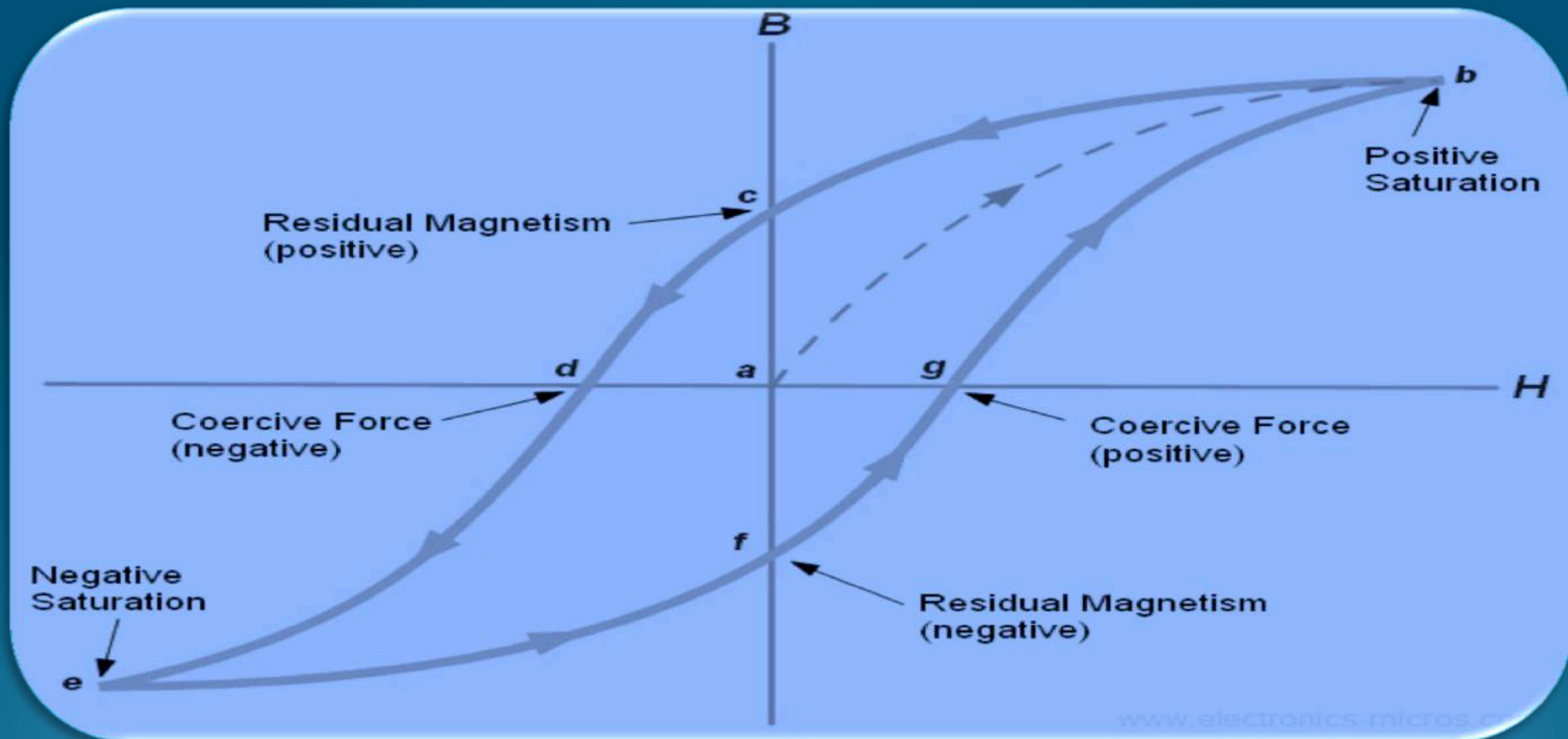


# B-H Curve



# Outline

- Introduction
- Theory
- Apparatus
- Observation & Calculations
- Graph
- Conclusion

# Introduction

- In B-H curve experiment we came to know about the relationship between magnetic field strength H and magnetic field intensity B.

- H is magnetic field intensity give as

$$H = n I$$

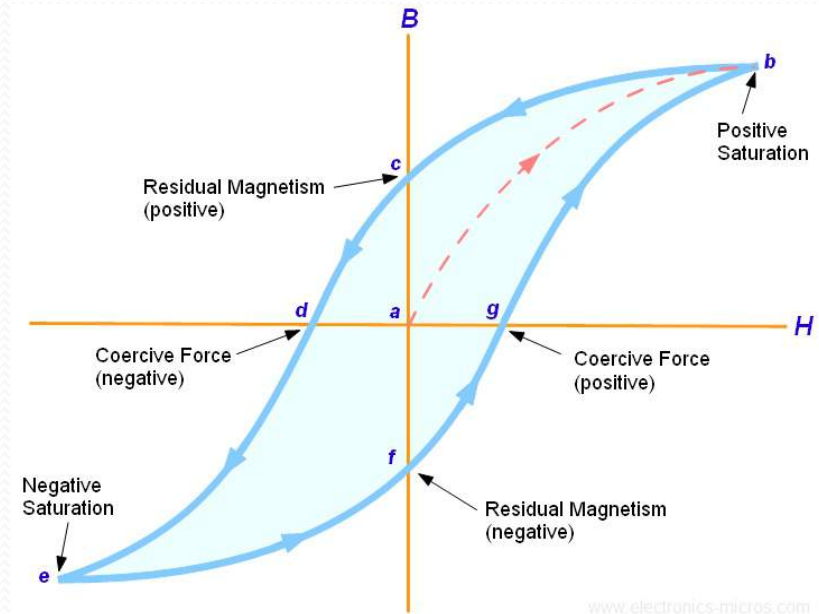
- B is magnetic field induction which is determined by

$$B = \mu (M+H)$$

# Theory

- To study the **magnetic properties** of some **ferromagnetic** material as iron we placed it in an alternating current solenoid.
- In positive peak value of current, it fully magnetizes the specimen in one direction while in **negative peak** value it fully magnetizes it in **opposite direction**.
- Thus as the alternating current changes from its positive peak value to its negative peak value and then back to **positive peak value**, the specimen undergoes complete cycle of **magnetization**.

- The flux density  $B$  versus Magnetic field strength  $H$  of a specimen for the various value of magnetization current of solenoid plotted by CRO is given as



## Saturation:

- The magnetic flux density increases from zero and reaches its maximum value. At this stage the material is said to be magnetically saturate.

## Retentivity:

- When the current is reduced to zero the material still remains strongly magnetized represented by point c on curve. It is due to the tendency of domains to stay partly in line, once they have been aligned.

## Coercivity:

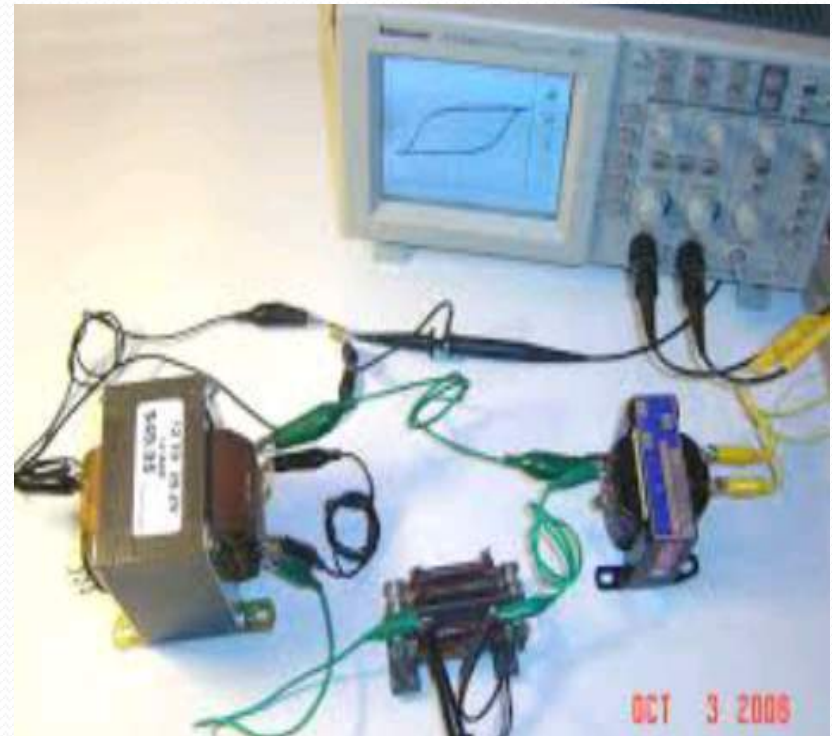
- To demagnetize the material, the magnetizing current is reversed and increased to reduce the magnetization to zero. This is known as coercive current and phenomenon known as coercivity represented by  $H_c$  on curve.

## Area of the loop:

- The area of the loop is a measure of the energy needed to magnetize and demagnetize the specimen during each cycle of the magnetizing current.
- A material with high retentivity and large coercive force would be most suitable to make a permanent magnet.

# Apparatus

- Rheostat:
- Deflection magneto compass:
- Electromagnetic coil:
- Ammeter:
- Voltmeter:
- Crocodile clip:
- Banana clip:
- Specimen:
- Solenoid:
- Power supply:





## Rheostat

- Rheostat is a variable resistor which is used to control the flow of electric current by manually increasing or decreasing the resistance.



## Magnetometer Compass

- An instrument used for measuring magnetic forces, especially the earth's magnetism.



## Electromagnetic Coil:

- The magnetic flux is generated by an electromagnetic coil is the amount magnetic field lines produced within a given area.



## Ammeter:

- It is an instrument used for measuring current in amperes in an electronic circuit.



