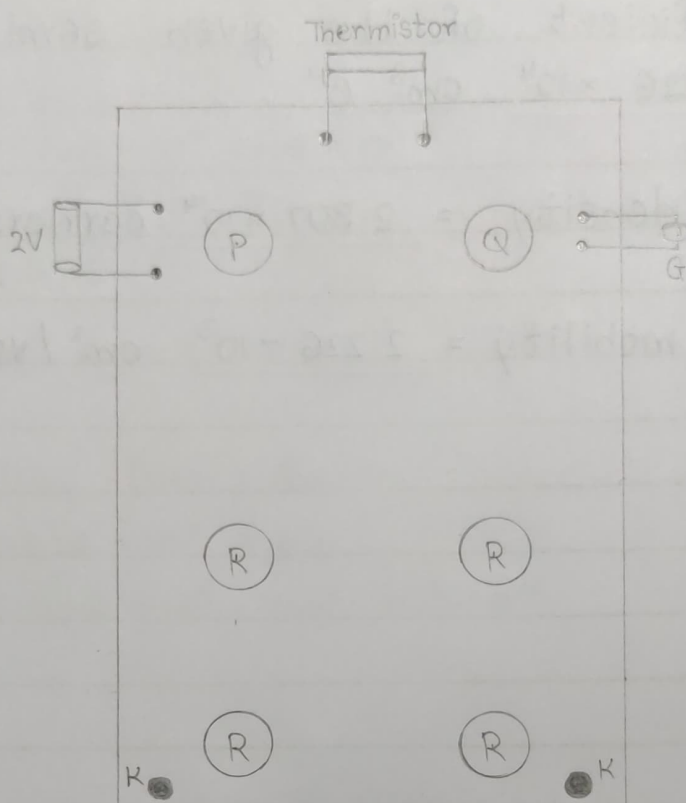


DIAGRAM  $\Rightarrow$



TO FIND THE RESISTANCE OF THE THERMISTOR AT DIFFERENT TEMPERATURES.

Temp. of Thermistor or $T = t + 273$	$\frac{1}{T}$	Resistance in P	Resistance in Q	Resistance in R	Resistance of thermistor : $R_T = \frac{P}{Q} \times R$	$2.303 \times \log_{10} R_T$
K	$K^{-1}$	ohm	ohm	ohm	ohm	ohm
305	0.00327	10	10	946	946	6.853
310	0.00322	10	10	740	740	6.607
318	0.00314	10	10	528	528	6.270

## BAND GAP DETERMINATION USING POST - OFFICE BOX.

AIM  $\Rightarrow$

To find the band gap of the material of the given thermistor using post-office box.

APPARATUS REQUIRED  $\Rightarrow$

Thermistor, thermometer, post-office box, power supply, galvanometer, insulating coil and glass beakers.

PRINCIPLE & FORMULAE  $\Rightarrow$

1) Wheatstone's Principle for balancing a network:

$$\frac{P}{Q} = \frac{R}{S}$$

Of the four resistances, if three resistances are known and one is unknown, the unknown resistances can be calculated.

2) The band gap for semiconductors is given by:

$$E_g = 2k \left( \frac{2.303 \times \log_{10} R_T}{1/T} \right)$$

where,  $k$  = Boltzmann constant =  $1.38 \times 10^{-23}$  J/K

$R_T$  = Resistance at  $T$

328	0.00304	10	10	400	400	5.992
333	0.00300	10	10	360	360	5.887
343	0.00291	10	10	300	300	5.704
353	0.00283	10	10	259	259	5.557
358	0.00279	10	10	200	200	5.299
363	0.00275	10	10	179	179	5.188
371	0.00269	10	10	173	173	5.154
MEAN $\Rightarrow$	0.002964			MEAN $\Rightarrow$		5.8511

OBSERVATIONS  $\Rightarrow$

A graph is drawn between  $1/T$  in  $x$ -axis and  $2.303 \times \log_{10} R_T$  in  $y$ -axis where 'T' is the temperature in K and  $R_T$  is resistance of thermistor at TK.

From graph, slope =  $\left( \frac{dy}{dx} \right) = 1985.714$

CALCULATIONS  $\Rightarrow$

For band-gap ;

