03
FEBRUARY • FRIDAY
WK05 • 034-331

FEB - 2017

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27	28					

Thermo couple → A device, consisting of two dissimilar metal wires or semiconducting rods welded together at their ends, is called thermocouple.

A Thermo e.m.f is generated in the device when the ends of ~~thermoco~~ thermocouple are maintained different temperatures, The magnitude of the e.m.f is related to the temperature difference. Hot junction is called the measuring junction which exposed to the temperature to be measured, The cold junction is called the reference junction, which is maintained at a known reference temperature.

Thermo electricity and thermo electric effect →

An electric current generated by a heat is known as thermo-electricity. There are three interrelated thermo electric effect known as

(1) seebeck effect
(2) Peltier effect
(3) Thomson effect

seebeck effect → when the Junction of couple kept at different Temps (Hot & cold), an electric current

Circulates round the circuit called thermo electric current and the corresponding emf is called the thermo emf is called seebeck effect. The magnitude of the emf depends on the nature of the metals and the difference in temperature. The seebeck effect is the basis of the thermo-couple.

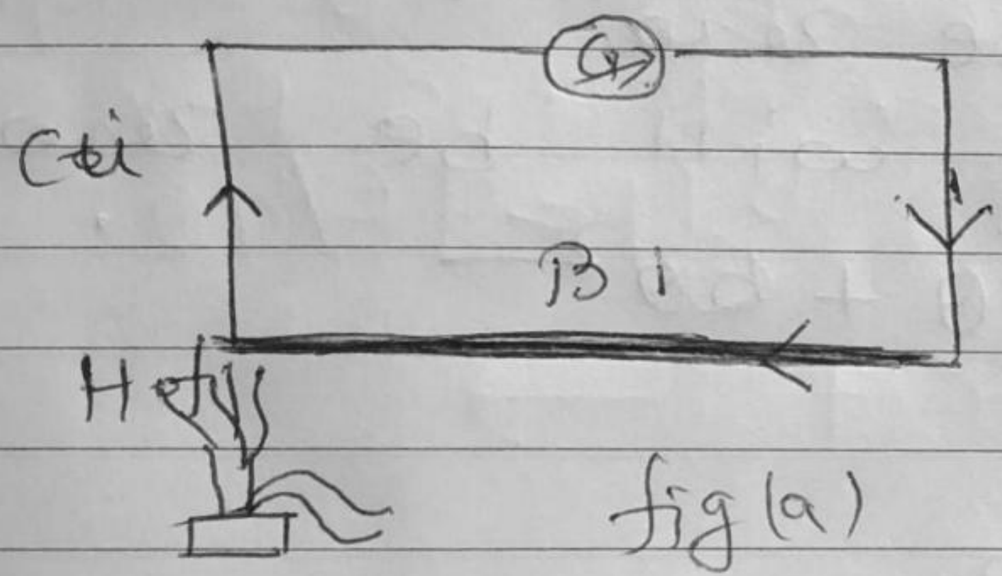


fig (a)

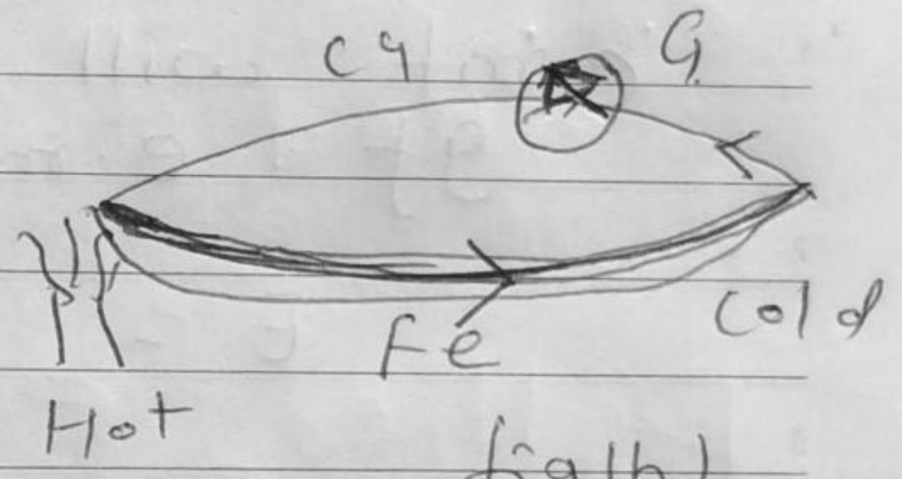


fig (b)

Experiment → Thermocouple of Cu-Bi & Cu-Fe connected with galvanometer and both ends are kept at Hot and cold junction then electric current flows in the couple shown in the deflection of galvanometer.

