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EXPERIMENT NO. 5

NAME OF EXPERIMENT: TO DETERMINE MAGNETIC MOMENT OF A BAR MAGNET BY OSCILLATION MAGNETOMETER

APPARATUS REQUIRED

1. Weight bar
2. Oscillation magnetometer
3. Stop watch
4. Compass needle.
5. Bar magnet

THEORY

When a magnet is suspended freely in a uniform magnetic field it comes to rest in a direction parallel to the field. When the magnet is slightly displaced from the equilibrium position and released, it begins to vibrate in simple harmonic motion about the equilibrium position with a time period.

$$T = 2\pi\sqrt{\frac{I}{MH}} \quad \text{---} \quad (i)$$

where I is the moment of Inertia of the magnet. M is the moment of the magnet. H is the horizontal component of the earth's field.

$I = \frac{a^2+b^2}{12} \times$ mass of rectangular bar, a is the

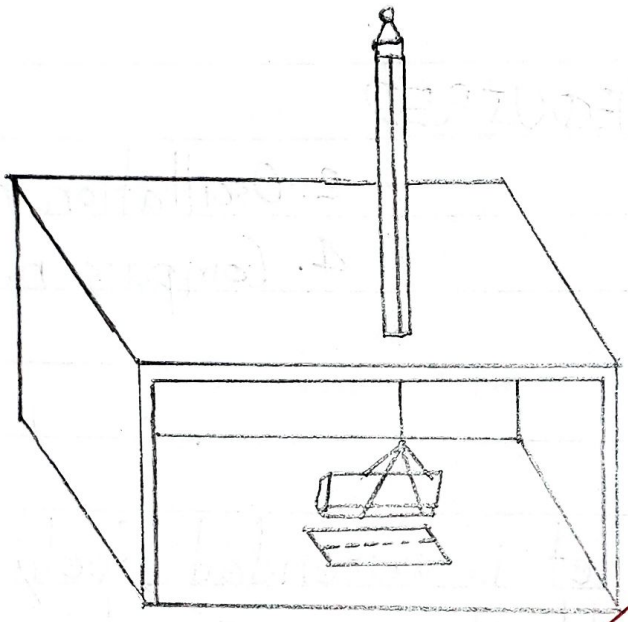

fig. Oscillation magnetometer

length of the bar and b is the breadth.

$$\text{or, } t^2 = 4\pi^2 \frac{I}{MH}$$

$$\text{or, } MH = \frac{4\pi^2 I}{t^2} \quad \text{---(ii)}$$

$$\therefore M = \frac{4\pi^2 I}{Ht^2} \quad \text{---(iii)}$$

PROCEDURE

1. The levelling screws of the box were adjusted to make the box horizontal and all the magnetic substances were removed from the working table.
2. A compass was placed on the reference line and the box was adjusted to become parallel to magnetic needle.
3. A bar was placed on the stirrup and torsion head was adjusted to make the bar parallel to the reference line. When the bar oscillated equally on both sides of the reference line, there was no torsion in the thread.
4. The stirrup was held with the fingers and bar was replaced with a magnet with n-pole pointing north. The sliding door was closed.
5. The magnet was slightly disturbed by another

magnet from outside the windows.

6. The time for 20 oscillations was noted with the help of stopwatch.
7. The process was repeated for 10 times.

OBSERVATIONS

Length of magnet (a) = 5.1 cm
Breadth of magnet (b) = 1.1 cm
Mass of magnet (W) = 31.17 gm
∴ Moment of Inertia (I) $= \frac{a^2+b^2}{12} \times$ mass

$= \frac{(5.1)^2+(1.1)^2}{12} \times 31.17$

$= 70.7\ g cm^2$

Value of H = 0.34 Oersted

OBSERVATION TABLE

No. of Obs.	Time for 20 oscs	Time period t secs	Mean (t)	$M = \frac{4\pi^2 I}{Ht^2}$
1.	67.19	3.35		
2.	66.41	3.32		
3.	66.44	3.32		
4.	65.31	3.26	3.35	731.49
5.	69.69	3.49		
6.	68.28	3.41		
7.	67.53	3.37		

8.	66.87	3.34		
9.	66.31	3.31		
10.	65.97	3.29		

CALCULATION

$$\text{Magnetic moment } (M) = \frac{4\pi^2 I}{Ht^2}$$

$$= \frac{4\pi^2 \times 70.7}{0.34 \times (3.35)^2}$$

$$= 731.49 \text{ cgs unit}$$

RESULT

From the above experiment the magnetic moment of given magnet was found to be 731.49 cgs unit.

PRECAUTION

1. Reading should be done accurately.
2. Time should be taken properly.
3. Magnetometer should be placed properly.