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EXPERIMENT - 3

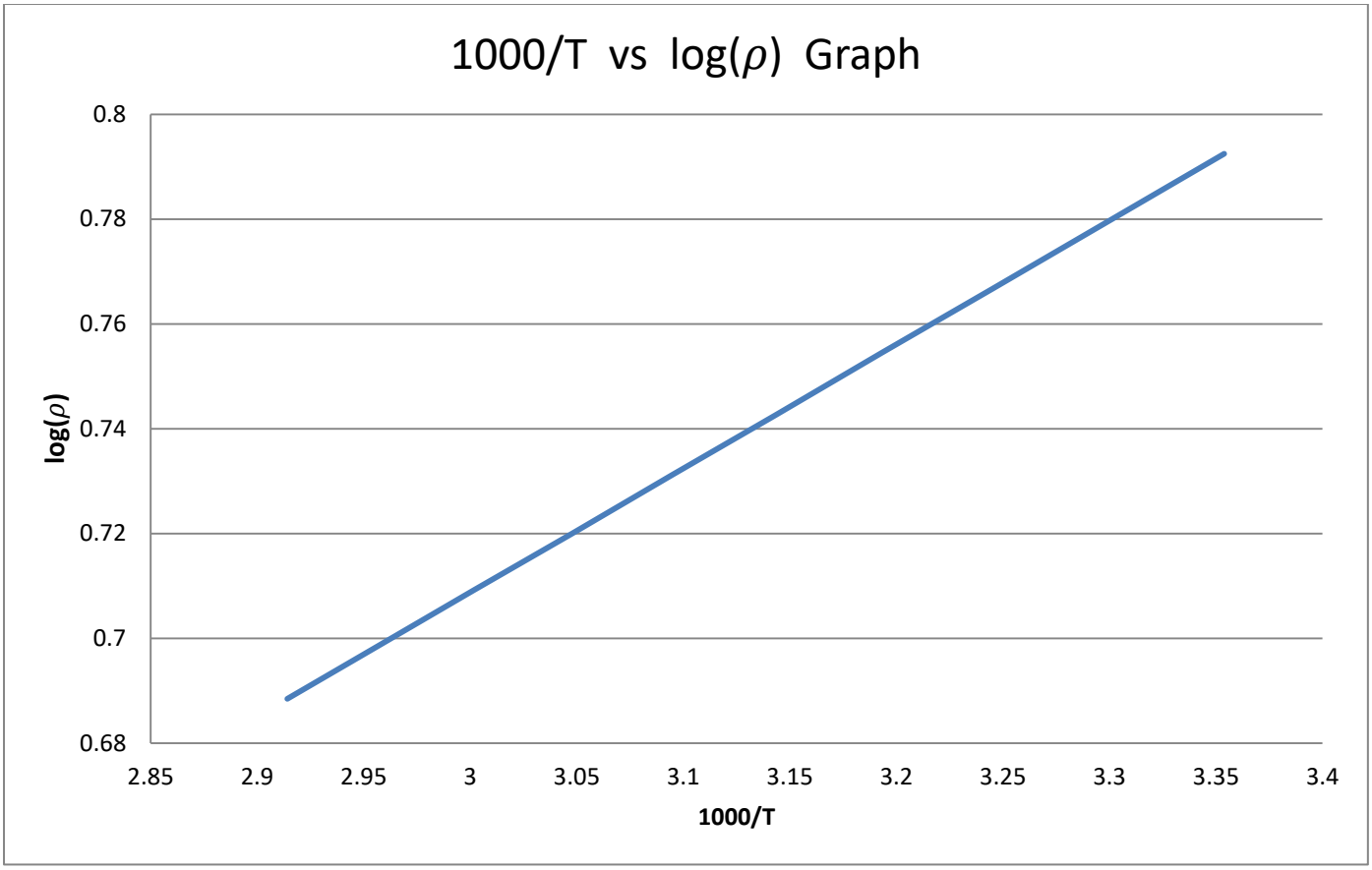
AIM:

To determine the energy band gap (E_g) of a semiconductor (Germanium (Ge) crystal) by Four - Probe method.

Observations:

Material Used = Germanium (Ge)
Length of sample, S = 0.2 cm
Thickness of sample, W = 0.05 cm
Current, I = 1 mA

S. no.	Temperature (K)	Voltage (mV)	$\frac{1000}{T}\ K^{-1}$	Resistivity, ρ (ohm-cm)	Log ρ
01.	298.16	29.08	3.3539	6.2011	0.7925
02.	303.16	28.22	3.2986	6.0172	0.7794
03.	308.16	27.41	3.2451	5.8444	0.7667
04.	313.16	26.65	3.1933	5.6819	0.7545
05.	318.16	25.93	3.1431	5.5288	0.7426
06.	323.16	25.25	3.0944	5.3843	0.7311
07.	328.16	24.61	3.0473	5.2479	0.7199
08.	333.16	24.00	3.0016	5.1189	0.7092
09.	338.16	23.43	2.9572	4.9967	0.6987
10.	343.16	22.89	2.9141	4.8809	0.6885



Calculations:

Let arbitrary points on the graph be (3.35, 0.79) and (2.915, 0.69)
Slope of the straight line on graph is,

$$m = \frac{0.79 - 0.69}{3.35 - 2.915} = 0.23\ (approx)$$

Energy Band Gap, $E_g = 2 * 2.3026 * slope\ (m) * 10^3 * 8.617 * 10^{-5} eV$
$E_g = 2 * 2.3026 * 0.23 * 0.01 * 8.617 = 0.9123\ eV$
$E_g = 0.9123\ eV$

Results:

Energy Band Gap, $E_g\ is\ 0.9123\ eV$.