Vivekanand College, Kolhapur

Department Of Physics

Magnetic Susceptibility

Presented By : Dr. N. A. Narewadikar
(Assistant Professor)

Date : 10/10/2023

Index

Introduction

Magnetic Susceptibility is a measure of the how magnetized material becomes when it is exposed to an external magnetic filed.

A liquid sample in a narrow tube placed between the poles of a magnet experiences a force and hence when the field is turned on , the meniscus in the narrow tube rises by an amount h, relative to its zero field position. Measuring this rise enables to determine the susceptibility of the solution .

Theory

Magnetic Susceptibility (X):

It is ratio of the intensity of magnetism induced (M) in a substance to the magnetizing force or intensity of field (B).

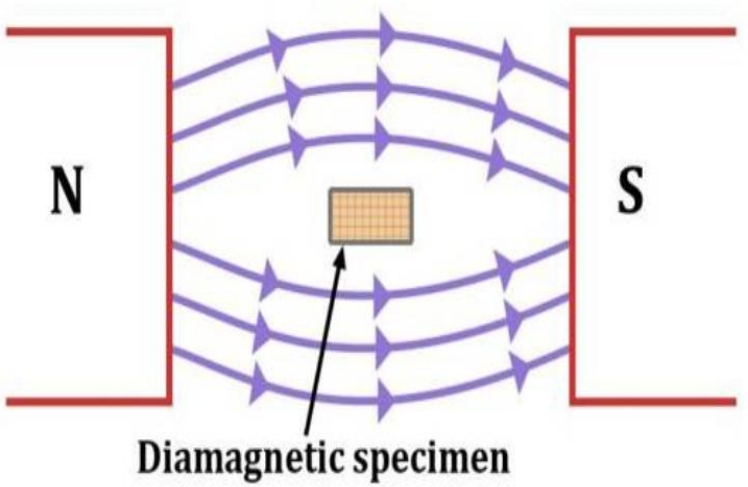
$$X = \frac{M}{B}$$

X :is dimensionless

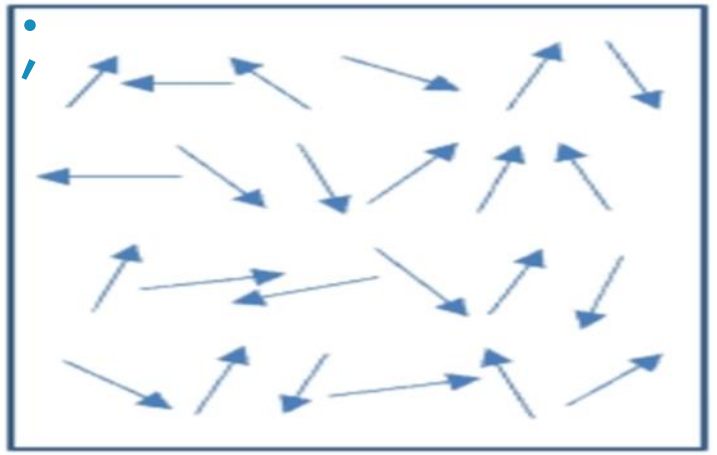
Types of Magnetic Materials :

1) Diamagnetic materials ($X < 0$)
2) Paramagnetic materials ($X > 0$)
3) Ferromagnetic materials ($X >> 0$)
4) Anti-Ferromagnetic materials

) Diamagnetic Material :



2) Paramagnetic Material :



* Curie Low :

The temperature dependence of the magnetic susceptibility of paramagnetic material is given by Curie Law;

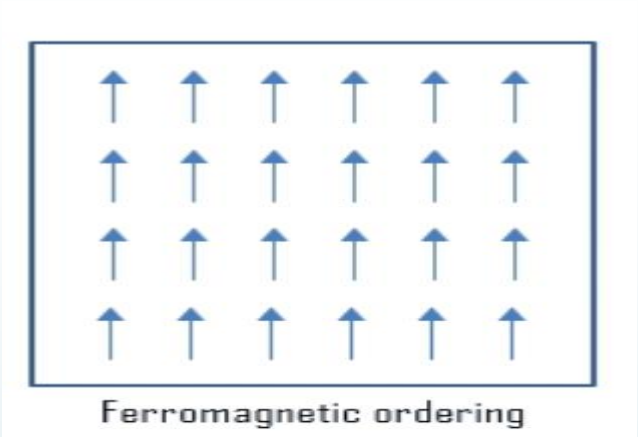
$$X_m = \frac{C}{(T-T_c)}$$

Where , T = Absolute temperature in K

T_c= paramagnetic curie temperature in K at Which the susceptibility its maximum value.

