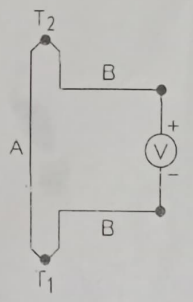
THERMOELECTRIC EFFECT APPARATUS

Aim: To Study Thermoelectric Effect and to measure Seebeck and Peltier Coefficient.

Theory: The **thermoelectric effect** is the direct conversion of temperature differences to electric voltage and vice versa. A thermoelectric device creates a voltage when there is a different temperature on each side. Conversely when a voltage is applied to it, it creates a temperature difference (known as the Peltier effect). At atomic scale (specifically, charge carriers), an applied temperature gradient causes charged carriers in the material, whether they are electrons or electron holes, to diffuse from the hot side to the cold side, similar to a classical gas that expands when heated; hence, the thermally induced current.

Two impotant processes of thermoelectric effects are Seebeck effect and Peltier Effect named after their respective discoverers. The **Seebeck effect** is the conversion of temperature differences directly into electricity. The effect is that a voltage, the thermoelectric EMF (E), is created in the presence of a temperature difference between two different metals.



In fig. A and B are the two different metals having respective seebeck coefficient as S_A and S_B and T_1 and T_2 are the thermocouple junctions. In General, variation of thermoelectric EMF(E) with temperature(T) follows a polynomial function, but in the operating range of the present setup, it can be written as

$$E = \alpha T \quad \text{where } \alpha \text{ is Seebeck coefficient.}$$

Also Peltier Coefficient (π) can be expressed as

$$\pi = \alpha T \quad \text{where T is absolute temperature.}$$

Experimental Procedure

1. Place glass beaker and Teflon beaker in the respective slots of the stands.
2. Place crushed ice into the Teflon beaker and silicon oil (provided with the setup) into the glass beaker.
3. Put one tip of the thermocouple into the Teflon beaker and other tip into the oil.
4. Place heating rod and thermometer into the glass beaker.

5. Connect the heating rod and the two ends of the thermocouple with the main unit with respective color coded connectors.

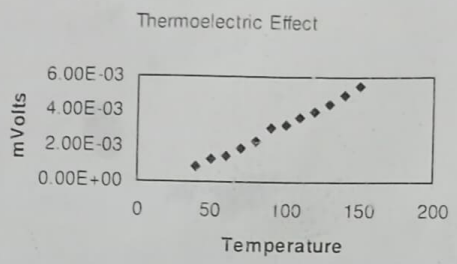
6. Switch ON the heater and raise the temperature of the oil upto 130 °C and switch off the heater.

7. Now tabulate the readings of the voltage (mV) vs Temperature (°C) in descending order in steps of 10 °C upto room temperature as shown below:

S.No.	Temperature (°C)	Voltage (mV)
1.	145	
2.	135	

IMPORTANT NOTE: During the whole experiment, ref temperature in

8. Plot a graph between voltage and Temperature as shown below:



In present experiment, one junction T1 is kept at low temperature and temperature of other junction T2 is raised and thermoemf (in mV) is measured and tabulated as a function of the temperature of junction T2. Thermoemf is plotted as a function of Temperature which is a straight line. Slope of this line is Seebeck coefficient (in mV/C).

Setup consists of thermocouple junctions, main unit to measure the thermoemf, heating arrangement, thermoflask, beaker, thermometer.

Red Yellow - Alumel Chromel