## Voltmeter:

- It is an instrument used for measuring the potential difference between two points in an electronic circuit.



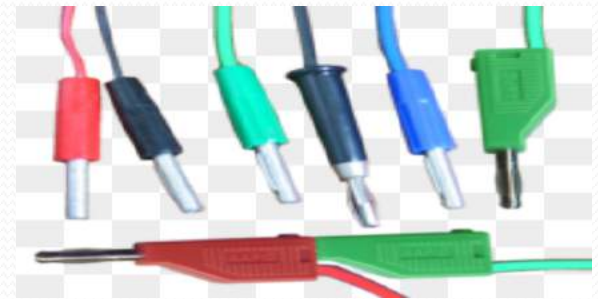
## Crocodile clip

- A sprung metal clip with long, serrated jaws which is used for creating a temporary electrical connection.



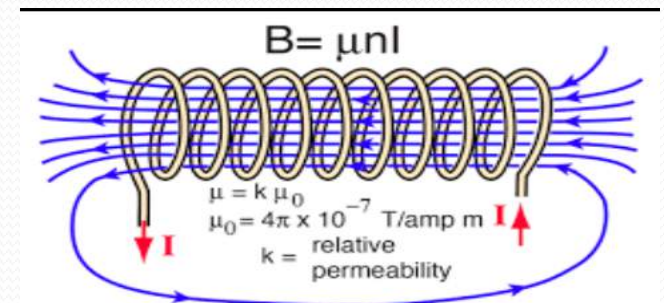
## Banana Clip

A banana clip or also called banana connector is a single wire electrical connector used for joining wires to equipment.



## Solenoid

- A solenoid is a coil wound into a tightly packed helix.



# Procedure

- First of we set up the apparatus to perform this experiment . Then connect banana clip with A.C source to remove parallax error.
- After removing error again connect the clip with D.C source and increase the value of current from 0 to 2( by difference of 0.1) by varying the voltage and measure the angle  $\theta$  at each point.
- Now decrease the value of current from 2 to 0 and again note value of  $\theta$  at every point.

- Now we reverse the polarity and repeat the same procedure as before ,then we remove clips from D.C and connect as in first point and note value of  $\theta$  by increasing current from 0 to 2.
- Then we put all these observation into table and find value of B and H ,take value of B on y-axis and H on x axis we draw a complete hysteresis loop.
- With the help of this loop we came to know about how strong given specimen has magnetic effect.



Video description  
in Next Slide

# Observations&Calculations

- Specimen used = Iron
- Length = 30 cm = 300 mm
- Diameter of specimen = 2.3 mm
- Radius = 1.15 mm
- $H=1.5 \times 10^{-3}$
- QR=75mm,PQ=300mm.
- No of turns per meter in solenoid
- $n=1900$
- Area of wire= $A=\pi r^2 = 4.15 \times 10^{-6} \text{ m}^2$
- $PR = (PQ)^2 + (QR)^2 = 309 \text{ mm}$

$$\alpha = \frac{H(PQ)^2}{A[1 - \left(\frac{QR}{PR}\right)^3]}$$



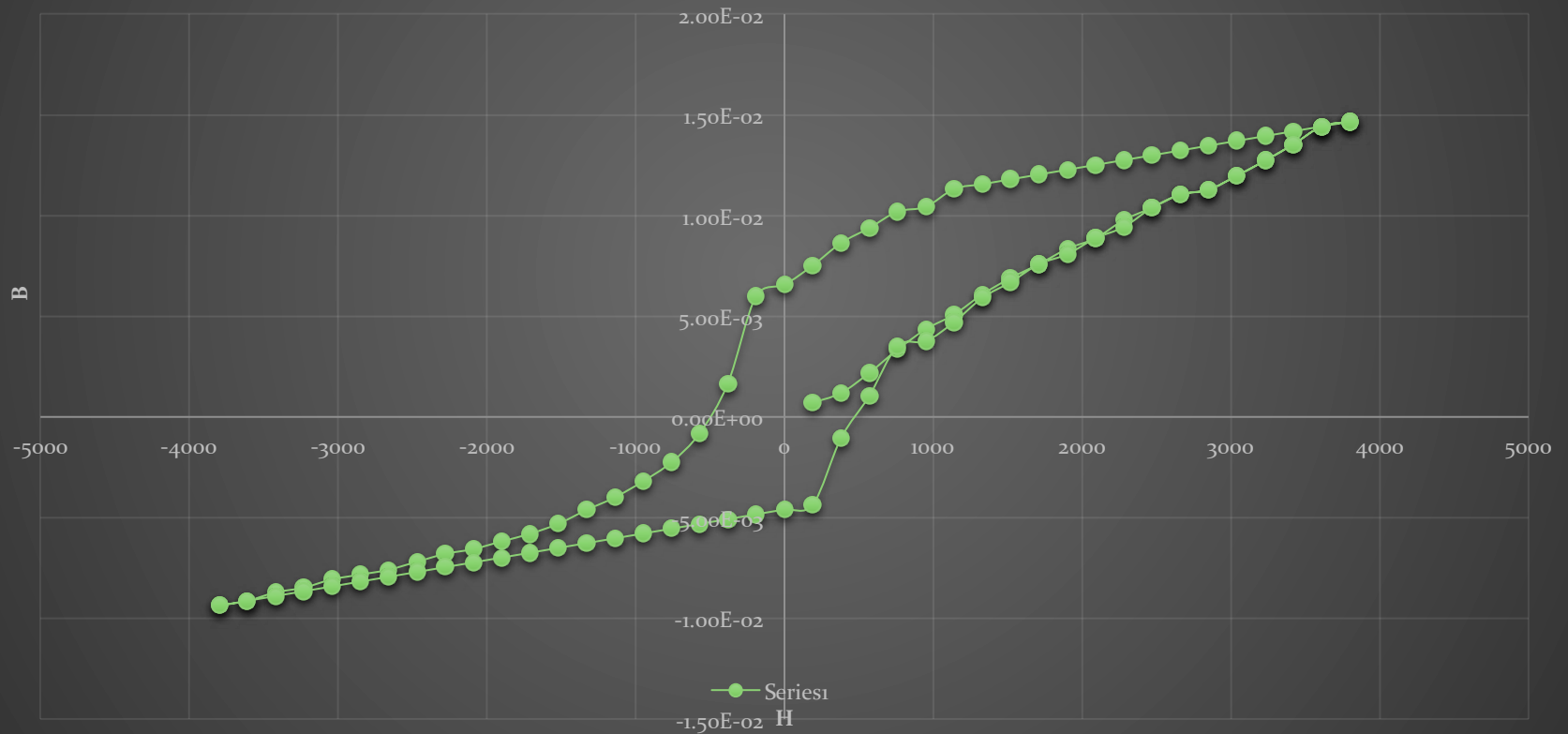
# Table

I	$\theta$	Tan $\theta$	$M=\alpha \text{Tan}\theta$	$H=n \text{ I}$	$B=\mu(M+H)$
0.1	10	0.176235	372.502456	190	7.07E-04
0.2	15	0.267806	566.052832	380	1.19E-03
0.3	29	0.553973	1170.91198	570	2.19E-03
0.4	42	0.899731	1901.7262	760	3.34E-03
0.5	50	1.190683	2516.69991	950	4.36E-03
0.6	54	1.374999	2906.28225	1140	5.08E-03
..	..	..	..	..	..
..	..	..	..	..	..
2	75	3.72216884	7867.39939	3800	1.47E-02



# Graph

Graph b/w B and H



# Conclusions

- From experiment we conclude that relation between B and H as

$$B = \mu H$$

- We find that current and volume of deflection is proportional but at certain point is constant Because the specimen becomes saturated.

$$B = 53.18 \times 10^{-7}$$

B-H curve shows that **magnetization** and **demagnetization** follow different path.

# MEASUREMENT OF RESISTIVITY AND CONDUCTIVITY BY ELECTROLYSIS OF $\text{CuSO}_4$ SOLUTION

# ABSTRACT

In this experiment we study about the conductivity and electrolytic properties of  $\text{CuSO}_4$ , by using wheat stone bridge method. We used the different concentration 5%, 10%, 15% solutions of  $\text{CuSO}_4$  and calculate their **resistivity** by using formula

$$R = l_1/l_2 * R_0$$

And **conductivity** calculated by using formula

$$\sigma = 1/\rho$$

Then we draw graphs for concentration solution between length of bridge, resistance which is slop or straight.

# ELECTROLYTE AND CONDUCTIVITY

An **electrolyte** is a substance that ionize when dissolved in suitable ionizing solvent such as water.

**Conductivity** of an electrolyte solution is a measure of its ability to conduct the electricity .Its unit is Siemens/m.

# ELECTROLYTIC SOLUTIONS

**Electrolytic Solutions** which conduct electricity. Their colligative properties such as vapour pressure, elevation of boiling point all depend on number of individual particles present in solution and give information about actual number of particles in solution .

# ELECTROLYSIS

The production of a chemical reaction by passing an electric current through an electrolyte. In **Electrolysis**, positive ions migrate toward the cathode and negative ions migrate toward anode.

# SOLVENT SOLUTE AND

**The substance that is dissolved in solution. The component of solution that is lesser amount is called **solute**.**

**The substance in which solute is dissolved. The component of solution that is in greater amount is called **solvent**.**



# ELECTROLYSIS OF $\text{CuSO}_4$ SOLUTION

The solution consists of  $\text{Cu}^{+2}$  and  $\text{SO}_4^{-2}$ . Also water itself provides small quantity of ions move towards cathode. At cathode 'Cu' is deposited but at anode instead of OH Ion CuOH began to discharge.

