ASSIGNMENT-4 EXPERIMENT-4

DETERMINATION OF PARAMAGNETIC SUSCEPTIBILITY – QUINCKE'S METHOD

AIM

To measure the susceptibility of paramagnetic solution by Quincke's tube method.

APPARATUS REQUIRED

Quincke's tube, Travelling microscope, sample ($FeCl_3$ solution), electromagnet, Power supply, Gauss meter.

PRINCIPLE

Based on molecular currents to explain Para and diamagnetic properties magnetic moment to the molecule and such substances are attracted in a magnetic field are called paramagnetic. The repulsion of diamagnetic is assigned to the induced molecular current and its respective reverse magnetic moment**.**

The force acting on a substance, of either repulsion or attraction, can be measured with the help of an accurate balance in case of solids or with the measurement of rise in level in narrow capillary in case of liquids.

The force depends on the susceptibility χ, of the material, i.e., on ratio of intensity of magnetization to magnetizing field I/H. If the force on the substance and field are measured the value of susceptibility can be calculated.

FORMULA

The susceptibility of the given sample is found by the formula

$$\chi = \frac{2(\rho - \sigma)gh}{H^2} \text{ kg m}^{-1} \text{ s}^{-2} \text{ gauss}^{-2}$$

Where ρ is the density of the liquid or solution (kg/m^3)
σ is the density of air (kg/m^3)
g is the acceleration due to gravity (ms^{-2})
h is the height through which the column rises (m)
H is the magnetic field at the centre of pole pieces (Gauss)

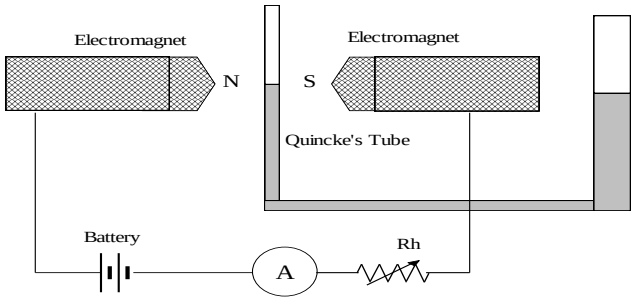

Table 4.1 To find the rise in the capillary tube of the solution:

Microscopic reading without field **(h_1)** = 2.854 cm

LC =0.001 cm TR = MSR + (VSC × LC)

S.No.	Current (i)	Field (H)	Travelling microscope reading **(h_2)** cm			Difference **$h = h_1 \sim h_2$**	h / H^2 (m^{-1})
	Ampere	Gauss	MSR (cm)	VSC (div)	TR (cm)	$\times 10^{-2}$ m	
1	1	2200	2.95	2	?	?	?
2	2	2850	3.00	21	?	?	?
3	3	3100	3.05	14	?	?	?
4	4	3650	3.10	11	?	?	?

Mean h/H^2 =

OBSERVATION

ρ = density of the liquid or solution = 1480 kg/m^3

σ = density of air = 1 kg/ m^3

Assignment Question:

1. From the main scale reading and Vernier scale coincidence, calculate the total reading by using following relation TR = MSR + (VSC × LC) and then enter the value of TR in the respective coloum. Also assume it as h_2.

2. From h_1 and h_2 to calculate h ($h= h_1 \sim h_2$) and enter the same in respective coloum in the tabular coloum in four decimal points.

3. From h and H, calculate h/H^2 and enter the values in the respective coloum. Also calculate the mean of h/H^2.

4. From the values of ρ, σ, g, h/H^2, calculate the susceptibility of the given paramagnetic solution by using the above formula.

5. Write the result in the following order

   The magnetic susceptibility of the given sample = …… kg m^{-1} s^{-2} $gauss^{-2}$

   Finally, submit the scanned copy of your observation note book in GCR on (or) before THREE working days from the date of experiment.