

Insulators, Semiconductors and Metals

Energy bands and the gaps between them determine the conductivity and other properties of solids.

Insulators

Have a full valence band and a large energy gap (a few eV). Higher energy states are not available.

In order to conduct, an electron must have an available state at higher energy.

Semiconductors

Are insulators at $T = 0$.
Have a small energy gap (~ 1 eV) between valence and conduction bands. Higher energy states become available (due to kT) as T increases.

Metals

Have a partly filled band. Higher energy states are available, even at $T = 0$.