Ions are also formed by copper anode itself. The formation of each ion leaves two surface electrons behind on the anode. Some charge is impure to each of  $\text{Cu}(\text{H}_2\text{O})^{++}$  ion discharge at cathode. So Current at both electrodes is same.

# ELECTROLYSIS OF $\text{CuSO}_4$ SOLUTION

**The concentration of electrolyte remains constant and net result is just transfer of copper from anode to cathode. So current at both electrode is same.**

**The concentration of electrolyte remains constant and net result is just transfer of copper from anode to cathode.**

**When electric current is passed through electrolyte positive or negative ions are produced which moves toward opposite electrodes causing a current. The amount of Current depends upon concentration of ions. In this experiment we find Conductivity of  $\text{CuSO}_4$  Solution by using Wheat stone Bridge.**

# BRIDGE WHEAT STONE

**It is used to find the unknown resistance. It consists of 4-resistance in which '2' are known, third is variable, the forth is unknown that can calculated by formula**

$$R_1/R_2 = R_3/R_4$$

**The 4- resistor must be connected to an electric source and galvanometer. We use 4- resistor because it is necessary condition to reach the equilibrium.**

# RESISTIVITY

**Resistivity** is the resistance of wire whose length is 1m and cross-section area is  $1\text{m}^2$ . Its unit is  $(\Omega\text{-m})$ . It depend on the nature of the material or temperature of the material.

- The electrical property of material called Conductance.
- The reciprocal of resistivity is called conductivity.
- Its unit is  $(\Omega\text{-m})^{-1}$ .

# PROCEDURE

**First of all we have 5%, 10% and 15% concentrations of electrolyte which is  $\text{CuSO}_4$ .**

**Now put 5%  $\text{CuSO}_4$  into conductivity vessel up to 12 cm of its length.**

**put cathode into vessel up to 4cm length which is movable and static is anode and make their connections with slide wire bridge.**

**Now make the 2 connections of audio generators and one of CRO with slide wire bridge and other connection of CRO with jokey .**

**Now connect shunt resistance box with bridge and choose 50 ohm resistance.**

**Turn on the generator and CRO.**

**Slide jokey on bridge and find its balancing point .**

**Left side length up to balancing point is  $l_1$  and right side length is  $l_2$ .**

**Then find out  $R_4$ , resistivity and conductivity by using their formula's as shown in tables.**

**Repeat this method 3times for 4cm,8cm and 12cm vessel's length and then for next concentration of  $\text{CuSO}_4$ .**

**Plot graphs between resistivity and length .**

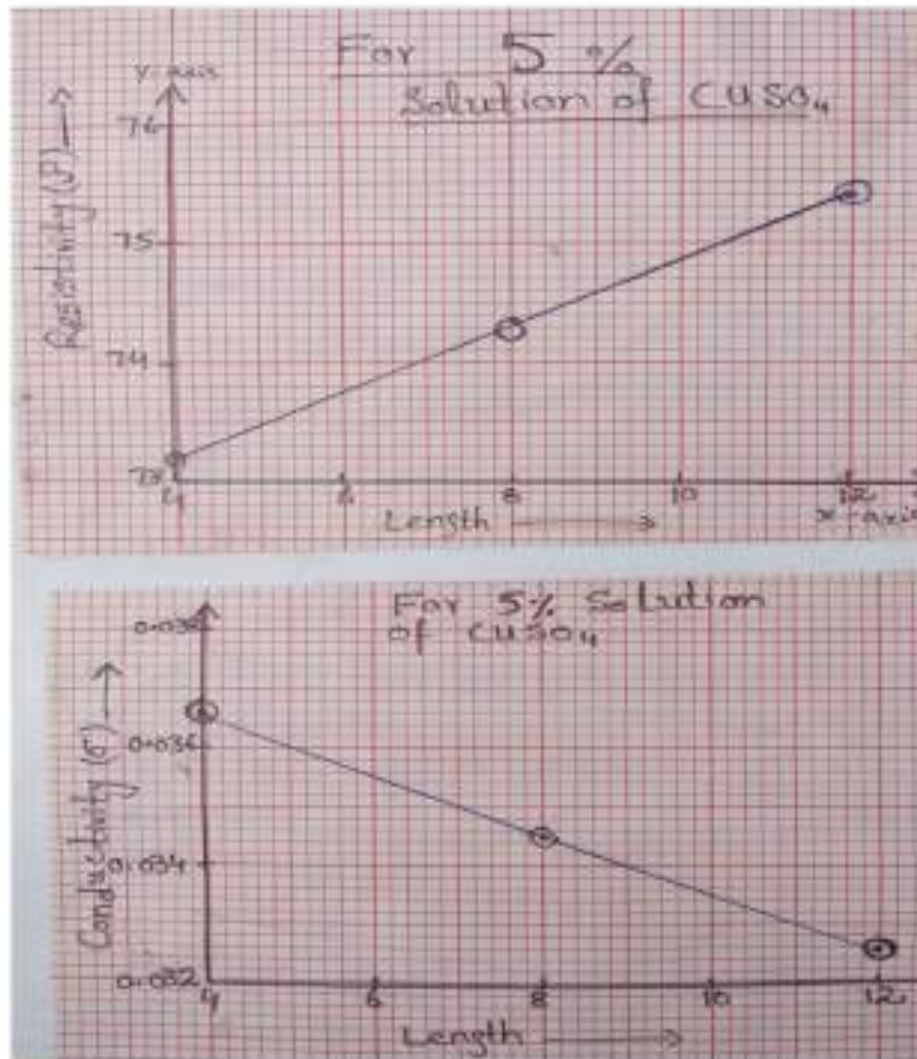
**Plot graphs between conductivity and length.**

# VIDEO DESCRIPTION

# TABLE # 1

Lenth of	l1	l2	Ro	$R = (l1/l2) * R_o$	$\rho = (R * A)$	$= 1 /$
Column (cm)	(cm)	(cm)	( $\Omega$ )	( $\Omega$ )	( $\Omega.m$ )	( $\Omega.m$ )
4	69.5	30.5	50	113.9344262	63.62098361	0.0157181
4	55	45	100	122.2222222	68.24888889	0.0146523
4	44.5	55.5	150	120.2702703	67.15891892	0.0148901
8	84	16	50	262.5	73.29	0.0136444
8	72	28	100	257.1428571	71.79428571	0.0139287
8	62	38	150	244.7368421	68.33052632	0.0146347
12	88	12	50	366.6666667	68.24888889	0.0146523
12	79	21	100	376.1904762	70.0215873	0.0142813
12	72	28	150	385.7142857	71.79428571	0.0139287

# GRAPH FOR 5% SOLUTION OF $\text{CuSO}_4$

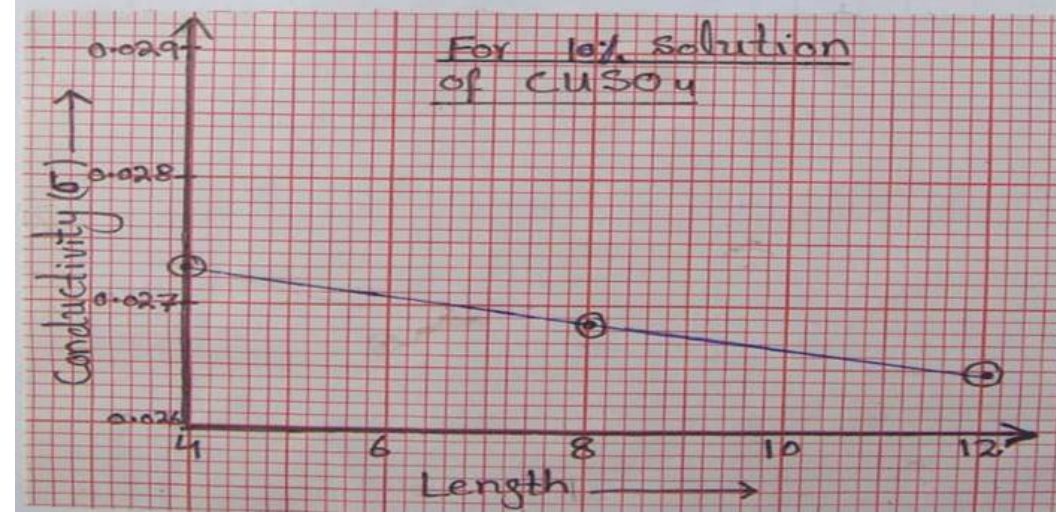
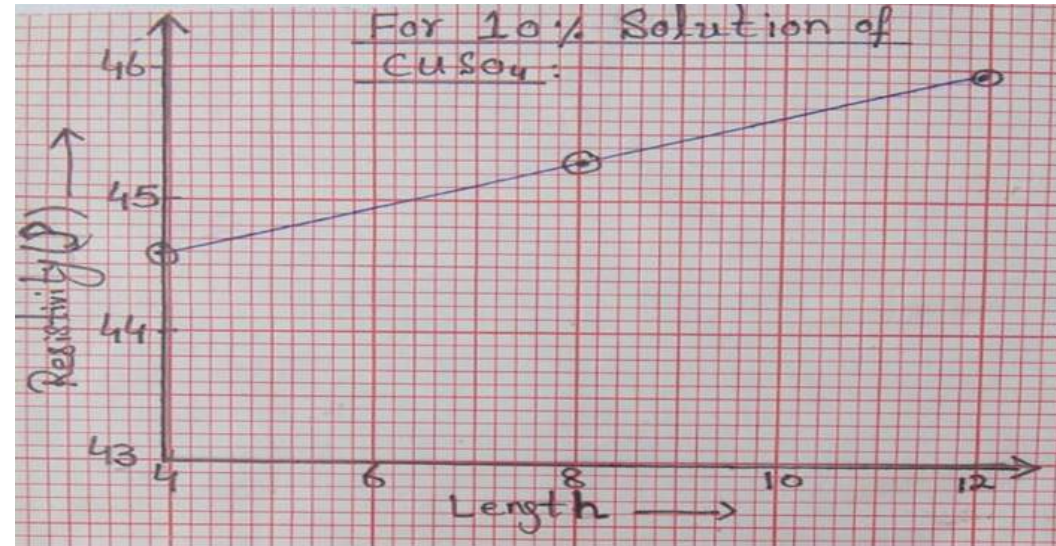




