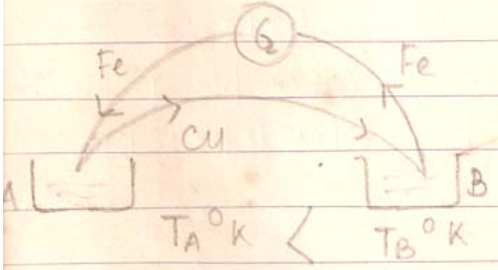
Thermo-electricity:

Seebeck Effect: When the junctions of two dis-similar metals are kept at different temp. a current flows through the circuit, known as Thermoelectric current & the e.m.f responsible for this current is known as thermo emf or Seebeck e.m.f and the phenomenon is known as thermoelectric effect or Seebeck effect.

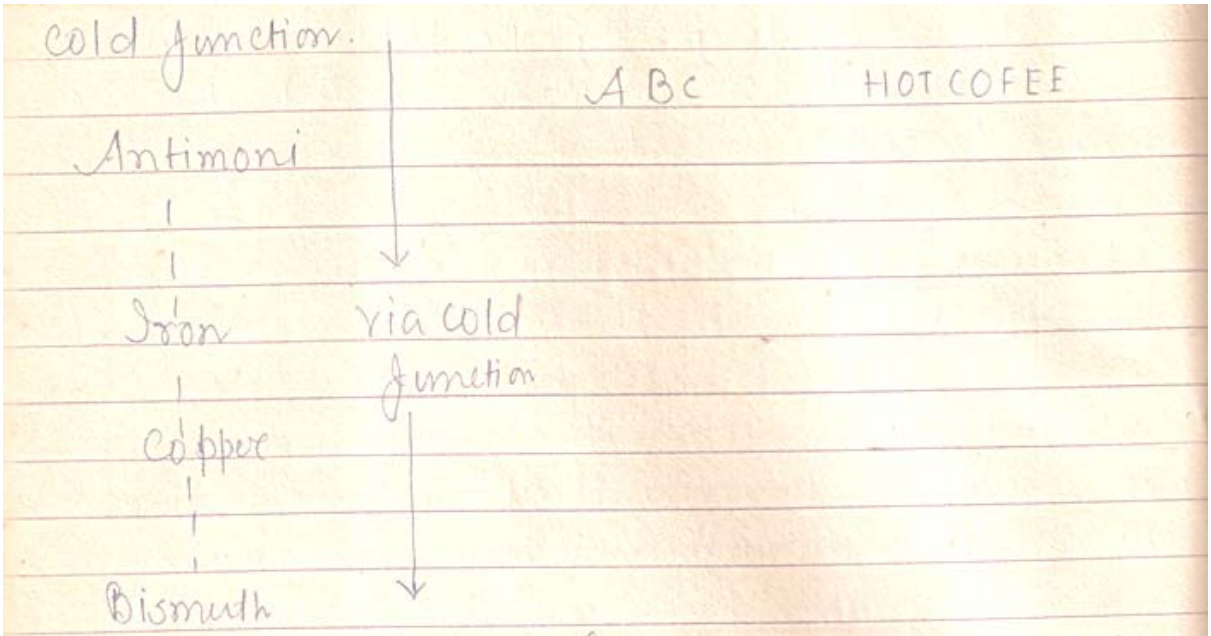


The thermo e.m.f is very very small of the order of few micro volts per °c.

$E = 2 \times 10^{-6}$ volts/°c to 20×10^{-6} volts/°c.

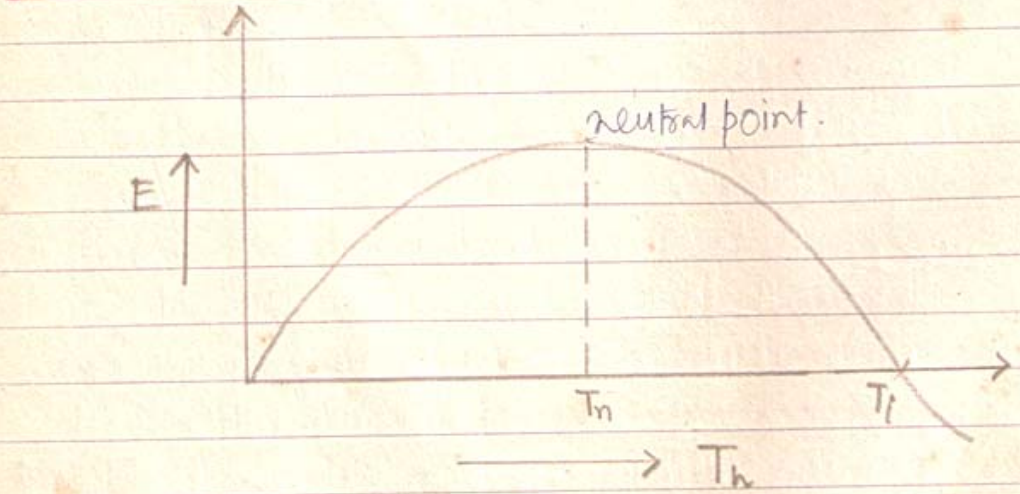
The thermo emf generated depends on two factors
(i) The elements forming the thermo couple.
(ii) The temp. difference between the two junctions.

To find the direction of current in the thermo couple, Seebeck from his experimental result listed all the element according to a sequence in a table current flows from the element occuring higher position in the table to that in the lower position via



If the gap in the Seebeck table between the elements which form the thermo couple is more, more Seebeck e.m.f is developed per degree Centigrade.

Variation of Seebeck e.m.f with temp.



Keeping the temp. of the cold junction constant if the temp. of the hot junction is increased temp. difference increases. It is found that the thermo e.m.f increases with increase in temp. differ

reaches a maximum value for a particular temp. of the hot junction, known as neutral temp. T_n & then thermo e.m.f decreases with increase in temp. and becomes zero for a particular temp. of the hot junction. If the temp. is increased further Seebeck e.m.f changes its sign & increases. This temp. of the hot junction at which Seebeck e.m.f becomes zero & changes its sign is known as Inversion temp. T_i.

The neutral temp. T_n is a constant for a given thermocouple, independent of the temp. of the cold junction, but temp. of inversion is not a constant, but depends on the temp. of the cold junction. " Temp. of Inversion T_i is always as high above the neutral temp. T_n as the cold junction below it."

For Cu-Fe thermocouple T_n = Constant = 550°C.

T_c	T_h		T_n	T_i
0°C	550°C	E_{max}	550°C	1100°C
100°C	550°C	→ E_{max}	550°C	1000°C
300°C	550°C	⟶ E_{max}	550°C	800°C

i.e. $T_i - T_n = T_n - T_c$

Or $$T_n = \frac{T_0 + T_i}{2}$$

also being same the e.m.f developed at the two junctions become same & hence no current flows through the circuit. But when the two junctions are kept at two different temp. the free electron concentration at the two junctions becomes different & hence the e.m.f developed at the two junctions also become different. A current flows through the circuit.