

CLASS 12

PHYSICS

REVISION NOTES

Class 12 Physics Chapter 14 Semiconductor Electronics – Revision Notes

Quick revision notes for Class 12 Physics Chapter 14 – Semiconductor Electronics, covering energy bands, intrinsic and extrinsic semiconductors, p-n junction formation, and rectification — the topics retained in the current 2026-27 syllabus. Ideal for last-minute board exam revision.

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Energy Bands in Solids

Electrons in a solid occupy a **valence band** (filled, lower energy) and a **conduction band** (available for conduction, higher energy), separated by an **energy band gap (E_g)**. In **conductors**, these bands overlap or the conduction band is partly filled, giving high conductivity. In **insulators**, E_g is very large (several eV), so almost no electrons cross it. In **semiconductors**, E_g is small (≈ 0.7 – 1.1 eV for germanium and silicon), allowing a modest, temperature-sensitive number of electrons into the conduction band.

Intrinsic and Extrinsic Semiconductors

An **intrinsic semiconductor** is chemically pure (e.g. pure silicon or germanium), with equal numbers of thermally generated electrons and holes. An **extrinsic semiconductor** is deliberately doped with impurity atoms: **n-type** doping uses pentavalent atoms (donors) that contribute extra electrons, making electrons the majority carriers; **p-type** doping uses trivalent atoms (acceptors) that create holes, making holes the majority carriers. Doping increases conductivity far beyond what an intrinsic semiconductor can achieve.

Formation of the p-n Junction

When p-type and n-type regions are joined, holes and electrons near the junction diffuse across it due to the concentration gradient, leaving behind fixed, ionised donor and acceptor atoms that create an internal electric field. This field opposes further diffusion, and the resulting narrow, carrier-depleted zone (the **depletion region**) together with its internal field constitutes the junction's **potential barrier**. **Forward bias** (p-side positive) reduces this barrier and allows large current flow; **reverse bias** (n-side positive) increases the barrier and permits only a very small current.

Half-Wave and Full-Wave Rectification

A **p-n junction diode** conducts easily in one direction and blocks the other, making it useful as a **rectifier** — converting AC into (pulsating) DC. A **half-wave rectifier** uses one diode and conducts for only one half of each input cycle, so its output ripple frequency equals the input frequency (e.g. 50Hz for 50Hz mains). A **full-wave rectifier** uses two diodes (centre-tap) or four diodes (bridge) and conducts during both halves of every cycle, giving an output ripple frequency of twice the input frequency (100Hz for 50Hz mains) and a smoother, more efficient DC output.

One-Line Summary

Chapter 14 explains how the size of the energy band gap distinguishes conductors, semiconductors, and insulators; how doping creates n-type and p-type extrinsic semiconductors; how joining them forms a p-n junction with a built-in potential barrier; and how that junction's one-way conduction is used to rectify AC into DC.

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