# TABLE # 2

Lenth of ▼	l1 ▼	l2 ▼	Ro ▼	$R = (l1/l2) * R$ ▼	$\rho = (R * A)$ ▼	$= 1/$ ▼
Column (cm)	(cm)	(cm)	( $\Omega$ )	( $\Omega$ )	( $\Omega.m$ )	( $\Omega.m$ )
4	59	41	50	71.95121951	40.17756098	0.0248895
4	42	58	100	72.4137931	40.43586207	0.0247305
4	31	69	150	67.39130435	37.63130435	0.0265736
8	75	25	50	150	41.88	0.0238777
8	60	40	100	150	41.88	0.0238777
8	50	50	150	150	41.88	0.0238777
12	82	18	50	227.7777778	42.39703704	0.0235866
12	70.5	29.5	100	238.9830508	44.48271186	0.0224806
12	60	40	150	225	41.88	0.0238777

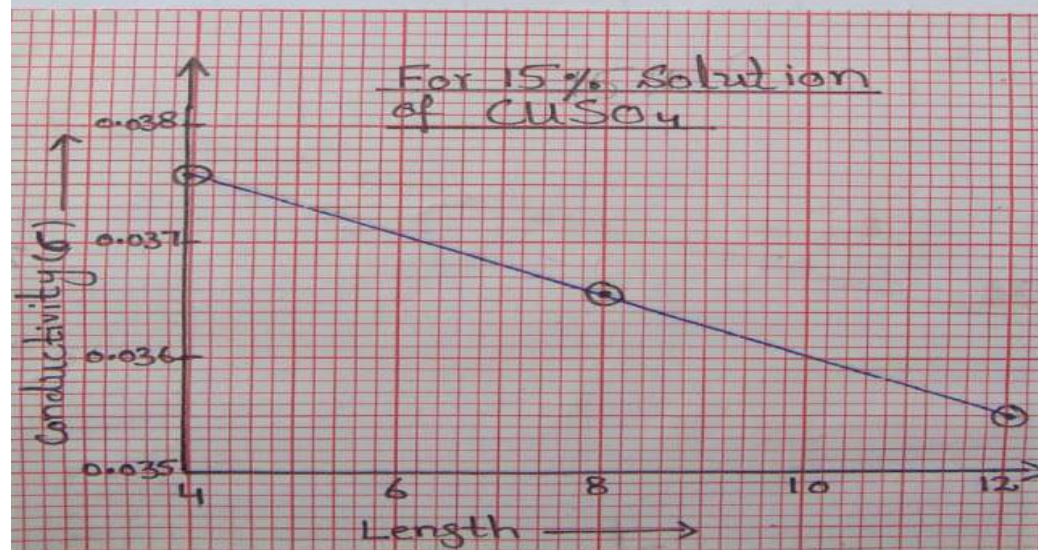
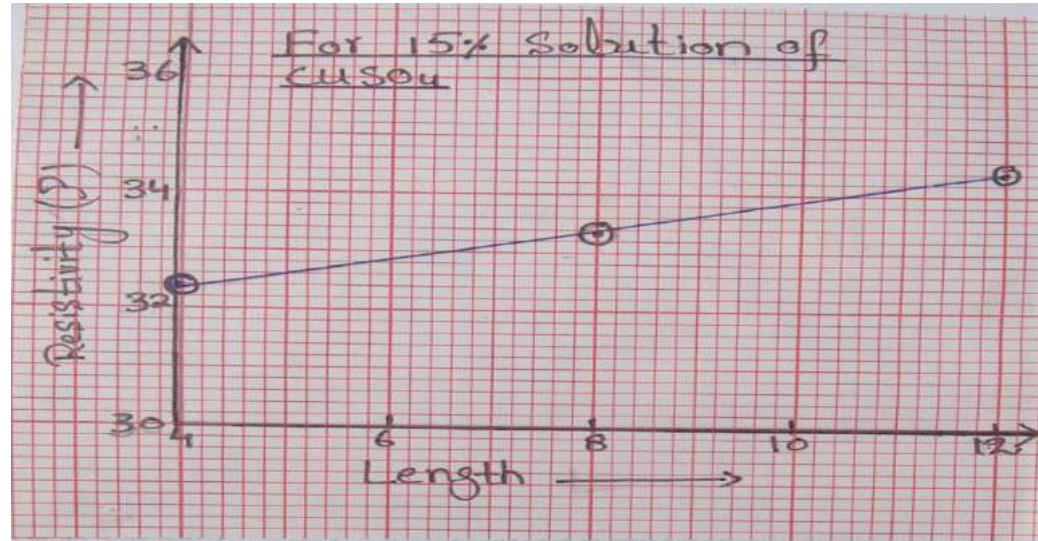
# GRAPH FOR 10% SOLUTION OF $\text{CuSO}_4$



# TABLE # 3

Lenth of	l1	l2	Ro	R = (l1/l2)*R	$\rho = (R*A)$	=1/
Column (cm)	(cm)	(cm)	( $\Omega$ )	( $\Omega$ )	( $\Omega.m$ )	( $\Omega.m$ )
4	51	49	50	52.04081633	29.05959184	0.034412
4	33	67	100	49.25373134	27.50328358	0.0363593
4	25	75	150	50	27.92	0.0358166
8	69	31	50	111.2903226	31.07225806	0.032183
8	51	49	100	104.0816327	29.05959184	0.034412
8	42	58	150	108.6206897	30.32689655	0.032974
12	76	24	50	158.3333333	29.47111111	0.0339315
12	63.5	36.5	100	173.9726027	32.38210046	0.0308813
12	54	46	150	176.0869565	32.77565217	0.0305105


# GRAPH FOR 15% SOLUTION OF $\text{CuSO}_4$



# CONCLUSIONS

**The Conductivity of electrolyte solution increases by increasing the concentration of electrolytic Solution**





# **Directional Characteristics And Polarization of Microwaves in front of Horn Antenna**

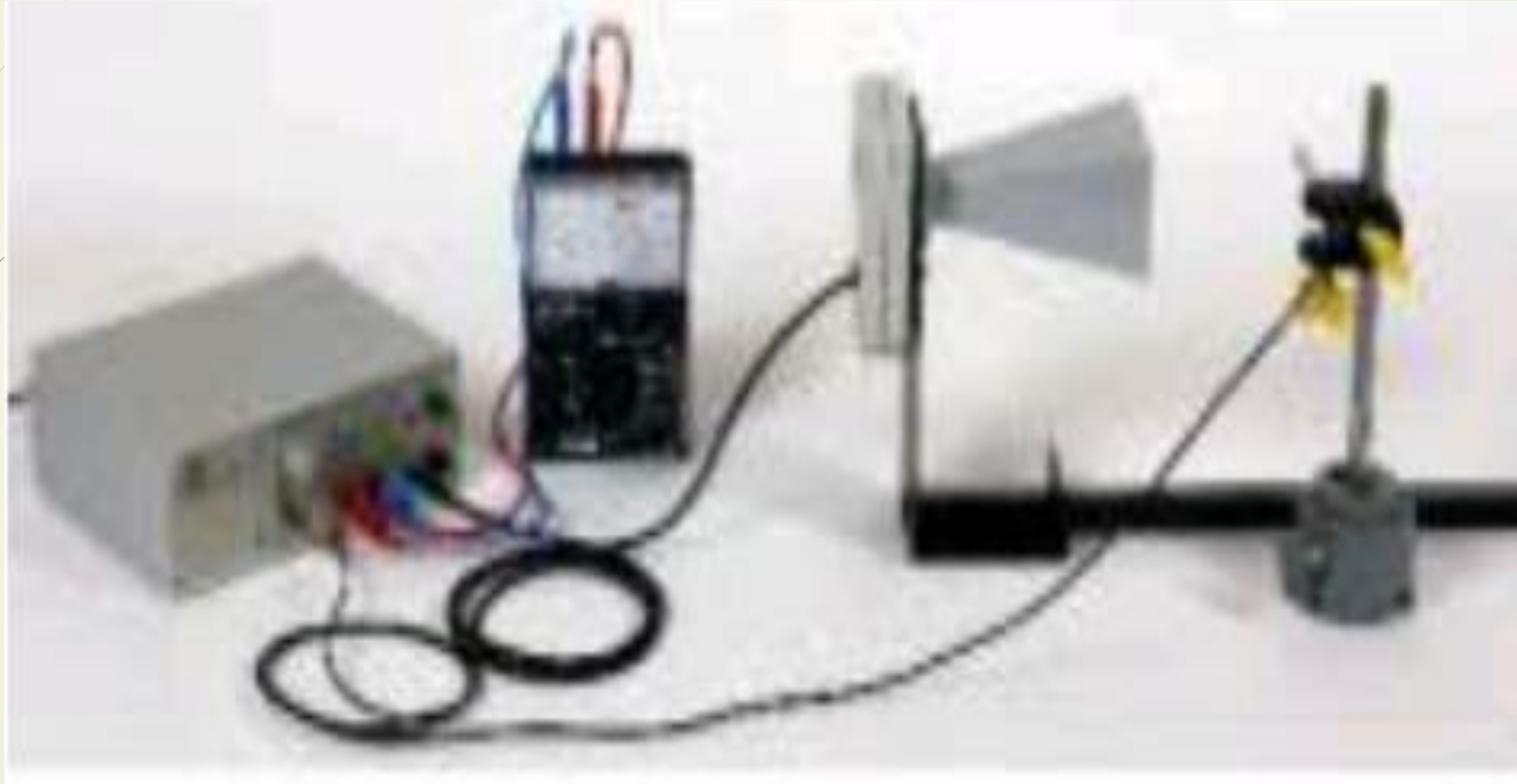


# Abstract:

- In this experiment we will study about microwaves, its polarization, setup which is used for its propagation, how we can find its wavelength, measure the focal length of lens which is used in this experiment and verification of Braggs Law using relation as:

$$2d\sin\theta = n\lambda$$

# EXPERIMENTAL SETUP





# Apparatus

- **Gunn diode:**
- **Gunn diodes** are used to build **oscillators** for generating **microwaves** with frequencies ranging from 10 GHz to THz. It is a Negative Differential Resistance device – also called as transferred electron device **oscillator**



Gunn Diode Oscillator

Gunn Diode Oscillator

# Horn Antenna

- A horn antenna or microwave horn is used for the transmission and reception of microwave signals.



