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Experiment -10

Title of experiment: Magnetic susceptibity of para magnetic material.

Objectives: To determine the magnetic susceptibity of para magnetic material. using Quincks method.

Observation:

Table :- 1

Calibration of electromagnet:-

S/NO	Current (I)	Magnet flux (B)
1	0.0	0
2	0.5	-13.2
3	1.0	-27.1
4	1.5	-39.3
5	2.0	-51.5
6	2.5	-60.9
7	3.0	-70.3
8	3.5	-79.0
9	4.0	-87.7

Density of solution, $\rho_{sol} = \rho_{water}\left[\frac{\text{mass of solution}}{\text{mass of water}}\right]$

→ $\rho_{water} = 1000\ kg/m^3$

→ Mass of empty specific gravity bottle, $m_1 = 17.066$ gms

→ Mass of Specific gravity bottle with Salt solution $m_3 = 44.280$ gms

→ Mass of Specific gravity bottle with water, $m_2 = 40.849$ gms

Table:-2

Height of Solution for different magnetic flux.

S/No	Current I	magnetic flux B	B^v	Meniscus Position for B=0, (a)	Meniscus Position for B≠0, b	Change in height h=b-a
1	1	-27.1	734.41	1.02	1.235	0.215
2	2	-51.5	2652.25	1.02	1.15	0.13
3	3	-70.3	4942.09	1.02	1.14	0.12
4	4	-87.9	7691.29	1.02	1.13	0.11

Calculations:

1) $B = -27.1 \Rightarrow B^v = 734.41$

$h = b - a = 1.235 - 1.02 = 0.215$

2) $B = -51.5 \Rightarrow B^v = 2652.25$

$h = b - a = 1.15 - 1.02 = 0.13$

3) $B = -70.3 \Rightarrow B^v = 4942.09$

$h = b - a = 1.14 - 1.02 = 0.12$

4) $B = -87.9 \Rightarrow B^v = 7691.29$

$h = b - a = 1.13 - 1.02 = 0.11$

$$B^v = \frac{734.41 + 2652.25 + 4942.09 + 7691.29}{4}$$

$B^v = 4005.01$

$$h = \frac{0.215 + 0.13 + 0.12 + 0.11}{4} = 0.14375$$

Suspectability $\chi_{sol} = \frac{2\mu_0 \rho_{sol} gh}{B^2}$, $\mu_0 = 4\pi \times 10^{-7}$.

$$\rho_{sol} = \frac{m_3 - m_1}{m_2 - m_1} = \frac{44.280 - 17.0668}{40.8493 - 17.0668}$$

$$= 1.1428 \text{ g/cm}^3$$

$$\chi_{sol} = \frac{2 \times 4 \times 3.14 \times 10^{-7} \times 1.448 \times 98 \times 0.14375}{4005.01}$$

$$= 0.010115318 9 \times 10^{-7}.$$

$$= 1.0115 \times 10^{-9} \text{ g/cm}^3.$$

Result:

Suspectability of $MnSO_4 \cdot H_2O$ is 1.01153×10^{-9} g/cm^3

Graph-10

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