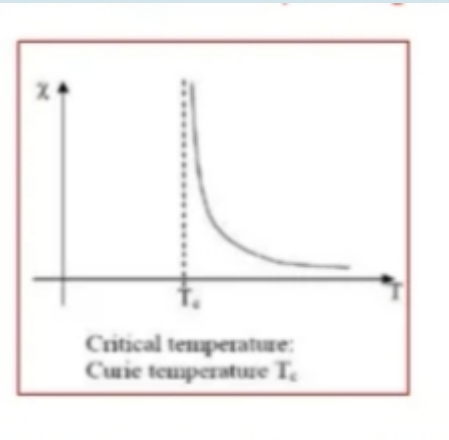
C= Paramagnetic curie constant

3) Ferromagnetic Material :

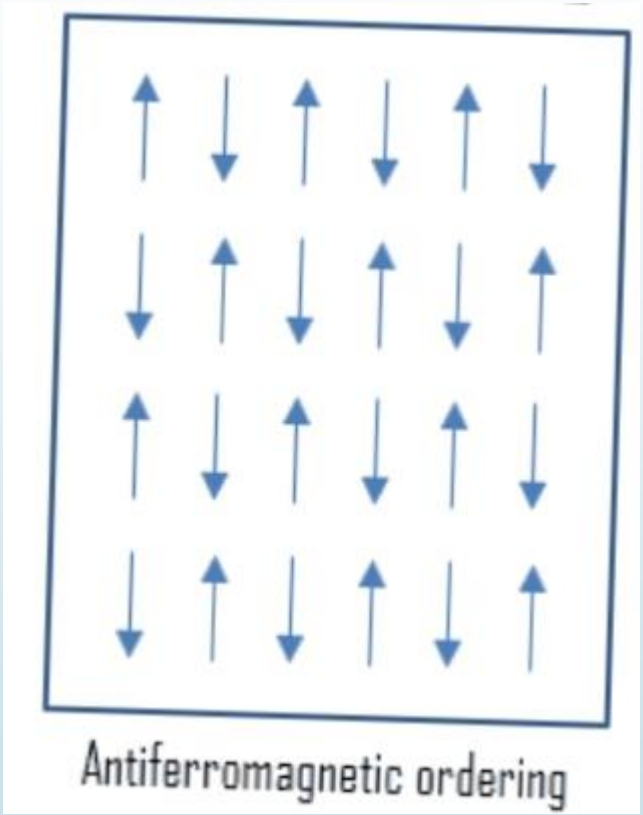


Curie Temperature :

The Curie temperature is the temperature above it the ferromagnetic materials become paramagnetic.



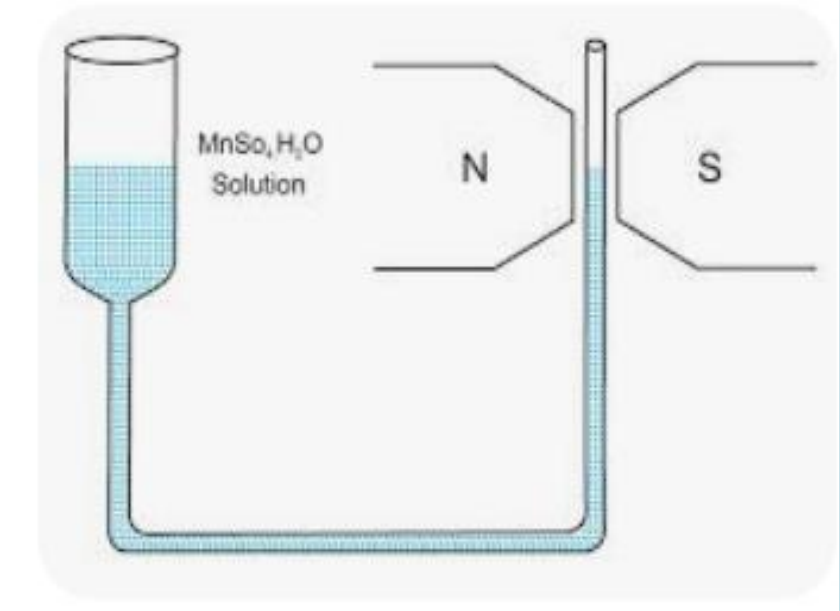
4) Antiferromagnetic Material :



Aim : To determine the magnetic susceptibility of given solution for different case.

Apparatus : Constant current supply, Digital glass meter, Electromagnetics, Microscope, Qunicke's tube .

Quincke Method :



Experimental Set Up

Diagram:

Procedure:

1)Prepare the Fecl3 solution.

2)Adjust the pole of pieces (Quinke's Tube)

3)Connect the Electromagnet coli.

4)Switch on the Gauss meter.

5) Taking the reading.