# BNC Leads

- The BNC (Bayonet Neill–Councilman) connector is a type of coaxial RF (radio frequency) electrical connector that is used in plane of coaxial connectors.



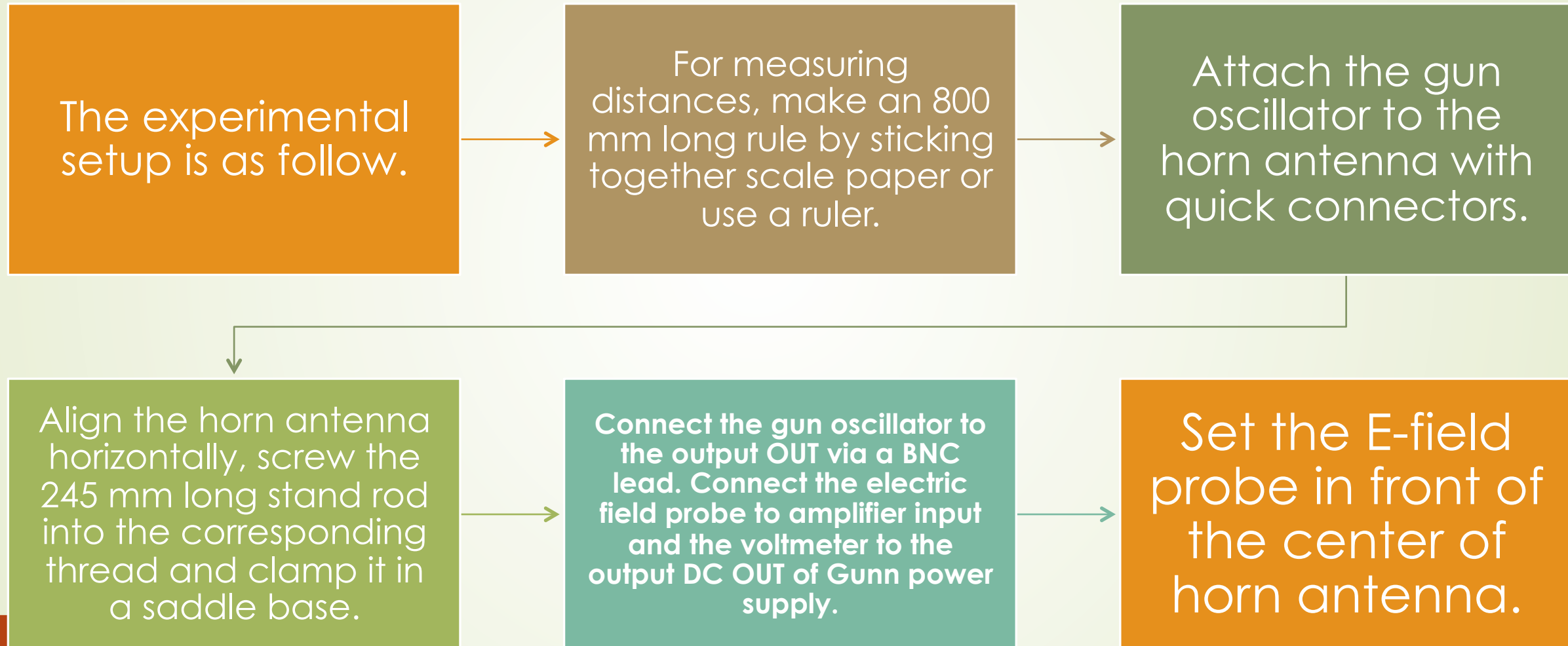
## Polarization Grating

- A polarization grating which is designed like a printed circuit on a board is used as a polarizer for microwaves.





# Set Up



# Calculations

No of observations:	Intensity (max)	Distance(mm)	Intensity (Min)	Distance (min) (cm)
1	8 2	1 1 . 5	3 5	1 2
2	8 4	1 2 . 4	3 4	1 3
3	9 5	1 3 . 3	3 2	1 3 . 8
4	8 9	1 4 . 2	2 5	1 4 . 9
5	6 6	1 5 . 4	2 2	1 6
6	5 5	1 6 . 5	2 0	1 7 . 3
7	5 6	1 8	1 9	1 8 . 4
8	5 4	1 9	1 7	1 9 . 3

Serial number	Maxima	Intensity	Difference
1	1 ..... 3	82 ..... 95	- 13
2	2 ..... 4	84 ..... 89	- 5
3	3 ..... 5	95 ..... 66	29
4	4 ..... 6	89 ..... 55	34
5	5 ..... 7	66 ..... 56	10
6	6 ..... 8	55 ..... 54	1

Now take the difference between odd to odd and even to even frequencies.

$$\text{Mean intensity} = (-13-5+29+34+10+16)/6$$



$$= 9.3 \text{ cm}$$

Wavelength of microwaves = 9.3 cm

# Calculate the focal length of the lens.

No. of observation	Intensity (max)	Distance (max)	Intensity (min)	Distance (min)
1	100	11.5	85	12
2	95	12.1	75	13.5
3	90	14	70	14.5
4	80	15	60	15.5
5	75	18	50	18
6	65	19.5	55	20
7	60	22	45	23.5
8	55	24	40	25





No of observations:	Intensity	Distance
1	100	11.5
2	95	12.5
3	90	14
4	80	15
5	75	16
6	65	18.5
7	60	22
8	55	24

By adding the distance only of maximum intensity:  
Mean focal length  $= (11.5 + 12.5 + 14 + 15 + 16 + 18.5 + 22 + 24) \div 8$   
 $= 16.6875 \text{ cm}$

➤ To verify the Bragg's law.

➤ 
$$n\lambda = 2d \sin \theta$$

No of observation	Intensity (max)	Distance (2d)	Intensity (min)	Distance (min)
1	85	12.6	32	15.5
2	82	24.8	29	25.6
3	-----	-----	-----	-----

To verify the Braggs law, we use the values of maximum distance.

