13.31) Ge is a semiconductor with a band gap of 0.7 eV. What colors of visible light does it transmit?

\[ E_{\text{light}} = hf \]

For transmission, \( E_{\text{light}} \leq 0.7 \text{ eV} \)

\[ \frac{hc}{\lambda} \leq 0.7 \text{ eV} \]

\[ \lambda \geq \frac{hc}{0.7} = \frac{1240 \text{ eV} \cdot \text{nm}}{0.7 \text{ eV}} = 1771 \text{ nm} \]

\( \Rightarrow \) Transmits radio but no visible!

13.32) Explain why semiconductors are opaque to visible light while insulators are clear.

To absorb visible light, the band gap must be narrower than the lowest energy light wave.

\[ \lambda_{\text{long}} = 700 \text{ nm} \]

\[ E_{\text{lowest}} = \frac{hc}{\lambda_{\text{long}}} = \frac{1240 \text{ eV} \cdot \text{nm}}{700} = 1.77 \text{ eV} \]

\( \Rightarrow \) Band gap < 1.77 eV \( \Rightarrow \) Light absorbed

Always with exceptions!
- These are semiconductors
- These are insulators