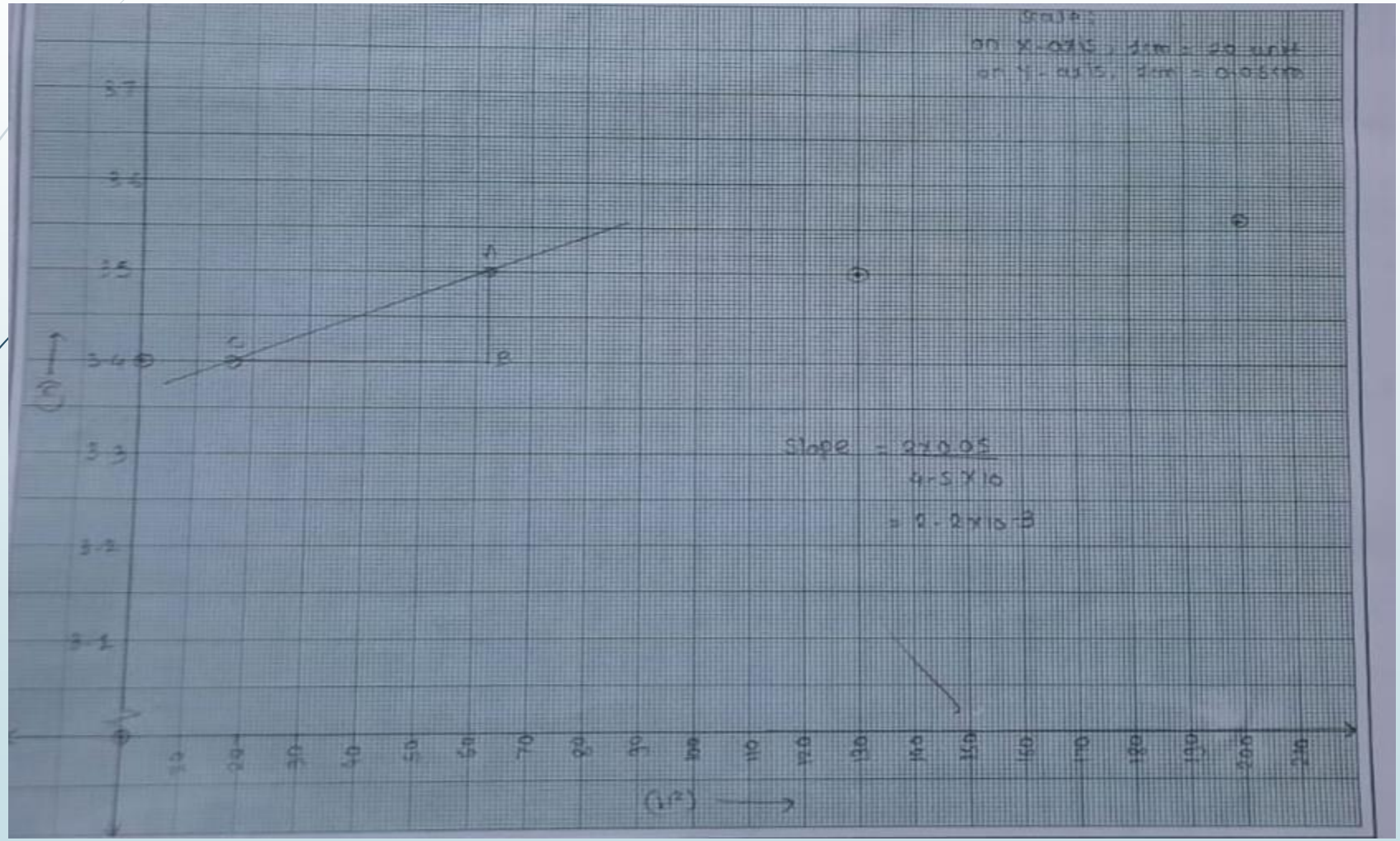
6) Draw the graph.

Observation Table :

Sr.No.	Current (I)	Magnetic Field (H)	H	Height of liquid (h)	Height
1.	0	0	0	0	3.402
2.	1	3.920	15.3664	0.002	3.404
3.	2	7.890	62.2521	0.047	3.451
4.	3	11.440	130.8736	0.053	3.501
5.	4	14.190	201.3561	0.054	3.56

Mean=3.653

Graph:



Calculation :

By Calculation:

1) $X = \frac{2\rho gh}{H}$

2) $X = 2\rho g \times \text{slope}$

$= 2 \times 2.9 \times 2.2 \times 10^{-3} \times 9.8$

$X = 0.1250$

Result :

1) Magnetic susceptibility of given solution using Quincke's tube method by calculation = 3.653
2) Magnetic susceptibility of given solution by graph , X = 0.1250

Conclusion :

* Magnetic susceptibility is a dimensionless proportionality constant that indicates the degree of magnetization of a material in response to an applied magnetic field.*

Application :

1)It is provide insights into the structure of materials, providing insight into bonding and energy levels.

2) It is a powerful tool, which is being increasingly on sedimentary rocks to constrain stratigraphic correlation.

3) Characterization of magnetic material.

THANK YOU