$$2d_1 = 12.6$$

$$2d_2 = 23$$

$$2d_3 = 39$$

$$n\lambda = 2d \sin \theta$$

$$n = 2d \sin \theta / \lambda$$



➤ For  $n \downarrow 1$

➤  $n \downarrow 1 = 12.6 * \sin 45 / 9.3 = 0.95 = 1$

➤ For  $n \downarrow 2$

➤  $n \downarrow 2 = 24.8 * \sin 45 / 9.3 = 1.89 \approx 2$

➤ For  $n \downarrow 3$

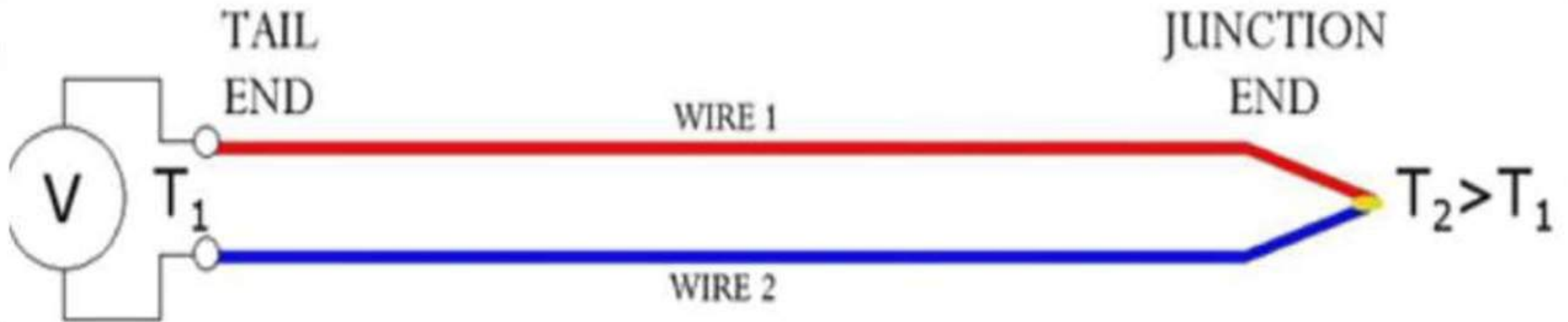
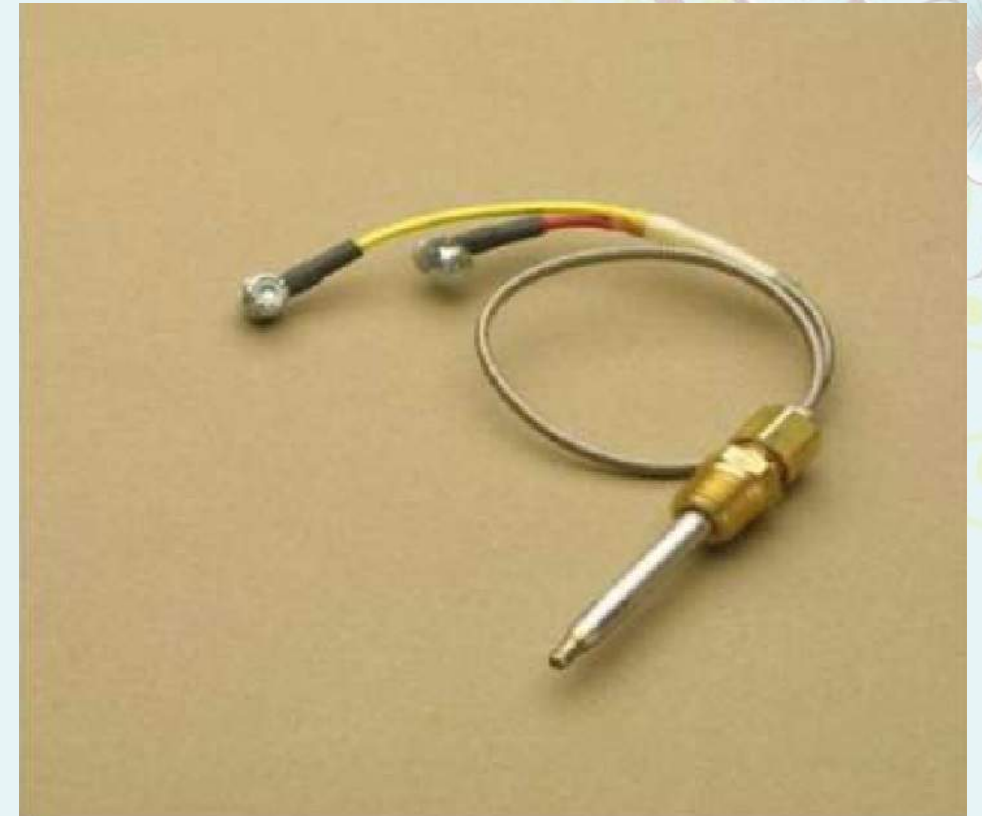
➤  $n \downarrow 3 = 39 * \sin 45 / 9.3 = 2.96 = 3$

# Overall Conclusion

No of observations	Distance (2 d)	Value of n	Integer n
1	1 2 . 6	0 . 9 5	1
2	2 4 . 8	1 . 8 9	2
3	3 9	2 . 9 6	3

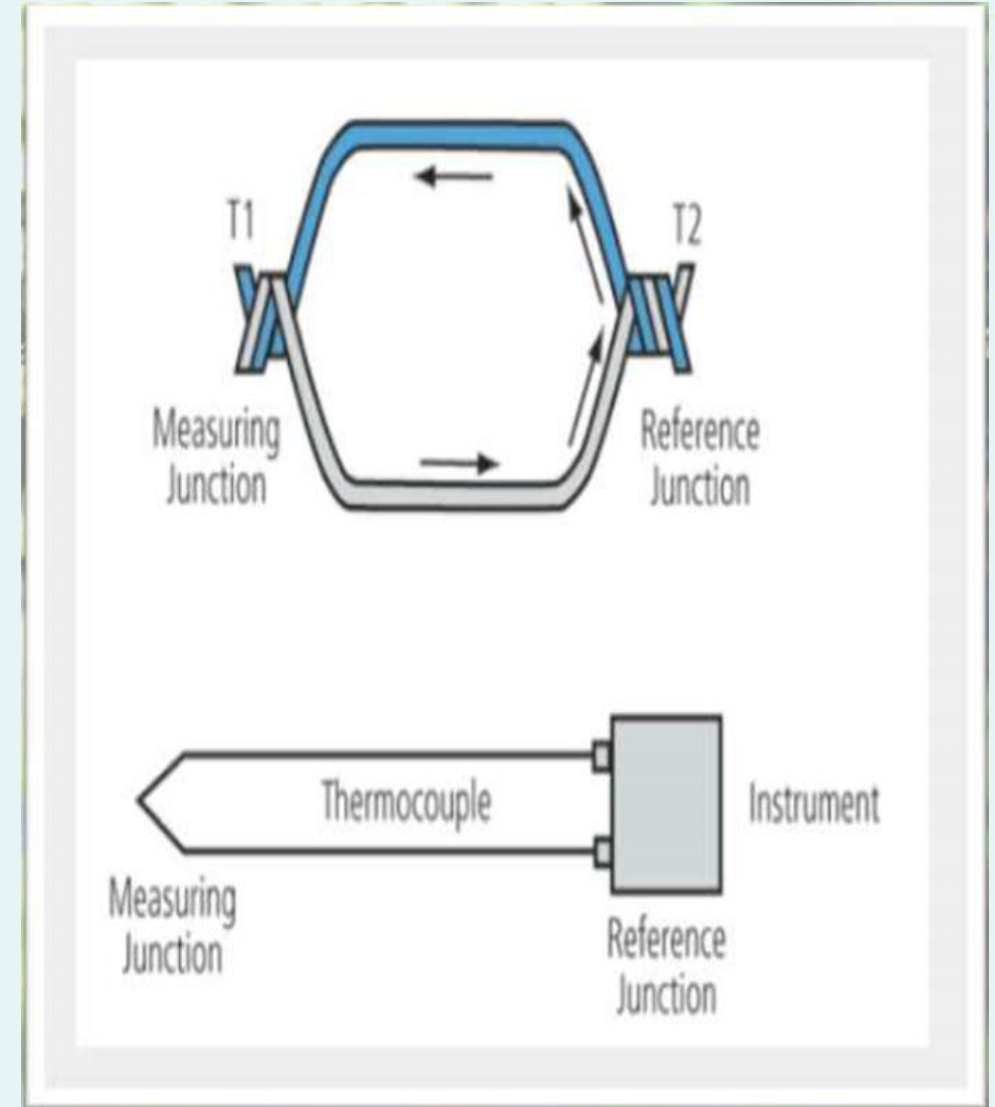
# THERMOCOUPLE

- A thermocouple is a junction between two different metals that produces a voltage related to a temperature difference.



# Principle of Operation

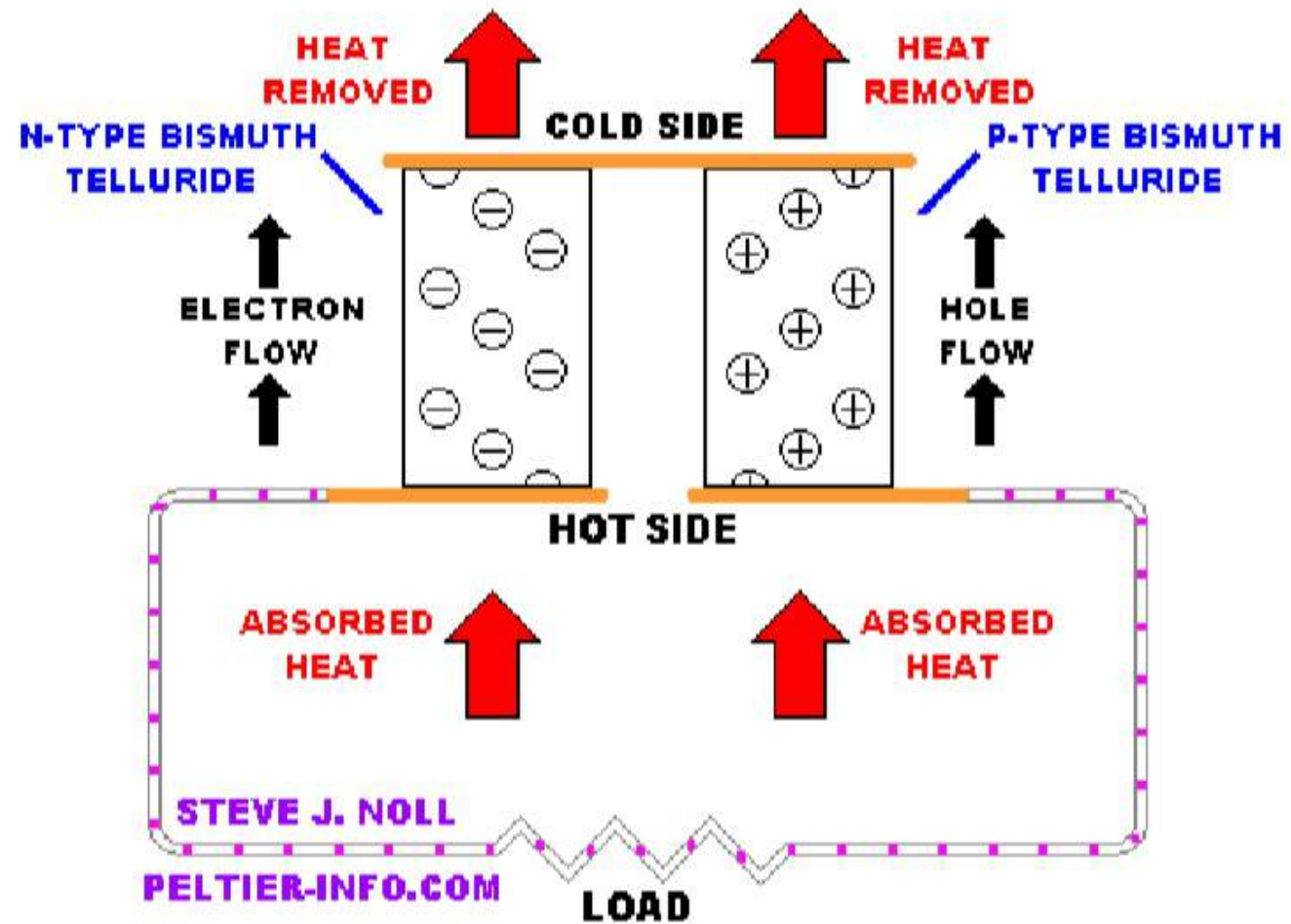
Thermocouples are based on the principle that two wires made of dissimilar materials connected at either end will generate a potential between the two ends that is a function of the materials and temperature difference between the two ends (also called the Seebeck Effect).





