2. Explanation of Seebeck and Peltier effects:

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According to electronic Theory, the free electrons inside the metal move freely like the molecules of a gas in a container. Therefore the free electrons are said to form a gas known as electron gas. This electron gas is uniformly distributed insident the entire volume of a metal. When the temp. of a metal is same every where, then the density and pressure of the electron gas inside the metal is also same everywhere. The density and pressure of an electron gas differ from metal to metal even at the same temp. when two metals are joined together, the electron gas diffuse from on metal to the other and vice versa in such a way that the net diffusion of the electron gas is from a metal at high pressure to that at low pressure. Due to the diffusion of the electron gas an e.m.f is produced at the junction of the two metals which opposes the diffusion the electron gas.

When this e.m.f. is sufficient to stop the further net diffusion of the electron gas, then the state of the dynamic equilibrium is reached. In the state of the dynamic equalibrium there exists a certain e.m.f at the junction of the two metals, which is known a Peltier e.m.f. π.

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Seebeck Effect

When two dissimilar metals A and B (say Cu and Fe) are joined together to form a Thermo-Couple (fig-5), then at each junction of Thermo-Couple, a Peltier e.m.f. is produced. If the two junctions are at the same temp., then the Peltier e.m.f.'s are equal and opposite. Therefore the net e.m.f. and hence the current in the Thermo-Couple is zero. If however the junctions are at different temp. T_1 and T_2 ($T_2 > T_1$), the Peltier e.m.f's π_1 and π_2 at the junctions are no longer equal so there is a resultant e.m.f. $\pi_2 - \pi_1$ in the circuit, due to which a current flows in the Thermo-Couple. This explains seebeck effect.

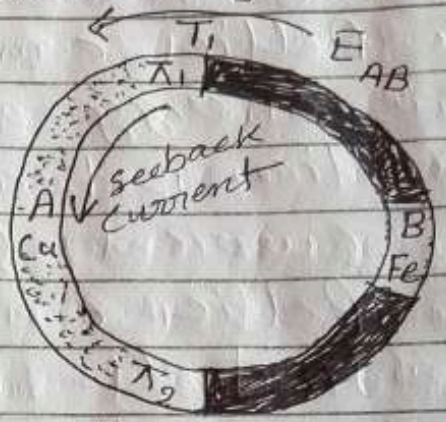

fig-5

Peltier effect :-

When two dissimilar metals A and B (say Cu and Fe) and joined together to form a Thermo-Couple (fig-5) then at each junction a Peltier e.m.f. is set up. Let the two junctions of the Thermocuple be at the same temperature, then the Peltier e.m.f's at the junctions are equal and opposite (i.e. $\pi_1 = \pi_2 = \pi$ say).

In the case of Fe-Cu junction, the Peltier e.m.f. acts from Cu to Fe. When a current flows through a junction from Fe to Cu by a battery of e.m.f. E_{AB}. it flows against the Peltier e.m.f. and hence loses energy. This energy appears as heat and the junction is heated. At the other junction the current flows in the direction of the Peltier e.m.f; so that the Peltier e.m.f. itself does the work and energy is absorbed from the junction resulting into cooling of the junction. This explains Peltier effect.