ENERGY LEVELS

Within the atomic structure of each and every *isolated* atom there are specific energy levels associated with each shell and orbiting electron, as shown in Fig. 1.6 . The energy levels associated with each shell will be different for every element. However, in general:

The farther an electron is from the nucleus, the higher is the energy state, and any electron that has left its parent atom has a higher energy state than any electron in the atomic structure.

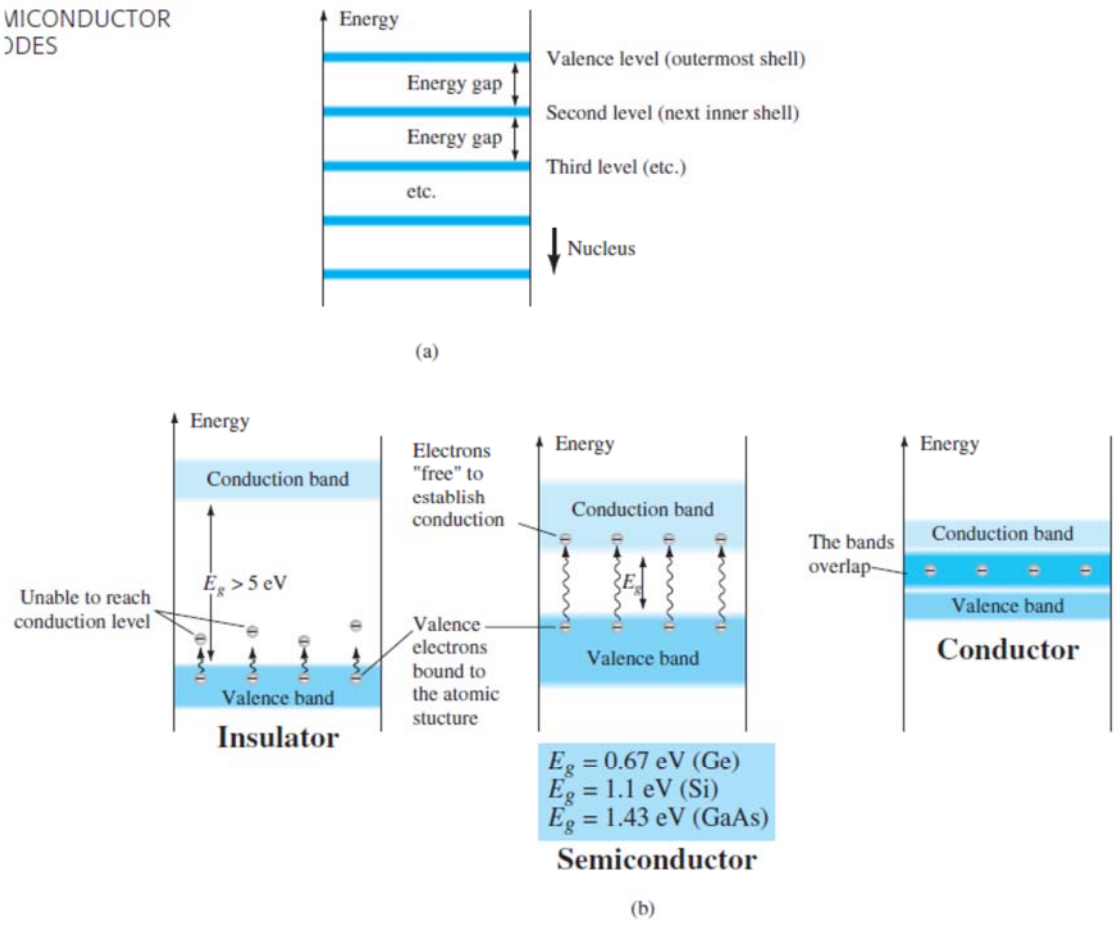

FIG. 1.6

Energy levels: (a) discrete levels in isolated atomic structures; (b) conduction and valence bands of an insulator, a semiconductor, and a conductor.

It is important to underscore the importance of understanding the units used for a quantity. In Fig. 1.6 the units of measurement are electron volts (eV). The unit of measure is appropriate because W (energy) = QV (as derived from the defining equation for voltage: V = W / Q). Substituting the charge of one electron and a potential difference of 1 V results in an energy level referred to as one electron volt .

That is,

$$\begin{aligned} W &= QV \\ &= (1.6 \times 10^{-19}\,\text{C})(1\,\text{V}) \\ &= 1.6 \times 10^{-19}\,\text{J} \end{aligned}$$

and

$$\boxed{1\,\text{eV} = 1.6 \times 10^{-19}\,\text{J}}$$