1) From manual - calculations :

$$E_g = 2k \left( \frac{2.303 \times \log_{10} R_T}{1/T} \right)$$

$$= 2 \times 1.38 \times 10^{-23} \left( \frac{5.8511}{0.002964} \right)$$

$$= \frac{16.1490}{0.002964} \times 10^{-23} = 5448.392 \times 10^{-23}$$

$$\text{now, } \frac{5448.392}{1.6} \times \frac{10^{-23}}{10^{-19}}$$

$$= \frac{3405.245}{10000} = 0.3405245 \text{ eV}$$



2) From graph :

$$E_g = 2k \times \text{slope of the graph}$$

$$= 2k \times (dy/dx)$$

$$= 2 \times 1.38 \times 10^{-23} \times 1985.714$$

$$= 5480.570 \times 10^{-23}$$

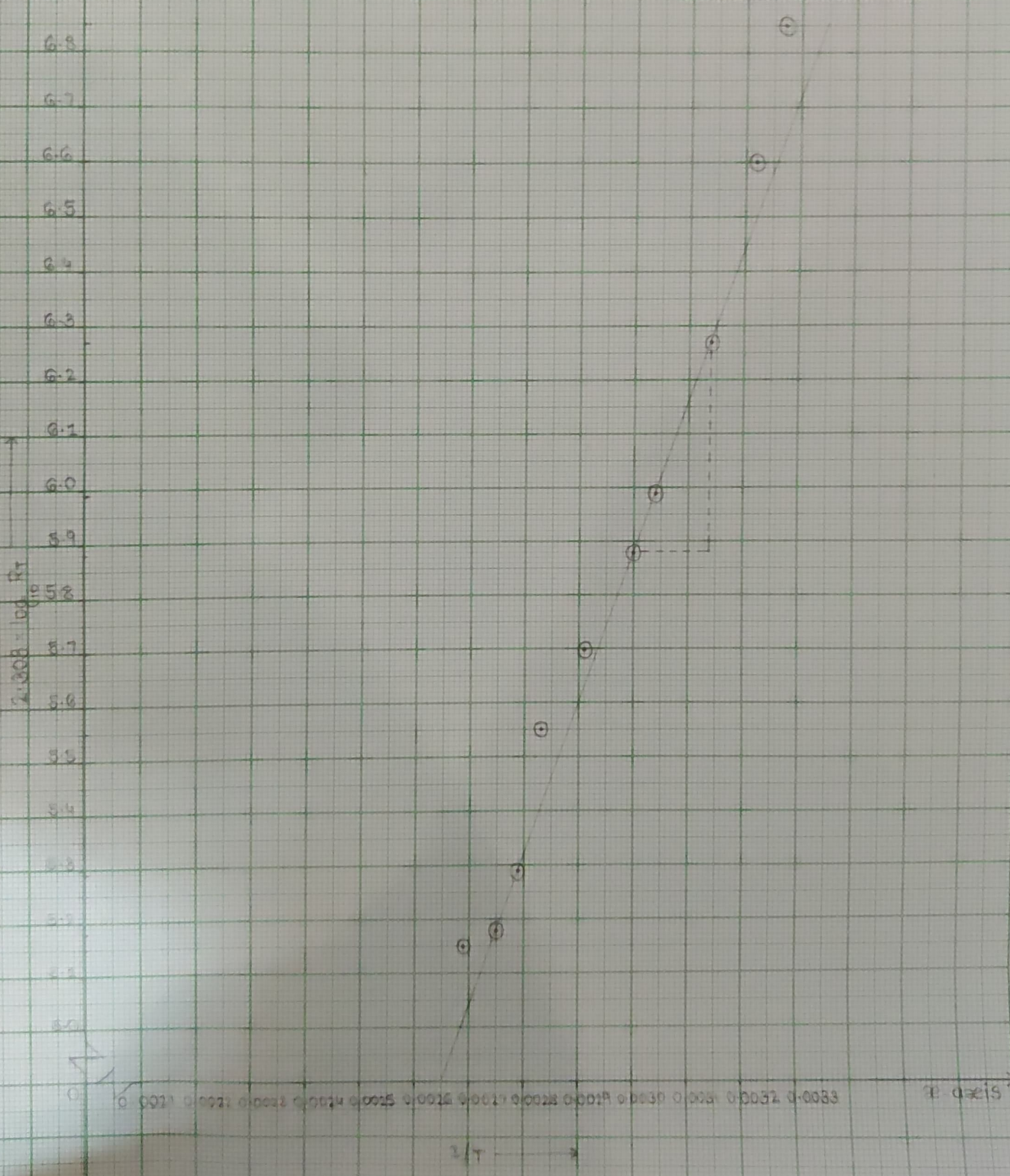
$$\text{now, } \frac{5480.570}{1.6} \times \frac{10^{-23}}{10^{-19}}$$

$$= \frac{3425.356}{10000} = 0.3425356 \text{ eV}$$

RESULT

The band gap of the material of the thermistor =  
0.34254 eV.

Scale:  
 On  $x$ -axis  $\uparrow$   
 1cm = 0.0001  $K^{-1}$   
 On  $y$ -axis  $\uparrow$   
 1cm = 0.1  $R_T$





$$\text{slope} \left( \frac{dy}{dx} \right) = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{6.27 - 5.88}{0.00314 - 0.00300}$$

$$= \frac{0.39}{0.00014} = 1985.714$$