

B.Sc. Part II

Physics Honors

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Current Electricity

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Peltier's Effect :-

When an electric current is passed through a thermocouple, heat is either absorbed or released at the junctions, depending on the direction of current flow. This effect is called Peltier effect, when the direction of current is reversed in thermocouple, the heat evolved or absorbed or interchanged at the junction. This effect is an inverse process of Seebeck effect.

Peltier Coefficient :-

Peltier Coefficient at any temp. for the junction of two metals is the product of absolute temp. and thermoelectric power at that temp. Peltier's coefficient, denoted by P .

$$\pi = TP$$

$$\text{or } \pi = T \frac{dE}{dT}$$

Cause of Peltier effect :-

If two dissimilar metals are joined, contact potential is established at the junctions i.e. the potential of one must become above that of the other. For example: in Cu-

Fe Thermocouple, The Potential of Fe is Greater than the Potential of Cu. At one junction, current flows from lower potential to a higher potential and the energy are required for this purpose, which is absorbed from the junction and hence it is cooled. At another junction, current flows from higher potential to lower potential. The energy is given out at this junction and makes the junction hot.

Thomson's effect :-

The phenomenon of evolution or absorption of heat along the length of a conductor on passing current through it when its two ends are kept at different temp. is known as Thomson's effect.

If an electric current is passed through a copper wire from its hotter end to the colder end the heat is evolved and the wire becomes hot. If the current is reversed, heat is absorbed along the conductor. Similarly, if an electric current is passed through an iron wire from its hotter end to the colder end, the heat is absorbed and the wire gets cooled. If the current is reversed, the heat is evolved along the conductor. So, Thomson's effect is reversible. The substances, which behave like copper are said to have a +ve Thomson's effect. The substances which behave like iron are said to have -ve Thomson's effect. Thomson's effect of lead is nil. So it is used as the standard metal in thermo electricity.

Causes of Thomson's effect :-

When two ends of a conductor are kept at different temperature, the number of free electrons in the higher temperature region will be higher than those in the lower region. So there is diffusion of electrons from one region to another and this gives rise to an emf which is called Thomson's emf.