Exp no:

Date:

THERMISTOR

Aim: To determine the temperature coefficient of resistance with varying temperature.

Apparatus:

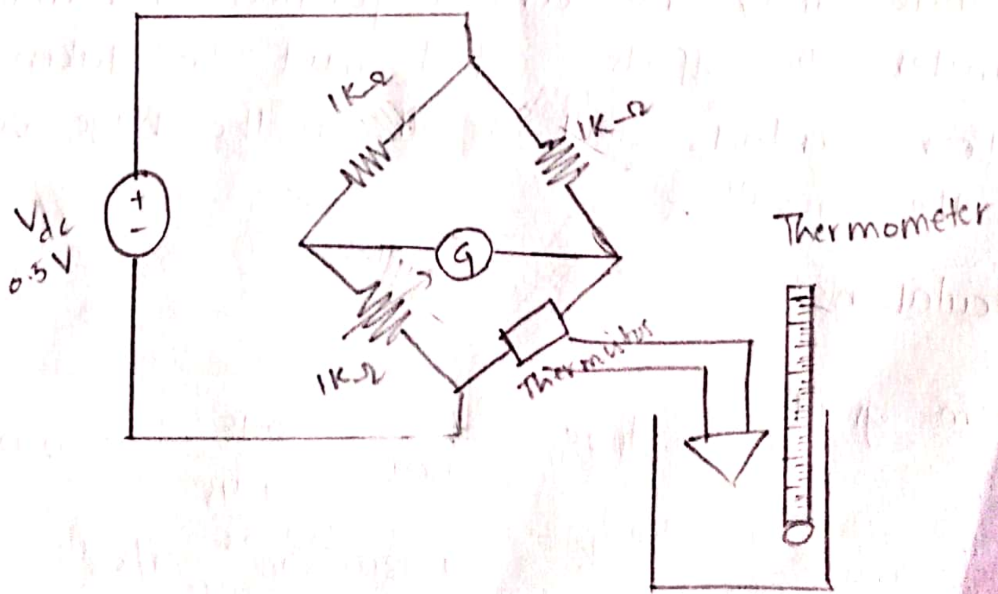
1. KΩ thermistor, variable resistance box, 1 kΩ resistances, DC power supply, Galvanometer, Thermometer, Oil pot, Connecting probes.

Formula:

$$\alpha = \frac{R_2 - R_1}{R_1 T_2 - R_2 T_1} \ /^\circ c$$

where R_1, R_2 are resistances.
T_1, T_2 are temperatures
α = temperature coefficient of resistance

Circuit Diagram:



A thermistor is a temperature sensor consisting of a semi-conductor material that exhibits a large notification in resistance in proportion to a tiny low modification in temp. Thermistors are inexpensive, rugged, and reliable which responds quickly. Because of these qualities thermistors are used to measure simple temperature measurements but not for high temperatures. Thermistor is easy to use, cheap and durable which respond predictably to a change in the temperature. Thermistors are mostly used in digital thermometers and home appliances such as refrigerator, ovens and so on. Stability, sensitivity and time constant are the final properties of thermistor that create these thermistors sturdy, portable, cost-efficient, sensitive, and best to measure single-point temperature. Thermistors are available in different shapes like rod, disc, bead, washer etc. This article gives an overview of thermistor working principle and applications

The thermistor is connected in the fourth arm's of the wheat stones bridge as shown. In the above two arms resistances 1 kΩ each are placed and in the third arm, a varciable resistance box is connected. The thermistor is placed in an oil post.

Procedure:

1. Connect the circuit as shown. Yellow wires should be connected from kit to oil pot.
2. The bridge is balanced by adjusting the variable resistance box. The resistance in the third arm R gives the resistance of the thermistor at room temperature which is to be noted.
3. Switch ON the heater and turn off when the temperature reached to 80°c

4. The Oil bath is allowed to cool and the resistance of the thermistor is noted at various temperatures when it is decreasing by adjusting the variable resistor at which the galvanometer reads to zero.

5. A graph is drawn taking the temperature along x-axis and resistance along y-axis. The graph gives temperature characteristics of the thermistor.

6. Draw the vertical tangent to the graph and find corresponding values of R_1 and R_2 for two different temperatures other than experimental values.

Observations.

