type

$$n_e \approx N_D \gg n_h$$

$$n_h \approx N_A \gg n_e$$

$N_D \rightarrow$ Density of donor atoms

$N_A \rightarrow$ Density of acceptor atoms

3. Mass action law

Under thermal equilibrium

$$n_e n_h = n_i^2$$

[In doped semiconductor]

$n_e \rightarrow$ number density of electrons

$n_h \rightarrow$ number density of holes

$n_i \rightarrow$ intrinsic carrier concentration

4. Dynamic Resistance

$$r_d = \frac{\Delta V}{\Delta I}$$

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Conduction band

CB

E_g

VB

Valence band

$E_g \rightarrow$ Forbidden energy band

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E_g for silicon 1.1 eV

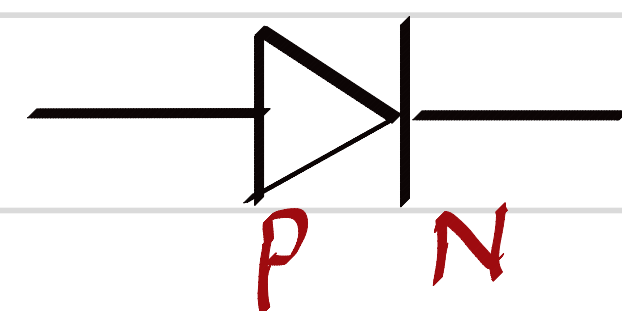
E_g for germanium 0.72 eV

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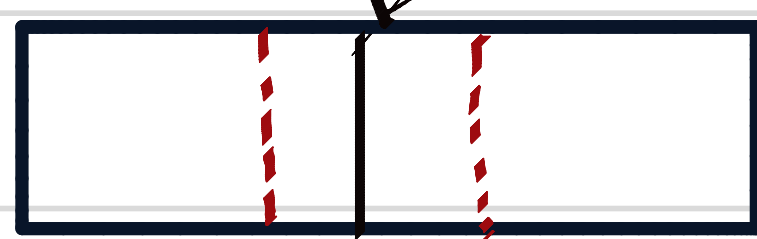
E_g for insulator is about 6 eV

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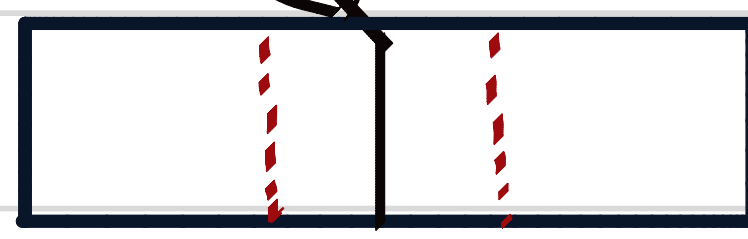
pn-junction



