EXPERIMENT NO. 11
THERMISTOR

Aim : To study the characteristics of a Thermistor.

Apparatus : Thermometer (0 - 100 oC), Bead type Thermistor, Battery Eliminator (0 - 5 V), mill ammeter, connecting wires.

Theory:

A thermistor is a thermal resistor having a large temperature coefficient of resistance. Thermistor works in a temperature range such that its resistance decreases rapidly with a rise in temperature. A thermistor is a composite semiconductor consisting of cobalt, nickel, manganese, copper, titanium, sintered oxides of iron etc. Thermistors are used for temperature measurement and in electronic circuits and devices such as fire alarms in industries.

Formulae : $R_{T1} = R_{T2}\,\beta \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$

Diagram:

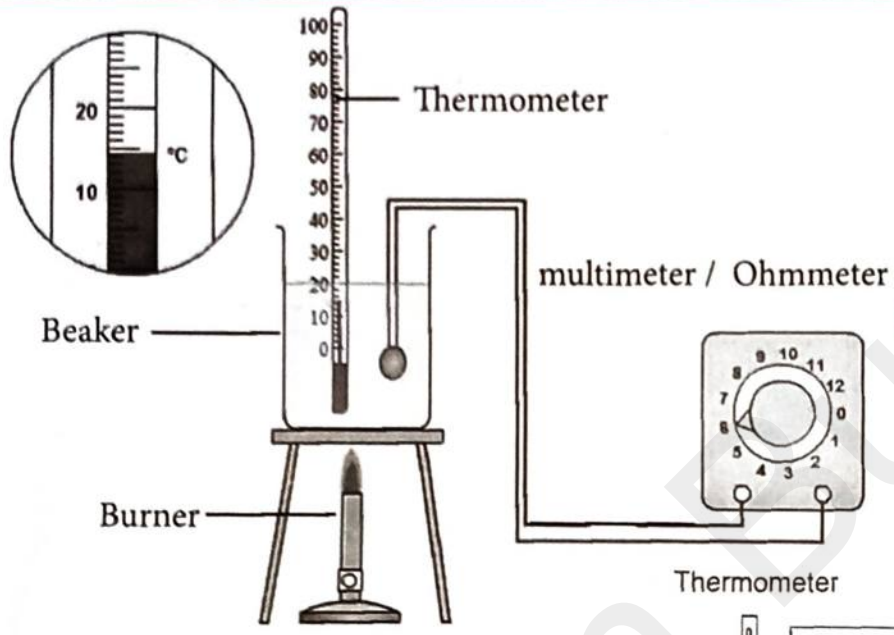


Fig 11.1 Experiment

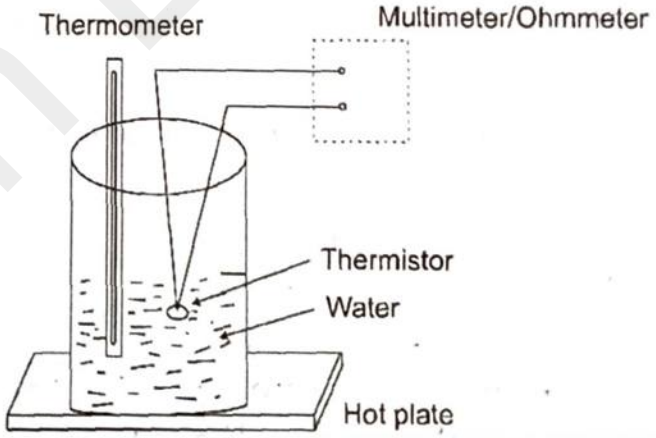


Fig 11.2 Experiment Setup (Laboratory)

Procedure:

1. Make the electrical connections as shown in figure.
2. Note down the least count of the thermometer.
3. Note down the temperature and corresponding resistance of the thermistor with the help of digital multimeter at room temperature.
4. Increase the temperature of water in step of 10° C with the help of hot plate or gas burner.
5. Note down the temperaure and corresponding resistance of the thermistor with the help of digital multimeter for every increase in temperature, in the steps of 10° C.
6. Plot the graph of resistance of thermistor against temperature.