S.no	(in °c) Temperature	Resistance of thermistor
1	70	142
2	65	168
3	60	192
4	55	221
5	50	247
6	45	271
7	40	304
8	35	331
9	30	362

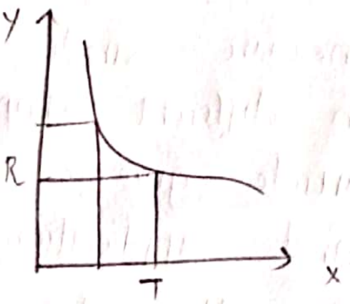
$T_1 = 52.5°c$

$T_2 = 62.5°c$

$R_1 = 232\,\Omega$

$R_2 = 180\,\Omega$

Model Graph:



$$\alpha = \frac{R_2 - R_1}{R_1T_2 - R_2T_1} = \frac{180-232}{232(62.5)-180(52.5)} = \frac{-52}{14500-9450} = \frac{-52}{5050} = -0.0103 /°c$$

Precautions:

1. When the heater is ON, Temperature should be observed carefully
2. Don't allow very high temperature
3. Observations should be taken carefully by adjusting the variable resistance gently.

Result: The temperature characteristic graph of the given thermistor is drawn and the negative temperature coefficient of resistance is $\alpha = 0.0103 /°c$

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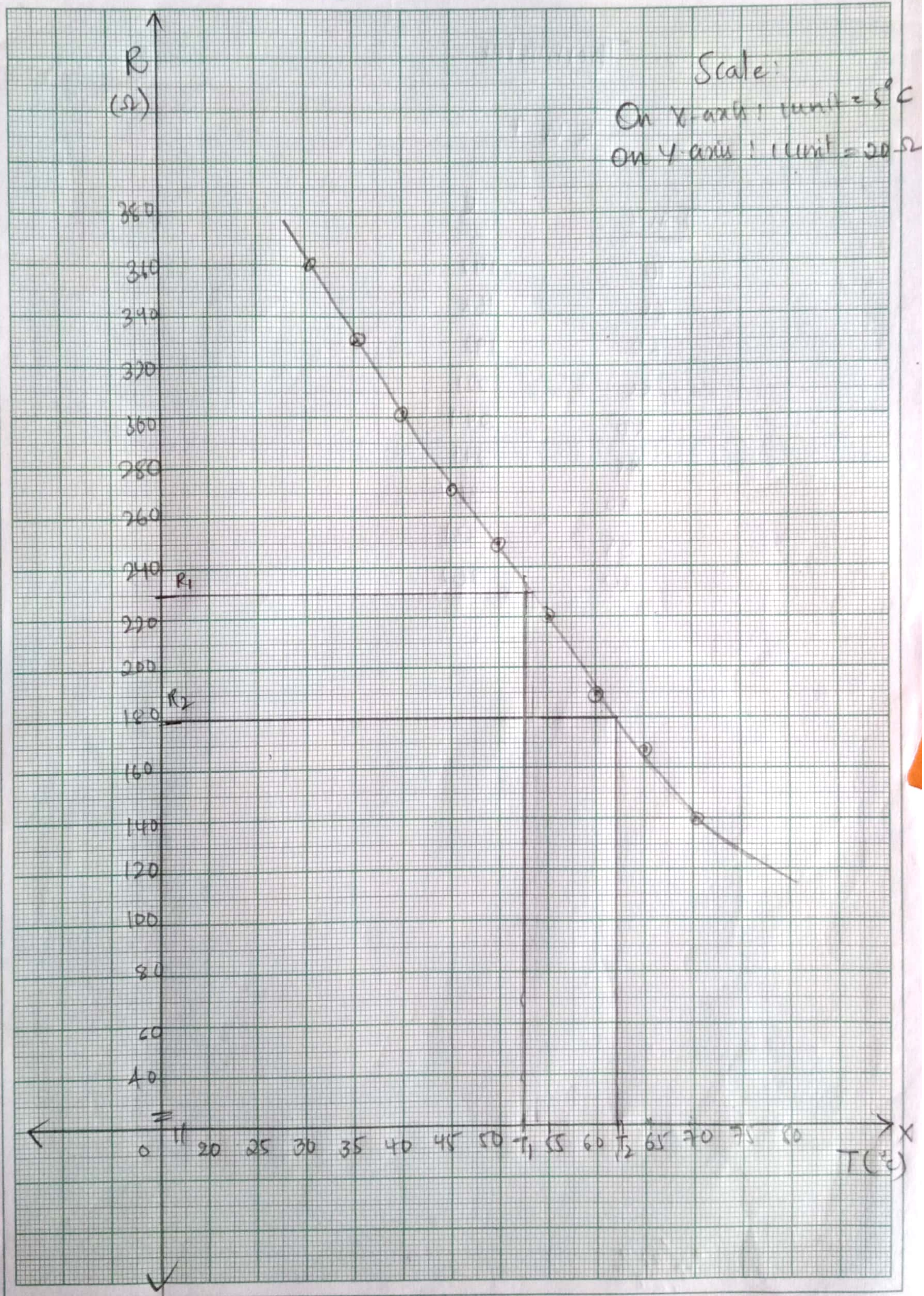

Thermistor

R Vs T

T in°C	R
70	142
65	168
60	192
55	221
50	247
45	271
40	304
35	331
30	362