

# Quasi-Fermi Levels Lesson

**Lesson Topic:** Quasi-Fermi Levels

**Objective of Lesson:** To understand quasi-Fermi levels.

**Reading Assignment:** Section 3.5.2

**What do you need to know for the exam?**

1. You should be able to place a quasi-Fermi level in the band diagram.

### Summary

The quasi-Fermi levels are used to specify (in equations and in the band diagram) the carrier concentrations under non-equilibrium conditions.

### Quasi-Fermi levels

The quasi-Fermi levels are used to specify (in equations and in the band diagram) the carrier concentrations under non-equilibrium conditions. The way I like to put it is to say that in equilibrium, one Fermi level is enough because  $p_0 n_0 = n_i^2$ . Out of equilibrium the carrier concentrations may have changed and if they have, typically  $p_n \neq p_0$  or  $n_n \neq n_0$ . One of the results of this is that one Fermi level is no longer sufficient for describing or calculating the carrier concentrations.

The section in the text is excellent on this subject so there is not much more that I need to lay out for you.

In the band diagram, the location of the quasi-Fermi levels provides visually an estimate as to whether the semiconductor is in low-level injection, and what the level of injection is in a "quasi-"quantitative way :).

We will not use quasi-Fermi levels a lot, but they are important and useful concepts at times so you need to be aware of them and the equations in which they find themselves (see text section).

### Definitions

**Quasi:** A prefix meaning, to some degree or in some manner.