effect of temperature → The thermo emf varies with temperature from this equation

$$E = a\theta + \frac{1}{2}b\theta^2$$

e.m.f

$$E = a\theta + \frac{1}{2}b\theta^2$$

where a & b cast & called thermo electric constants of the couple and

θ = The difference of temperature between the Hot and cold junction

Now variation of e.m.f with temp

$$dE/d\theta = a + 2b\theta$$

of $dE/d\theta = 0$

$$a + 2b\theta_n = 0$$

$$\theta_n = -(a/2b)^{\circ}C$$

This is called neutral temp at which variation of temp with e.m.f will be zero

If e.m.f will be zero then

$$E = a\theta + b\theta^2$$

$$E = 0$$

$$a\theta + b\theta^2 = 0$$

$$\theta(a + b\theta) = 0$$

$$\theta_i = 0$$

$$(a + b\theta) = 0$$

$$a + b\theta = 0$$

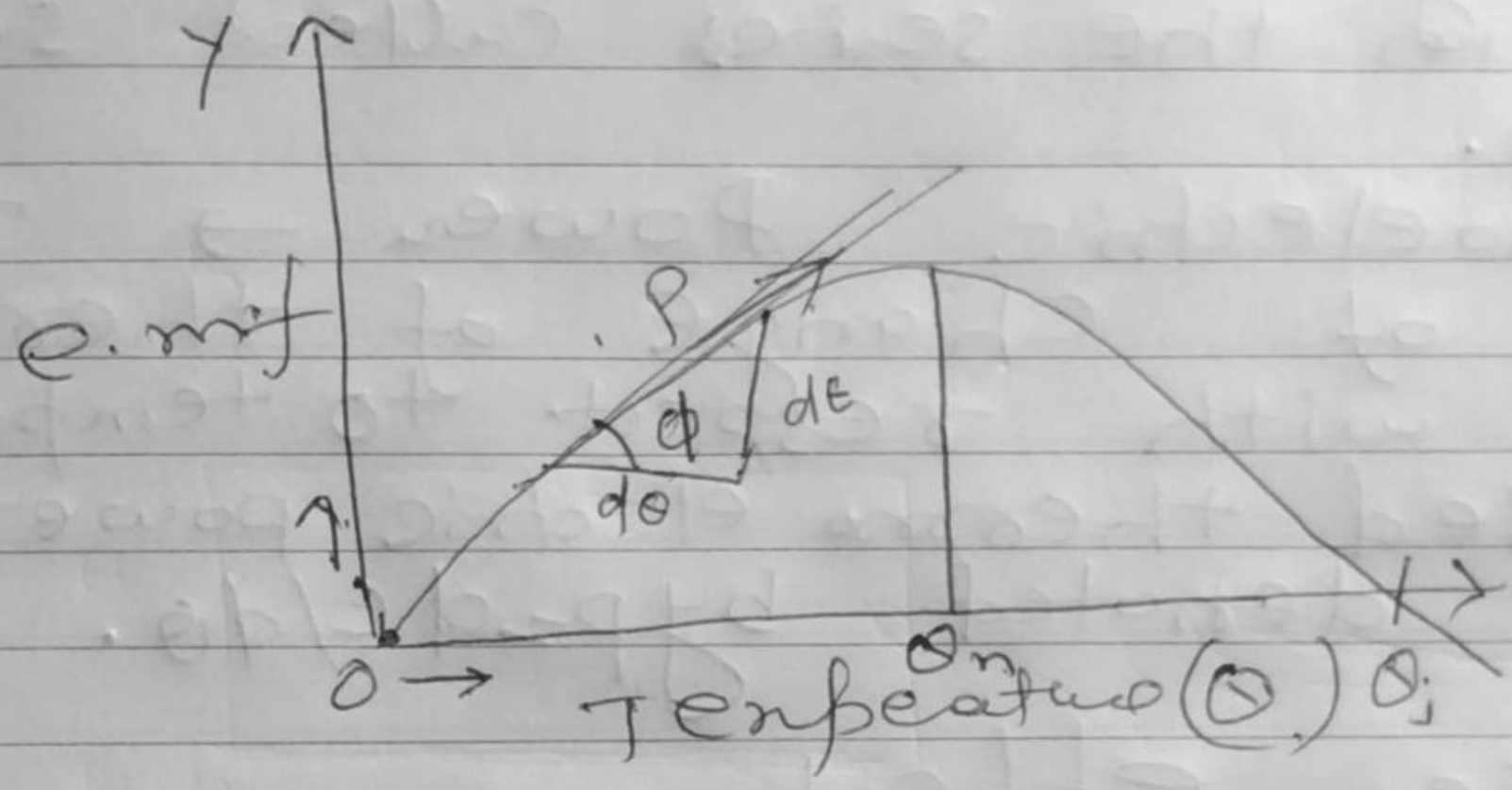
$$\theta_i = -a/b = -2(a/-2b) = -2\theta_n$$

$\theta = \theta_i$ = temp of inversion

= Twice of neutral temp

This shows that the temperature of inversion is as much above the neutral temp as the neutral temp

is above that of the cold junction. Hence, for a given thermocouple, the temperature of inversion is not constant but depends on the temp of the cold junction.



The variation of emf and temperature is a parabola. The temp of the junction at which maximum current flows in a circuit is known as the neutral temp for that couple. The neutral temperature for a given thermo couple is fixed and remains constant whatever may be the temp of the cold junction. The emf produced in this way is called thermo e.m.f. The temp of the hot junction beyond which the direction of the current or e.m.f is reversed is known as temperature of inversion. For Cu-Fe. neutral temp = 270°C
temp of inversion = 540°C } of temp of cold junction = 0°C

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Seebeck series ⇒ The arrangement of met. different metals in series

Bi — Ni — Co — Pd — Pt — V — Mn — Ti — — etc the current flows across the hot junction from the metal occuring earlier to that occuring later in the series called seebeck series.

Thermoelectric Power → The rate of change of thermo. emf with respect to temperature is called thermo electric power and it is denoted by $p = d\epsilon/d\theta$.