816.

Problem 53.48 (RHK)

In a particular crystal, the highest occupied band of states is full. The crystal is transparent to light of wavelengths longer than 295 nm *but opaque at shorter wavelengths. We have to calculate the width, in electron-volts, of the gap between the highest occupied band and the next* (*empty*) *band.*

Solution:

The crystal is transparent to light of wavelengths longer than 295 nm but opaque at shorter wavelengths.

Therefore, photons of wavelength 295 nm or shorter wavelength have energy equal to more than the gap between the filled band and the vacant band of the crystal.

The energy gap between the two bands will therefore be

$$E_g = \frac{hc}{\lambda} = \frac{6.63\times10^{-34}\times3\times10^{8}}{295\times10^{-9}}\ \text{J}$$

$$= 6.74\times10^{-19}\ \text{J}$$

$$= \frac{6.74\times10^{-19}}{1.6\times10^{-19}}\ \text{eV} = 4.2\ \text{eV}.$$