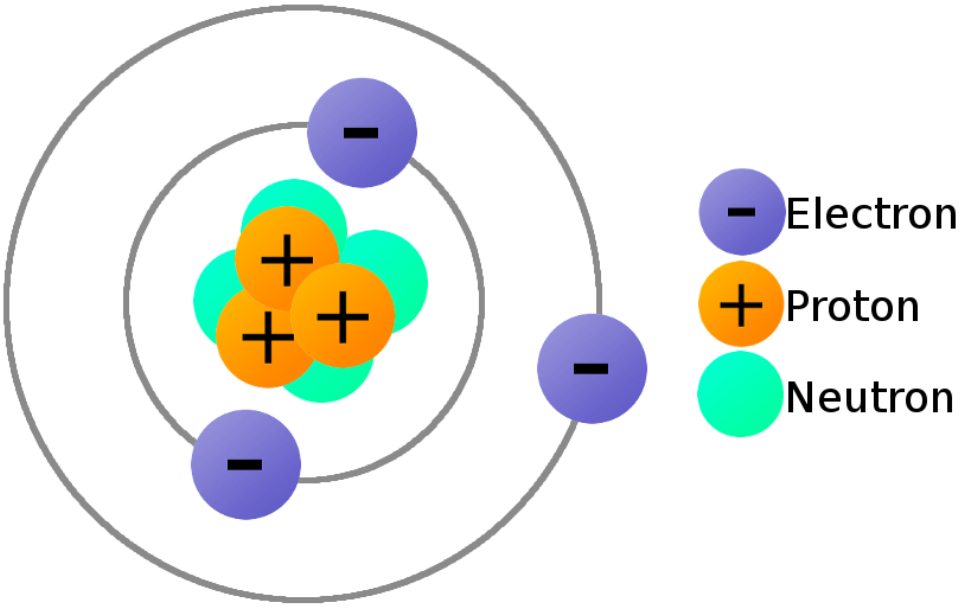
# Basic Electronics Engineering



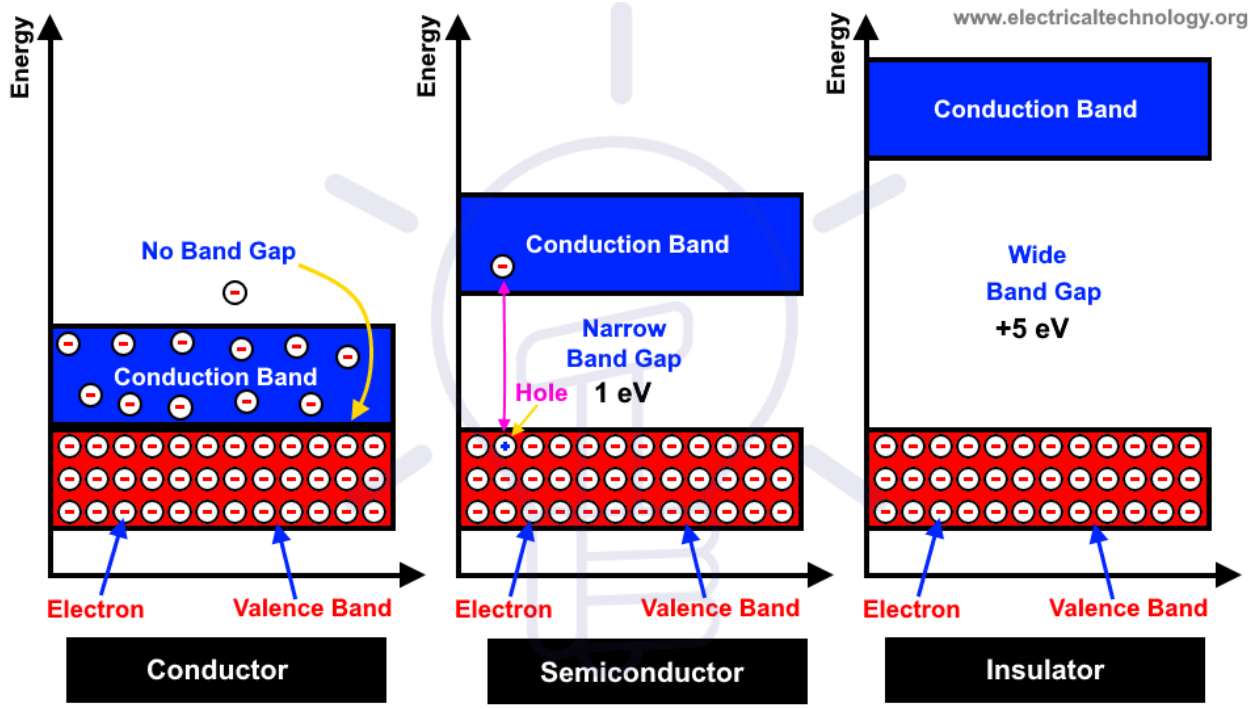

1. **Energy Band**

2. **Conduction Band:** In certain materials (*e.g.* metals), the valence electrons are loosely attached to the nucleus. Even at ordinary temperature, some of the valence electrons may get detached to become free electrons. In fact, it is these free electrons which are responsible for the conduction of current in a conductor. For this reason, they are called *conduction electrons*. *The range of energies* (*i.e. band*) *possessed by conduction band electrons is known as* **conduction band.**

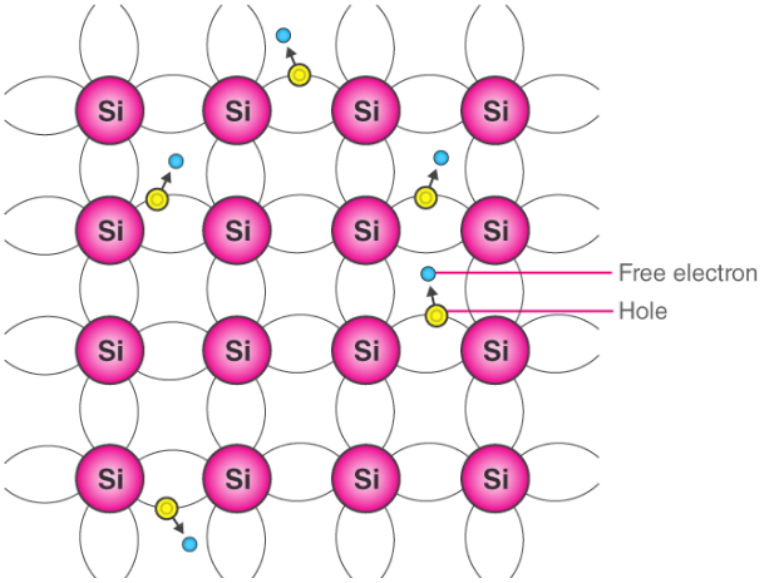
3. **Valance Band** : *The range of energies* (*i.e. band*) *possessed by valence electrons is known as* valence band. The electrons in the outermost orbit of an atom are known as valence electrons.

4. **Forbidden Energy Gap**:

**Energy Band Diagram:**




**Intrinsic Semiconductors:** Semiconductors that are chemically pure, in other words, free from impurities are termed as intrinsic semiconductors. The number of holes and electrons is therefore determined by the properties of the material itself instead of the impurities. In intrinsic semiconductors, the number of excited electrons is equal to the number of holes; $\boldsymbol{n} = \boldsymbol{p}$. They are also termed as undoped semiconductors or i-type semiconductors. Silicon and germanium are examples of i-type semiconductors. These elements belong to the IVth Group of the periodic table and their atomic numbers are 14 and 32 respectively.




We notice from the electron configurations of both the elements that they have four electrons in their outermost shell or valence shell. As the temperature of the semiconductor is increased, the electrons gain more thermal energy and thus break free from their shell. The process of ionization of the atoms in the crystal lattice creates a vacancy in the bond between the atoms. The position from which the electron gets dislodged has a hole which is equivalent to an effective positive charge. The hole is then occupied by a free electron, as a result of which the latter vacant position becomes a hole and the former becomes a neutral position. This way the hole or the effective positive charge is transferred from one position to another. In an intrinsic semiconductor, the number of free electrons is equal to the number of holes.

When the temperature of an intrinsic semiconductor is T=0K, it behaves like an insulator. When the temperature is increased further, (T>0), the electrons get excited and move from the valence band to the conduction band. These electrons occupy the conduction band partially, leaving a correspondingly equal number of holes in the valence band.