## Seebeck Effect

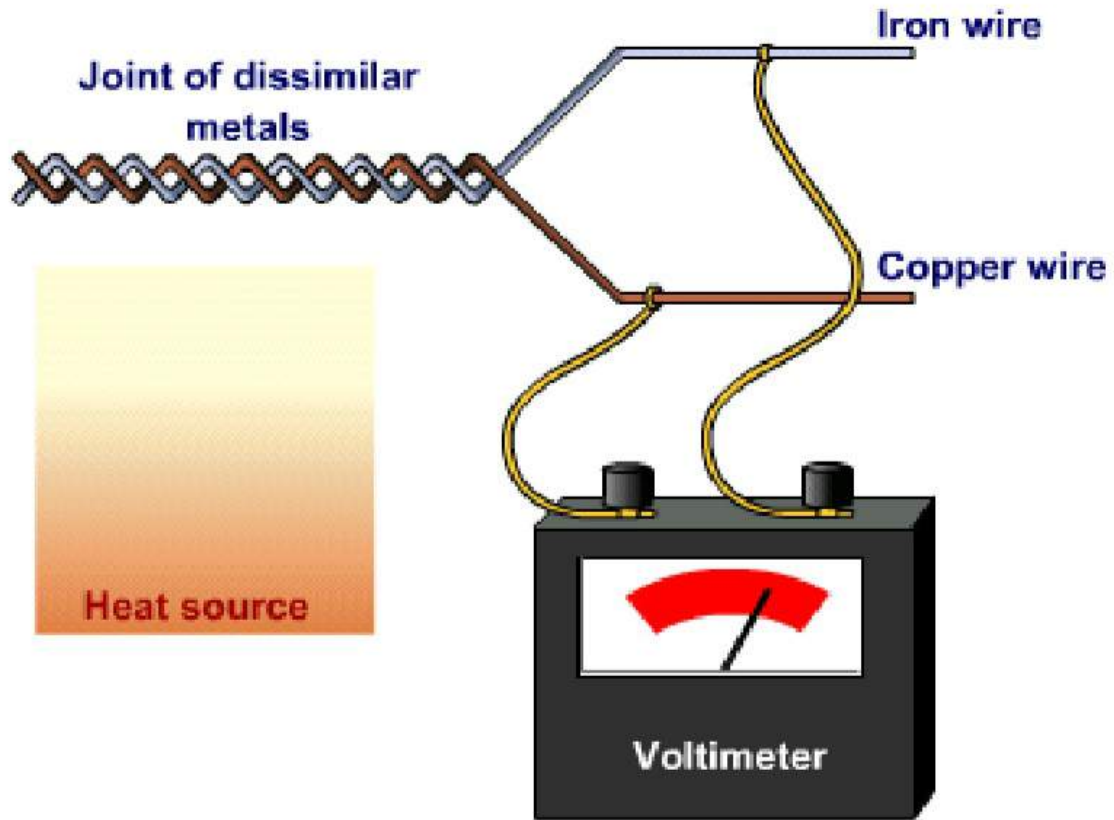
ONE SEEBECK DEVICE "COUPLE" CONSISTS OF ONE N-TYPE AND ONE P-TYPE SEMICONDUCTOR PELLET



THERE MUST BE A TEMPERATURE DIFFERENCE BETWEEN THE HOT AND COLD SIDES FOR POWER TO BE GENERATED



# Circuit construction



# Video description

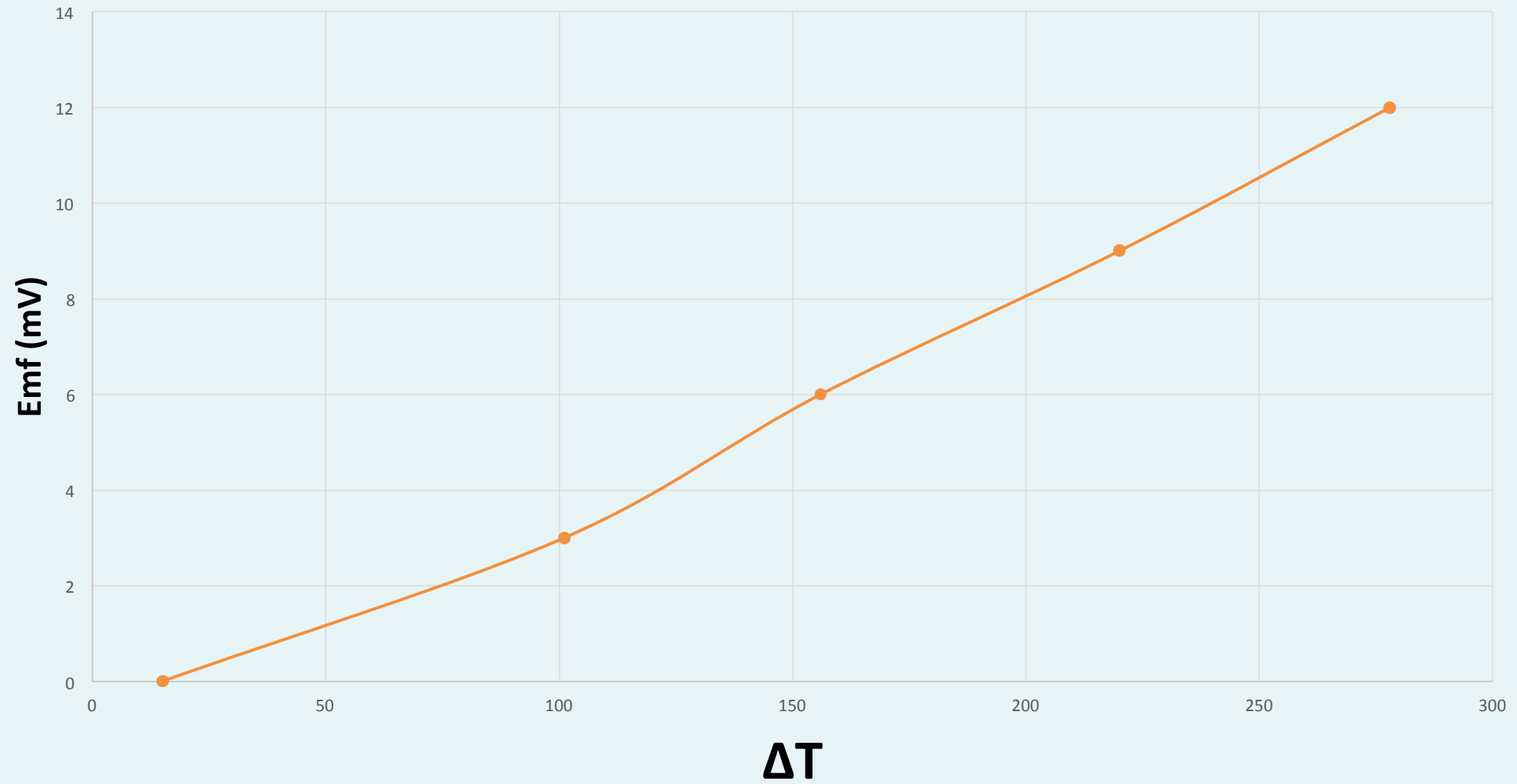


# Calculations:

For heating process

Sr No.	$T_1 (^{\circ}\text{C})$	$T_2 (^{\circ}\text{C})$	$\Delta T$	Emf (mV)
1	7	22	15	0
2	7	108	101	3
3	8	164	156	6
4	8	228	220	9
5	8	286	278	12

