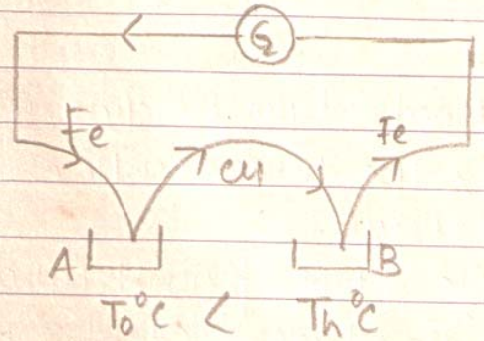
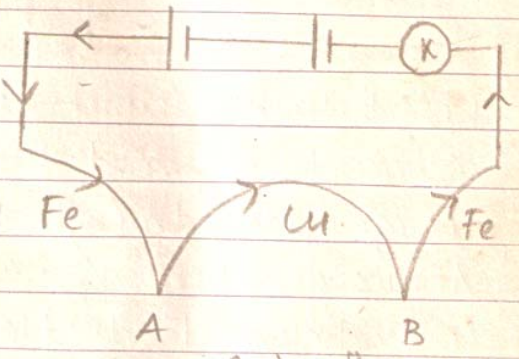
Peltier Effect: Peltier effect is just the reverse of Seebeck effect.



Seebeck Effect.

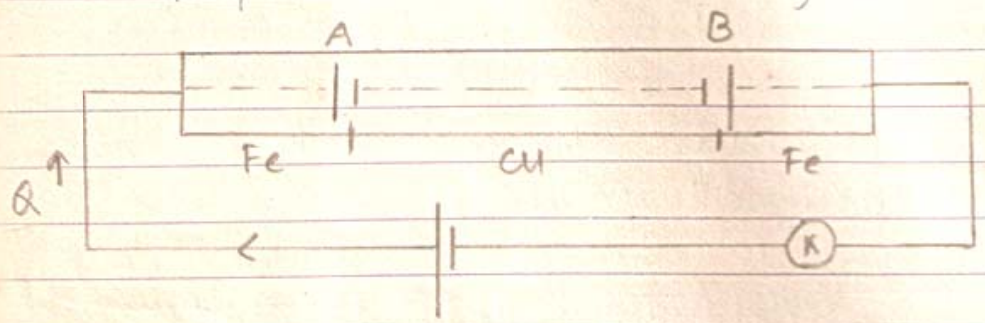


Peltier Effect.

A current is passed through a thermo couple, by keeping a battery in the circuit. Before passing current through the circuit both the junctions are at same temp. When current is passed by closing the key K; it is found that the temp. at the two junctions become different. Comparing the two figs. we find that in Peltier effect the temp. of that particular junction (A) rises (T_A°C > T_B°C) which is to be kept cold

($T_0°K < T_h°C$) in Seebeck effect, to get the current in the same direction.

Explanation: When two dis-similar metals are joined to form a junction due to diffusion of free electrons across the boundary a small e.m.f is developed across the boundary.



Let E be the e.m.f developed at the junction. When current is passed through the thermocouple a charge flows through the circuit.

At the junction A, charge flows from higher to lower potential i.e flows in favour of the P.d & hence work is done $W = Q \cdot V = Q \cdot E$ and this work done is released in the form of heat energy, which raises the temp. of the junction A.

At the junction B, charge flows from lower to higher potential i.e against the P.d & hence work is done to be done on the charge; energy is absorbed in the form of heat energy & consequently the temp. of the junction B falls.

The work done in taking a unit positive charge across the junction is the heat energy evolved or absorbed at the junction when unit +ve charge flows across it is

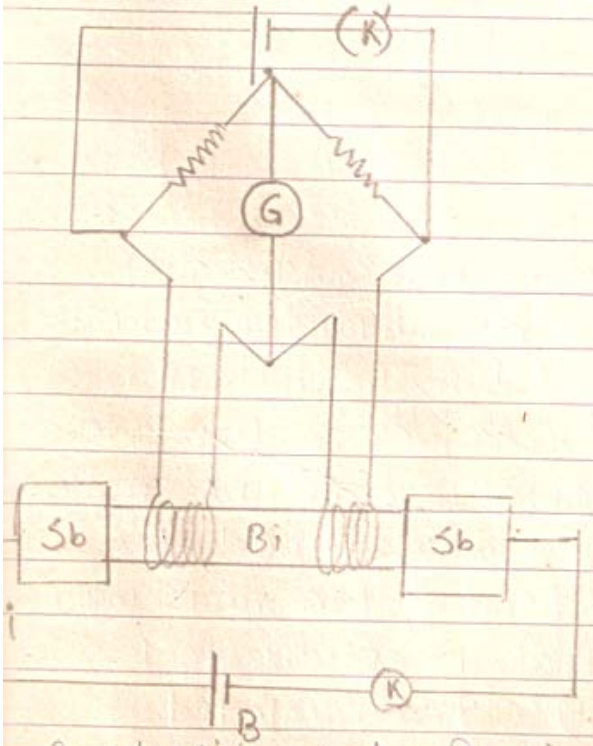
known as Peltier co-efficient of that junction Π.

$$\Pi = \frac{W}{Q} = P.d = E.m.f \text{ developed at the junction.}$$

unit of Π is volts.

The Peltier co-efficient of a junction depends on
(i) elements forming the thermo couple.
(ii) the temp. of that junction.
For a given thermocouple, Peltier coefficient depends only on the temp. of that junction.

Demonstration: A composite rod of antimony & Bismuth is taken as shown. Two coils of insulated copper wire having equal resistance are wound at the two junctions & are connected in the 3rd & 4th arms of a wheatstone bridge. The ratio arms are also kept ~~also kept~~ equal. The bridge is balanced & on closing the key K' the galvanometer gives null deflection. A battery B is connected in series with the composite rod, through a key K. Closing the key 'K' a current is passed through the composite rod. It is found that the galvano-meter



gives a deflection indicating that the bridge is thrown out of balance. This is possible only if the resistance of the coils wound at the junctions changes due to the change in temp at the two junctions. Hence on passing current heat must have been absorbed & evolved at the two junctions, resulting in the change in temp at the two junction.