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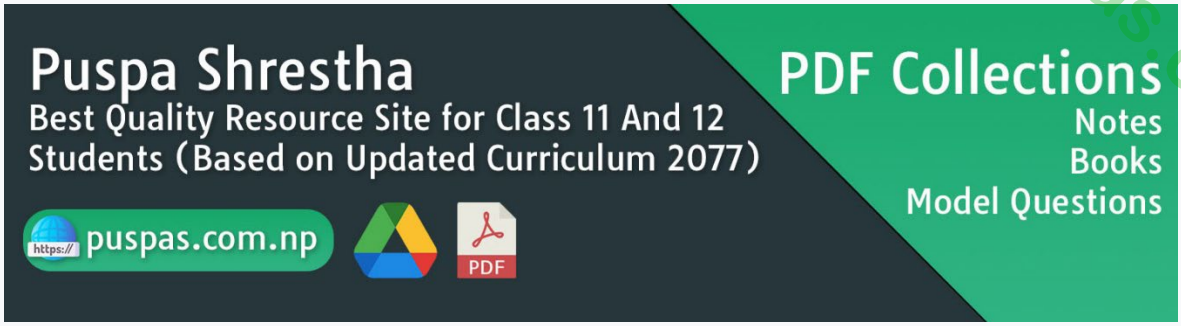

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EXPERIMENT NO. 2

NAME OF EXPERIMENT: TO USE DEFLECTION MAGNETOMETER TO COMPARE THE MOMENTS OF TWO MAGNETS BY NULL DEFLECTION METHOD

APPARATUS REQUIRED

1. Deflection magnetometer
2. Two bar magnets.

THEORY

Tangent A position of Gauss

The first magnet is placed on one of the arms of the magnetometer at distance d from the centre producing a deflection θ so that;

$$F_1 = \frac{2M_1 d_1}{(d_1^2 - l_1)^2} = \mu \tan\theta$$

The second magnet is placed on the other arm with a similar pole containing towards the needle and the distance adjusted such that the needle is brought back to zero position.

$$F_2 = \frac{2M_2 d_2}{(d_2^2 - l_2^2)^2} = \mu \tan\theta$$

That the needle is brought back to zero shows

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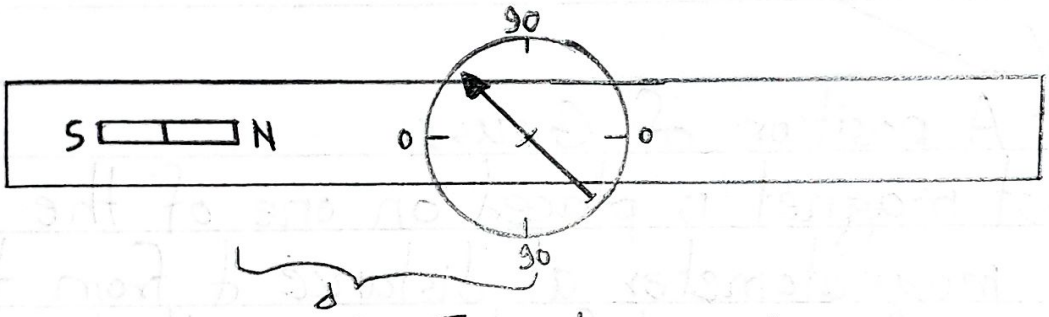

fig. Tangent A position of gauss

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that the deflection in the 2nd case is the same as that in the 1st case. i.e,

$$F_1 = F_2$$

$$\frac{2M_1 d_1}{(d_1^2 - l_1^2)^2} = \frac{2M_2 d_2}{(d_2^2 - l_2^2)^2}$$

$$\frac{M_1}{M_2} = \frac{(d_1^2 - l_1^2)^2}{(d_2^2 - l_2^2)^2} \times \frac{d_2}{d_1}$$

PROCEDURE

1. First of all, the deflection magnetometer was placed in the magnetic meridian.
2. The 1st magnet was placed on one of the arms say the east arm at a certain distance d_1, with its axis at rt. angles to the magnetic meridian and with its n-pole pointing towards the needle.
3. The 2nd magnet was similarly placed on the other arms with its n-pole pointing towards the needle. Its distance was adjusted such that the needle was brought back to zero position. Then, the distance d_2 was noted.
4. The first magnet was then placed in the same position with its south pole pointing towards the needle. The 2nd magnet was also reversed and its distance d_2 was adjusted to produce null deflection.

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5. Placing the 1st magnet on the west arm at the same distance d_1 operation (3) and (4) were repeated. The mean of these 4 readings gave the value of d_2 for the 1st set of observations.
6. The 1st magnet was the placed at some other distance and operations (3) and (5) were repeated.

OBSERVATIONS

For 1st magnet,

Real length of magnet, $x_1 = 15.1$ cm

Effective length of magnet, $2l_1$ = Real length $\times .85$

or, $2l_1 = 12.84$

$\therefore l_1 = 6.42$

For 2nd magnet,

Real length of magnet, $x_2 = 15$ cm

Effective length of magnet, $2l_2$ = Real length $\times 0.85$

or, $2l_2 = 12.75$

$\therefore l_2 = 6.38$ cm

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OBSERVATION TABLE

No. of Obs.	Distance of the magnet 1 d_1 (cm)	Position of the magnet	n-pole of 1st magnet pointing	Distance of the magnet 2 d_2 (cm)	Mean d_2 (cm)	$\frac{M_1}{M_2} = \frac{(d_1^2 - l_1^2)^2}{(d_2^2 - l_2^2)^2} \times \frac{d_2}{d_1}$	Mean
1.	24+7.5	East	East	31.3			
	=31.5		West	30.6	30.8	1.07	
		West	East	30.7			
			West	30.4			
2.	22+7.5	East	East	29.4			1.07
	=29.5		West	28.8	28.83	1.07	
		West	East	28.6			
			West	28.5			
3.	20+7.5	East	East	27.4			
	=27.5		West	26.9	26.9	1.07	
		West	East	26.6			
			West	26.7			

CALCULATION

1. $$\frac{M_1}{M_2} = \frac{(d_1^2 - l_1^2)^2}{(d_2^2 - l_2^2)^2} \times \frac{d_2}{d_1} = \frac{(992.25 - 41.216)^2}{(948.64 - 40.704)^2} \times \frac{30.8}{31.5}$$

$$= \frac{904465.669}{824347.78} \times \frac{30.8}{31.5}$$

$$= 1.07$$

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2. $\frac{M_1}{M_2} = \frac{(d_1^2 - l_1^2)^2}{(d_2^2 - l_2^2)^2} \times \frac{d_2}{d_1} = \frac{(870.25 - 41.216)^2}{(831.169 - 40.704)^2} \times \frac{28.83}{29.5}$

$= 1.07$

3. $\frac{M_1}{M_2} = \frac{(d_1^2 - l_1^2)^2}{(d_2^2 - l_2^2)^2} \times \frac{d_2}{d_1} = \frac{(756.25 - 41.216)^2}{(723.61 - 40.704)^2} \times \frac{26.9}{27.5}$

$= 1.07$

Mean $\frac{M_1}{M_2} = 1.07$

RESULT

The magnetic moment of first magnet is greater than magnetic moment of second magnet. The ratio of magnetic moment of first and second magnet is 1.07.

PRECAUTIONS

1. The needle of deflection magnetometer must be managed at 0-0.
2. Magnet must be taken far from deflection magnetometer to manage it at 0-0.
3. Magnetometer should be placed properly.

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