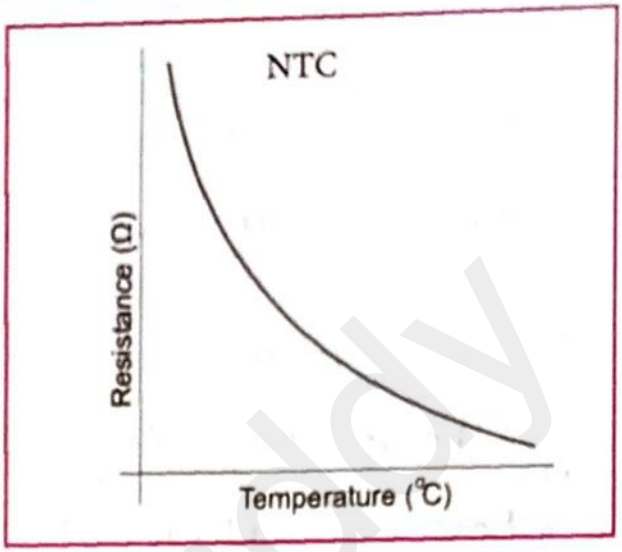
Observations:

Least count of Thermometer = 0.2 °C.

Sr. No.	Temperature (°C)	Resistance (Ω)
1	30	1004
2	40	503
3	50	400
4	60	300
5	70	210
6	80	100

Graph :

Plot the graph of Resistance R (on Y axis) against Temperature T (°C) (on axis)



Calculation of β:

θ_1 = -0.049 °C θ_2 = -0.039 °C

R_{T_1} = 910 Ω R_{T_2} = 470 Ω

$$R_{T_1} = R_{T_2} \beta \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$$

Result :

1. Temperature coefficient of resistance β = 0.00125 Ω.

2. Give your opinion about the nature of the graph.

Temperature dependance of resistivity for a typical semiconductor In conductors average evlution time decrease with increase is resistivity : In semiconductors, the inverse in density is more than the decrease in relaxation time, the net result therefore decrese its resistivity.

Precautions:

1. Thermistor should be immersed completely in water.
2. Bulb of the thermometer should not touch the sides of the contender.

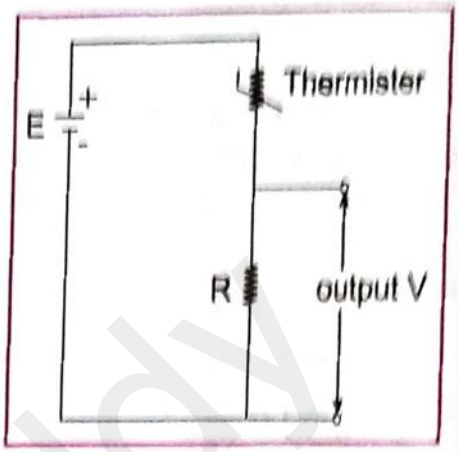
Additional Experiment you can do :

Try to use another thermistor with PTC characteristics and do the same experiment and compare the graph of Resistance V/s Temperature of this experiment with the previous one.

Try to plot the graph of resistance of thermistor with temperature while cooling.

Multiple Choice Question:

1. Thermistors _____
   a) sense only positive changes in temperature
   b) cannot sense any change in temperature
   c) sense only negative changes in temperature
   d) sense positive and negative changes in temperature
2. When temperature rises, resistance of negative temperature coefficient thermistor
   a) Increases b) decreases c) zero d) infinity
3. A student designs a circuit to give a decreasing voltage output as the temperature increases. He builds the circuit in the diagram, but finds that the output voltage increases with increasing temperature.
   Four of his friends suggest four possible changes to the circuit. Which change would produce the effect he wanted?
   a) Replace the resistor with one of the higher resistance.
   b) Replace the resistor with one of the lower resistance.
   c) Reverse the polarity of the battery
   d) Swap the position of the thermistor and resistor



Questions

1. What is thermistor? Why is it so called?

A thermistor (or thermal resistance) its depend as type of resistance whose electrical resistance various with in temperature with all resistors well functionate slight with temperature a thermistor is particular resistance to temperature changes.

2. What does a thermistor consist of?

A thermistor is a resistance thermistor a resistor whose resistance it dependent on temperature The return is a combination of thermistor and resistor. At is made a metaballic oxides pressed into a grald disk, or ugindrical shape and and them encopsulated unpressured material such as of the glass

Remark and sign of teacher: .....