**Insulators:**

- Valence band is completely filled. Energy gap $\Delta E$ large ($\leq 7$ eV) with $\Delta E \gg kT$.
- At high $T$, if $kT \approx \Delta E$ get some conducting.

**Semiconductors:**

- No sharp distinction between insulator and semiconductor at $T \approx 0K$. Except $\Delta E$ is smaller with $\Delta E$ typically $\leq 1$ eV. At high $T$, some electrons will be excited into valence band.

**Conductors:**

- Highest occupied band is only partially filled. At $T \approx 0K$ electrons can easily get into nearby empty energy levels. $\Delta E \approx kT$ for $T \approx 0K$.

**Fermi-Dirac Distribution:**

$$f_{FD}(E) = \frac{1}{e^{(E-E_F)/kT} + 1}$$

And $\Delta E = E - E_F$.