Diode symbol



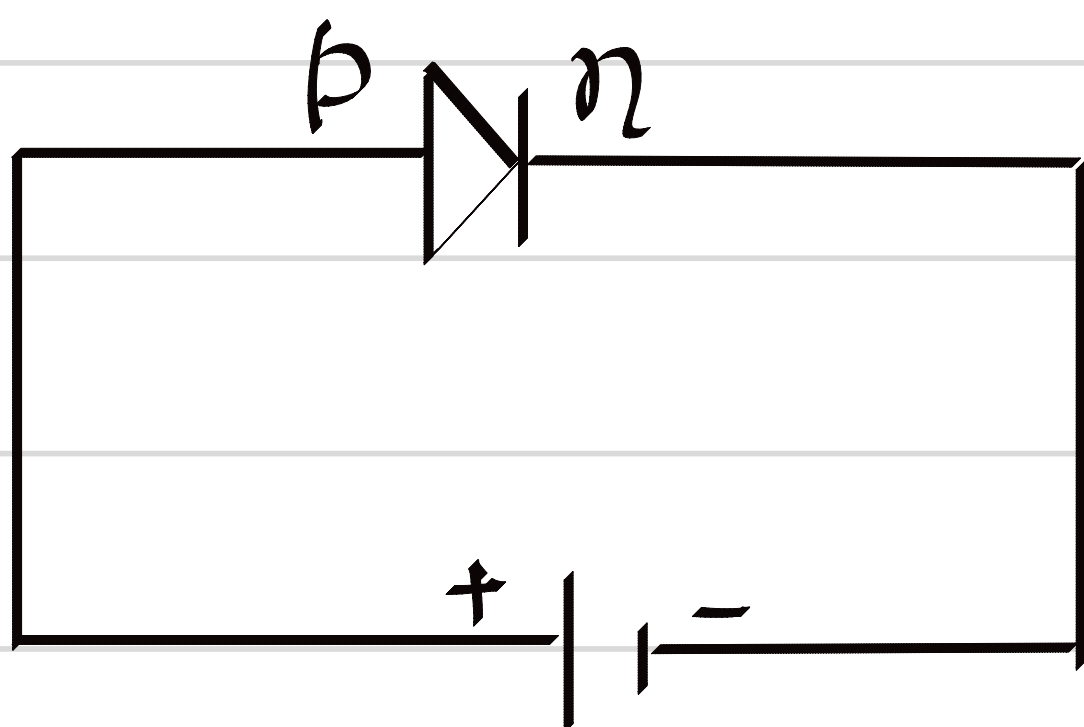
Depletion layer



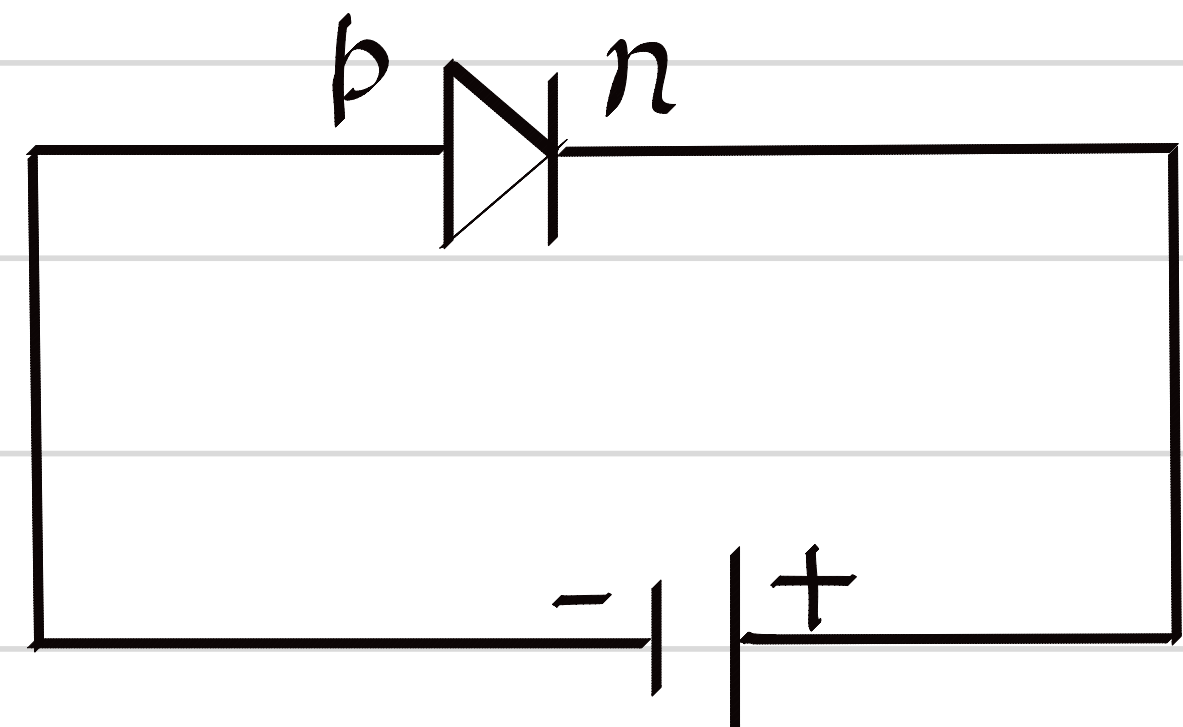
Potential barrier

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Forward Bias



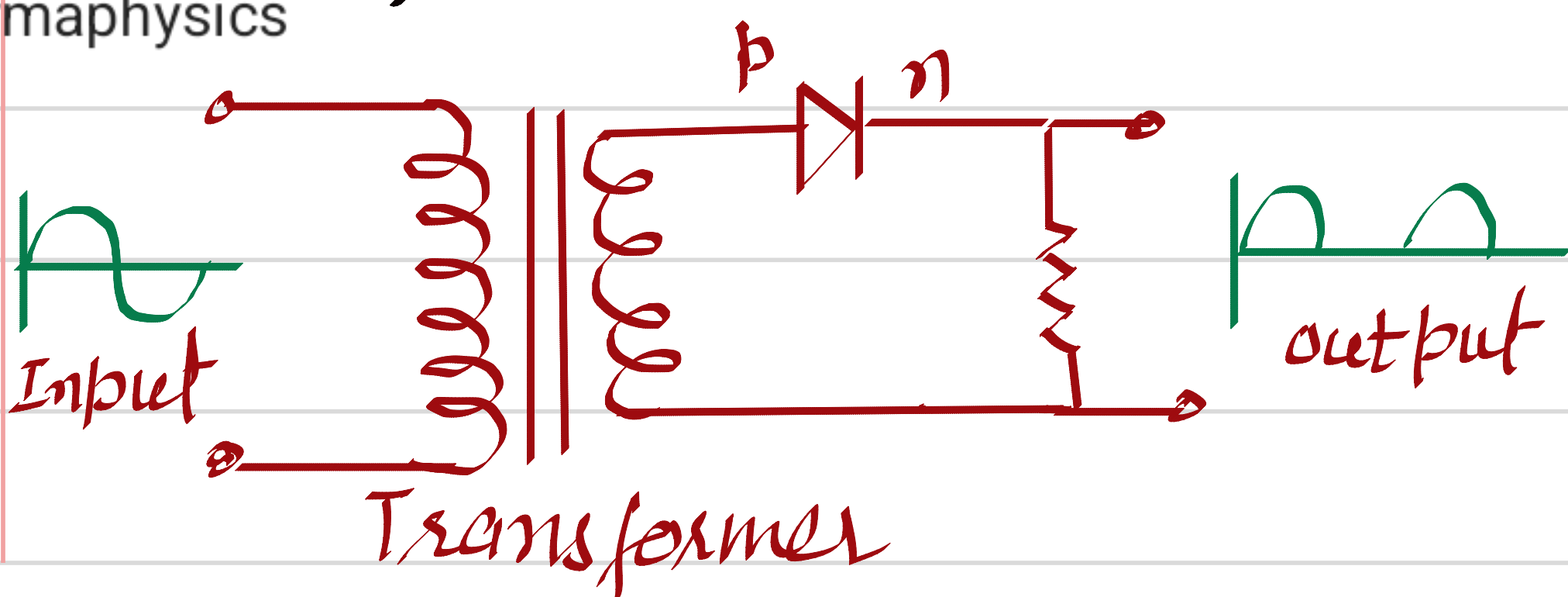
Reverse Bias



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Half Wave Rectifier

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Full Wave Rectifier

