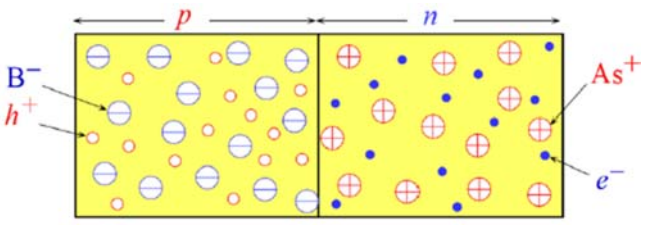
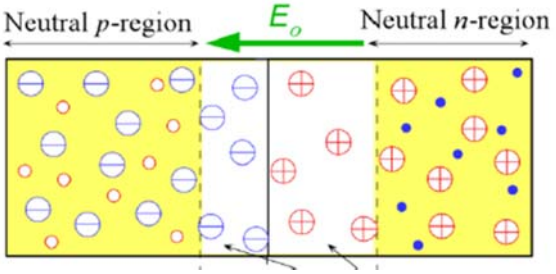
PN Junction





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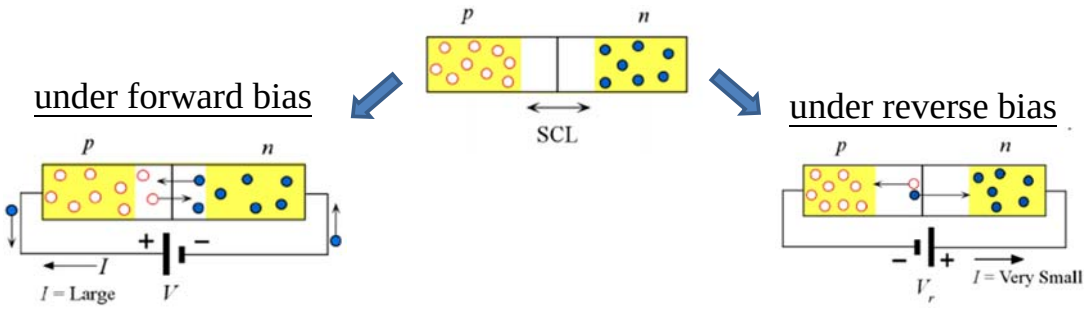
- ✓ A junction is formed by p- and n-type semiconductors, where the fixed ionized donors and the free electrons in the n-region and fixed ionized acceptors and holes in the p-region.
- ✓ Due to the hole concentration gradient from the p-side, holes diffuse towards the right and enter the n-region and recombine with the electrons in the this region. Similarly, the electron concentration gradient drives the electrons by diffusion towards the left.
- ✓ A region called “depletion region” or “space charge layer (SCL)” is created.
- ✓ An internal electric field E_0 established from positive ions to negative ions, as well as the established potential called built-in potential V_0, prevents the diffusion of carriers through the junction (achieve equilibrium).

PN Junction



- ✓ A voltage V is connected across a pn junction with positive terminal attached to the p-side and the negative terminal to the n-side (forward bias). The negative polarity of the supply will reduce the potential barrier to $(V_0 - V)$.
- ✓ Electrons in the n-side can now diffuse to the p-side. Similarly, holes diffuse from p- to n-side. The battery can replenish the carriers. There is therefore a current flow through the junction and around the circuit.
- ✓ When a reverse voltage V_r is applied, V_r adds to the built-in potential V_0 so that the potential becomes $(V_0 + V_r)$.
- ✓ There is hardly any reverse current from diffusion of carriers. There is, however, a small reverse current arising from thermal generation of electron hole pairs (EHPs) in the SCL. The reverse current due to thermally generated EHPs are very small compared with the forward current as they depend on the rate of thermal generation.

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