

Dr. Shiva Kant Mishra

Dept. of Physics

H. D. Jain College Ara

B. Sc. Part II Paper IV

Physics Hons

Current Electricity

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VKSU

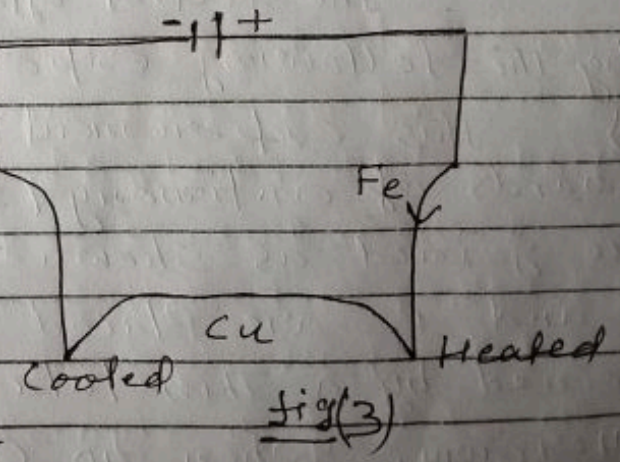
Peltier Effect



In 1834 Jean Peltier (1785-1845) discovered a Thermo-electric effect which is the converse of Seebeck effect. He found that when a current is passed through a Thermo-couple whose two junctions are initially at the same temperature. Then one of the junctions is heated while the other is cooled; showing that heat energy is being liberated at one junction (there by causing it to be heated) and absorbed at the other junction there by causing it to be cooled.

Thus by the passage of electric current through a Thermo Couple with junctions initially at the same temp. a difference of temp. is developed between the two junctions. The effect is known as Peltier effect.

For a given pair of metals the heating or cooling of the junction depends on the direction of the current. At a particular junction is heated by passing the current in one direction.



The same is cooled when the direction of the current is reversed i.e. the Peltier effect is reversible.

It should be noted that the heating & the cooling of the two junctions for fig (3) caused by the Peltier effect provide the conditions necessary for the Seebeck effect of fig (1). The direction of the resulting Seebeck current is opposite to the battery current. If this thermoelectric current did not oppose, but aided the battery current, it would result in the heated (cooled) junction being still further heated (cooled), thereby resulting in a still greater current and so on, without limit.

Experimental demonstration of Peltier effect:

The Peltier effect may be demonstrated by the following experiments. —

(1) This experiment is due to Peltier himself. Rods of antimony (Sb) and Bismuth (Bi) are joined as shown in fig (4). The two junctions A and B are placed in two glass bulbs joined by a thin tube containing a pellet of mercury. When no current is passed through the rods, junction A and B are at the same temperatures and the pellet of mercury

lies symmetrically at the centre. However when a current is passed from a battery in a particular direction [say in the direction shown by arrow] through the couple then there is evolution of heat at the junction A and absorption of heat at the other junction B. therefore the junction A is heated and the junction B is cooled. Due to heating of air in bulb A and the cooling in the B mercury moves along the direction \vec{AB} (i.e. from A to B). If now the direction of current is reversed then A will be cooled and B will be heated. therefore the pellet of mercury now moves along the direction \vec{BA} (i.e. from B to A). It may be noted that Joule heating has no effect on the motion of the pellet since it is the same for the metals inside each bulb.

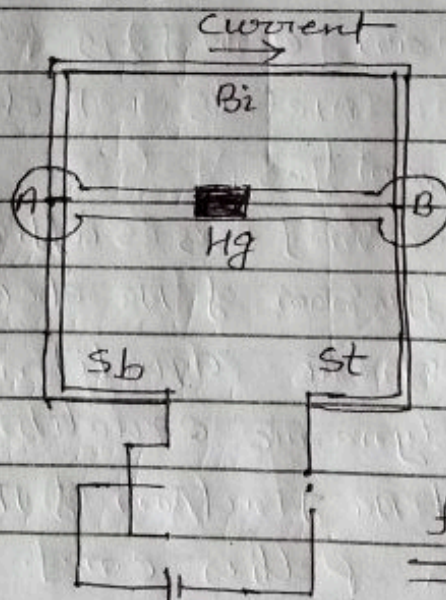


Fig (4)