Vlab Experiment 3: Quincke's Method

Aim:

To determine the volume magnetic susceptibility of Manganese sulphate solution at different concentrations.

Formula used:

We can derive an expression for the susceptibility of the liquid as given below,

$$X_2 - X_1 = \frac{2gh(\rho - \sigma)}{\mu_0 H_m^2} \quad \text{.....(2)}$$

where χ_2, χ_1 are the susceptibilities of the solution and air; ρ, σ are the densities of liquid and air ; 'g' the acceleration due to gravity; 'h' the rise in the surface of the liquid; and H_m is the final field applied.

Taking the susceptibility of air approximately equal to zero, (2) becomes,

$$X_{soln} = \frac{2gh(\rho - \sigma)}{\mu_0 H_m^2} \quad \text{.....(3)}$$

Observations:

Magnetic susceptibility of water = 9.04×10^{-6}
Molarity of MnSO4 solution = 1M
Volume of MnSO4 = 46.462 cm3
Density of MnSO4 = 151.0013 g/L

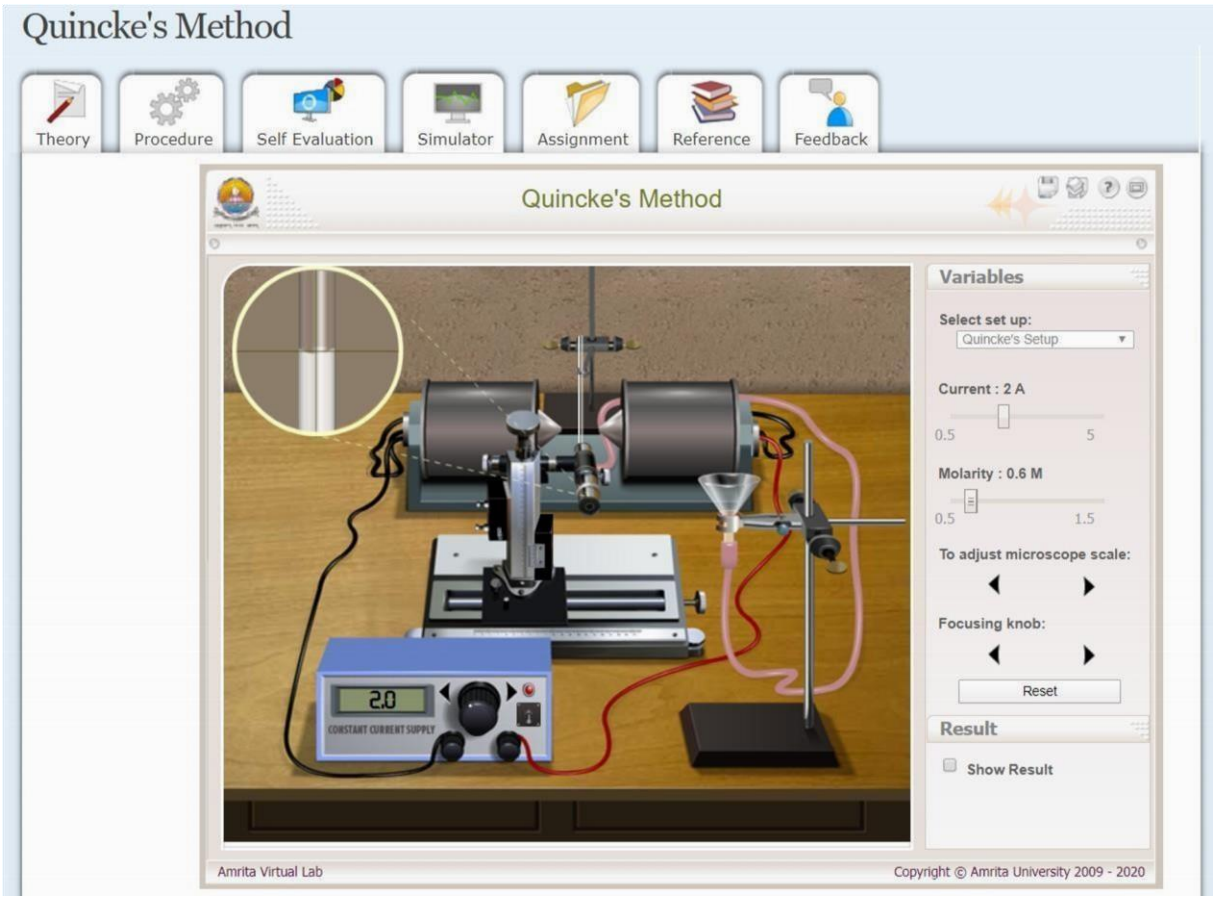
Magnetic Field VS Current

S.No.	Current (Amp)	Magnetic Field B(T)
1	1	0.2267
2	2	0.4534
3	3	0.6801
4	4	0.9068

Quincke's Method

Current I (Amp)	Field Generated (H)	Rise in Height (m)	Susceptibility of Solution X ($X_{Mn^{2+}} + X_{Water}$)
1	180493.63057324843	0.00001743383676590086	0.000009214210733017989
2	360987.26114649686	0.00006973534706360344	0.000009214210733017989
3	541480.8917197452	0.00015690453089310771	0.000009214210733017989
4	721974.5222929937	0.00027894138825441375	0.000009214210733017989

Simulator:



Result:

The Magnetic Susceptibility of the solution is: 9.214×10^{-6}.