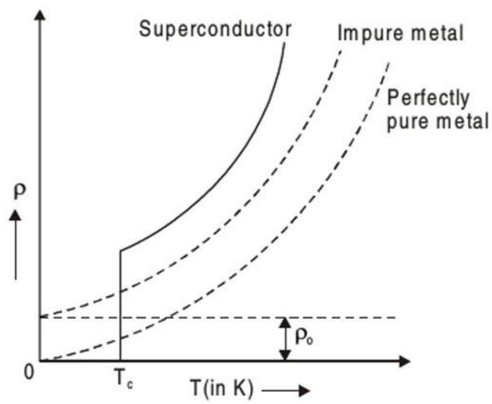
CL34_Q1: Compare the dependence of resistance on temperature of a superconductor with that of a normal conductor.

Answer



The low resistance offered by the metals to the flow of current is due to the scattering of the free electrons by vibrating ions of the lattice. When temperature increases, the amplitude of lattice vibrations also increases and causes more scattering of electrons leading to more resistance. The resistance decreases with temperature and reaches a minimum value at T=0 k. Even at 0 k, metals offer finite resistance called residual resistance which is due to the scattering of electrons by impurities and crystal defects present in the material. Therefore, the resistance of an impure metal decreases with temperature and at 0 k residual resistance exists.

For a perfectly pure metal, where the electron motion is affected only by the thermal vibrations of the lattice, the resistance becomes zero at 0 k. This zero resistance state is however not the phenomenon of superconductivity.

In case of superconductors, the resistance of a superconductor in the non-superconducting state decreases with decrease in temperature as in case of a normal metal up to a particular temperature T_C. At T_C, the resistance abruptly drops to zero and signifies the transition from a normal state to the superconducting state of the material under study.

CL34_Q2. What is meant by persistent currents in a superconductor?

Answer

Once a current is started in a closed loop of superconducting material, it will continue to keep flowing on its own accord around the loop without attenuation as long as the loop is held below the critical temperature. Such a steady current which flows with undiminishing strength is called a persistent current. The persistent current does not need external power to maintain it because there does not exist I^2R losses.