

47. The valence band is essentially filled and the conduction band is essentially empty. If an electron in the valence band is to absorb a photon, the energy it receives must be sufficient to excite it across the band gap. Photons with energies less than the gap width are not absorbed and the semiconductor is transparent to this radiation. Photons with energies greater than the gap width are absorbed and the semiconductor is opaque to this radiation. Thus, the width of the band gap is the same as the energy of a photon associated with a wavelength of 295 nm. We use the result of Exercise 3 of Chapter 39 to obtain

$$E_{\text{gap}} = \frac{1240 \text{ eV} \cdot \text{nm}}{\lambda} = \frac{1240 \text{ eV} \cdot \text{nm}}{295 \text{ nm}} = 4.20 \text{ eV} .$$