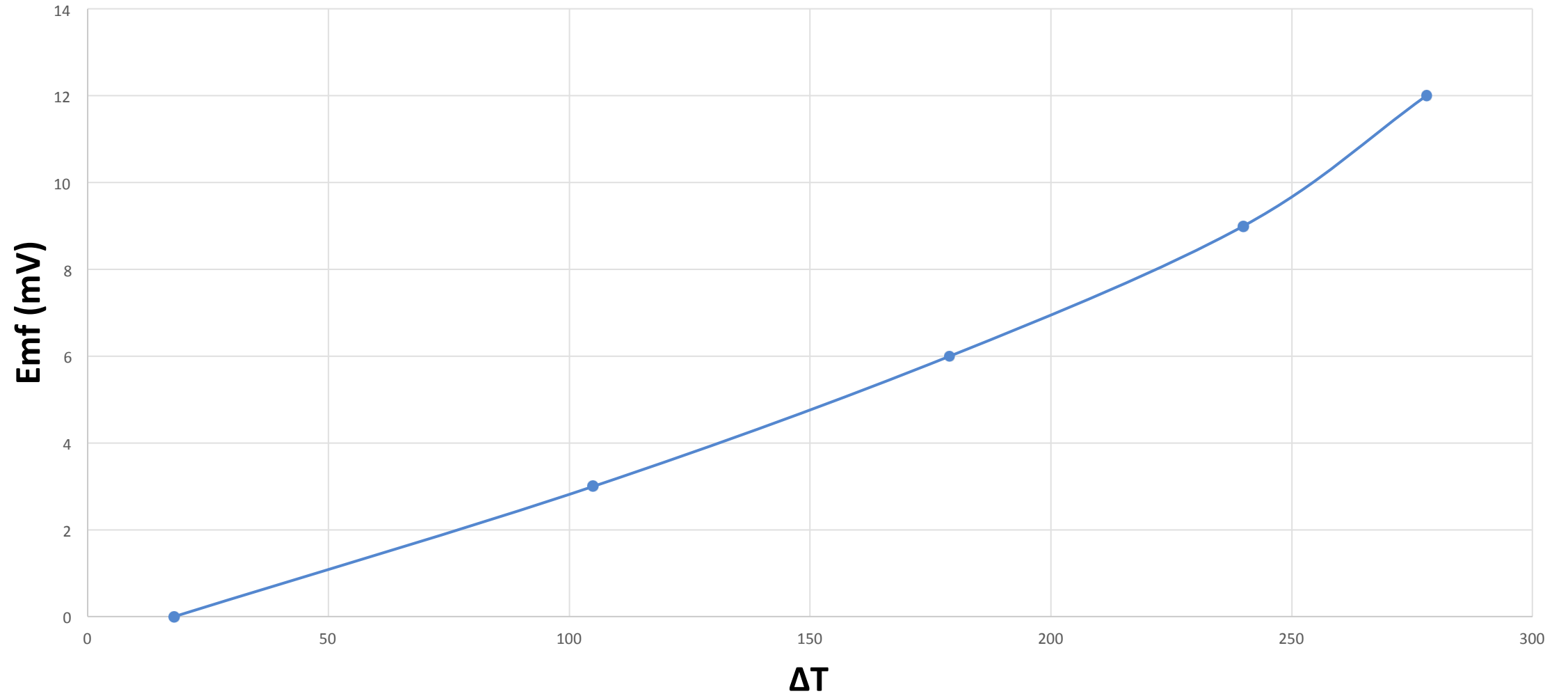
# Graph for heating process



### For cooling process

Sr No.	$T_1 (^{\circ}\text{C})$	$T_2 (^{\circ}\text{C})$	$\Delta T$	Emf (mV)
1	8	286	278	12
2	8	248	240	9
3	7	186	179	6
4	7	112	105	3
5	7	25	18	0

# Graph for cooling process



# Applications

1. Gas appliance safety
2. Thermopile radiation sensors
3. Manufacturing
4. Power production
5. Thermoelectric cooling



# Questions

Q.1 What is parallax error?

Ans: This error is caused when eye level of reader is not in good position with reading scale.

Q.2 Why thermometer filled with alcohol and mercury is used?

Ans: As freezing point of alcohol is very low as compared to mercury, So it (alcohol) is used to measure temperature in cooler regions.

While the thermometer filled with mercury is used to measure temperature in hotter regions.





# X-RAY DIFFRACTION



# Objective

- Firstly to find the operating voltage of GM tube.
- To determine intermolecular distance or spacing of crystal by using Bragg's law which states as:

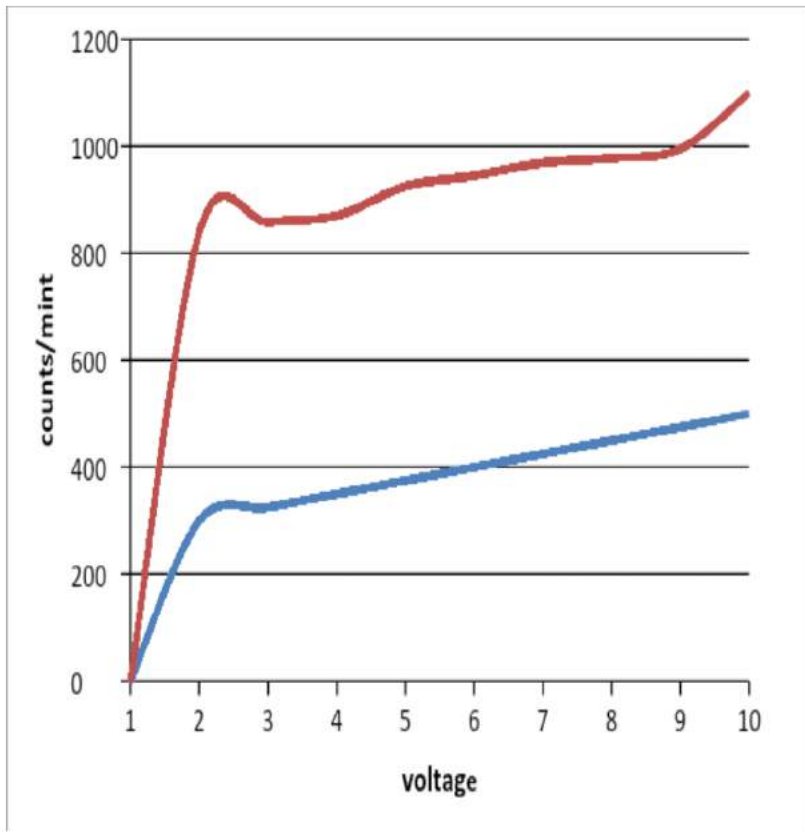
$$2d\sin\theta = n\lambda$$

# What are X rays?

- X- rays are electromagnetic radiation of wavelength  $1\text{\AA}$  ( $10^{-10}$  m), which is about the same size as an atom. They occur in the portion of the electromagnetic spectra between gamma rays and the ultraviolet.

Video description  
in Next Slide

# Part 1



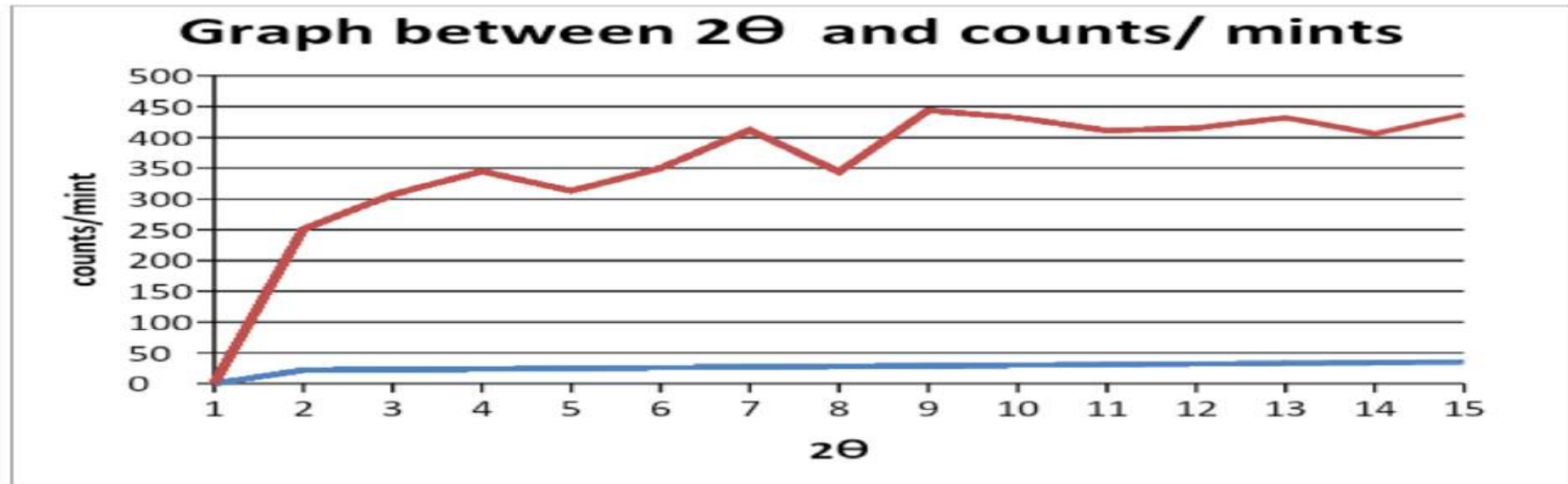
X(Voltage)	Y(Counts/mint)
300	840
325	858
350	870
375	925
400	945
425	969
450	978
475	995
500	1100

# Part 2

<b>2θ</b>	<b>Counts/min</b>
<b>12</b>	<b>5271</b>
<b>13</b>	<b>2005</b>
<b>14</b>	<b>1526</b>
<b>15</b>	<b>1355</b>
<b>16</b>	<b>979</b>
<b>17</b>	<b>813</b>
<b>18</b>	<b>732</b>
<b>19</b>	<b>417</b>
<b>20</b>	<b>391</b>
<b>21</b>	<b>310</b>
<b>22</b>	<b>251</b>
<b>23</b>	<b>307</b>
<b>24</b>	<b>345</b>

<b>2θ</b>	<b>Counts/mint</b>
<b>26</b>	<b>313</b>
<b>27</b>	<b>350</b>
<b>28</b>	<b>412</b>
<b>29</b>	<b>344</b>
<b>30</b>	<b>444</b>
<b>31</b>	<b>432</b>
<b>32</b>	<b>411</b>
<b>33</b>	<b>415</b>
<b>34</b>	<b>406</b>
<b>35</b>	<b>432</b>

## Graph 2:



# Calculations

$$n\lambda = 2d \sin \theta$$

$$2\theta = 29^\circ$$

$$\theta = 14.5^\circ$$

$$\lambda = 0.15 \times 10^{-9}$$

$$n = 1$$

$$2d = n\lambda / \sin \theta$$

$$2d = (1 \times 0.15 \times 10^{-9}) / \sin 14.5^\circ$$

$$2d = 6.15 \times 10^{-10}$$

$$2d = 615 \times 10^{-12}$$

$$2d = 615 \text{ pm}$$