



Figure 49–5
Lattice structure of a P-type material. (Source: Delmar/Cengage Learning)

When a semiconductor material is mixed with an impurity that has 5 valence electrons, such as arsenic or antimony, the lattice structure will have an excess of electrons, Figure 49–6. Because electrons are negative particles, and there are more electrons in the material than there should be, the material has a net negative charge. This material is referred to as an **N-type material** because of its negative charge.

All solid-state devices are made from a combination of P- and N-type materials. The type of device formed is determined by how the P- and N-type

materials are connected or joined together. The number of layers of material and the thickness of various layers play an important part in determining what type of device will be formed. For instance, the diode is often called a PN junction because it is made by joining together a piece of P-type and a piece of N-type material, Figure 49–7.

The transistor, on the other hand, is made by joining three layers of semiconductor material, Figure 49–8. Regardless of the type of solid-state device being used, it is made by the joining together of P- and N-type materials.