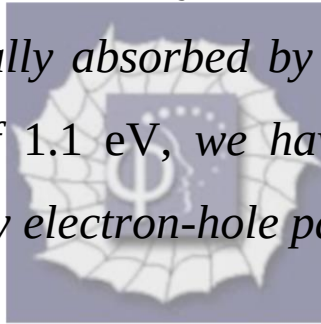


813.

Problem 53.42 (RHK)

When a photon enters the depletion region of a pn junction, electron-hole pairs can be created as electrons absorb part of the photon's energy and are excited from the valence to the conduction band. These junctions are thus often used as detectors for photons, especially x-rays and nuclear gamma rays. When a 6.62-keV gamma-ray photon is totally absorbed by a semiconductor with an energy gap of 1.1 eV, we have to calculate on an average how many electron-hole pairs are created.



Solution:

The gap between the valence band and the conduction band of the semiconductor is 1.1 eV. Therefore, energy of 1.1 eV of the photon is used up in creating one electron-hole pair.

When a 6.6 keV gamma ray photon is totally absorbed by the semiconductor, the average number of electron-hole pairs created in the semiconductor will be

$$N = \frac{6.6 \times 10^3 \text{ eV}}{1.1 \text{ eV}} = 6 \times 10^3.$$

