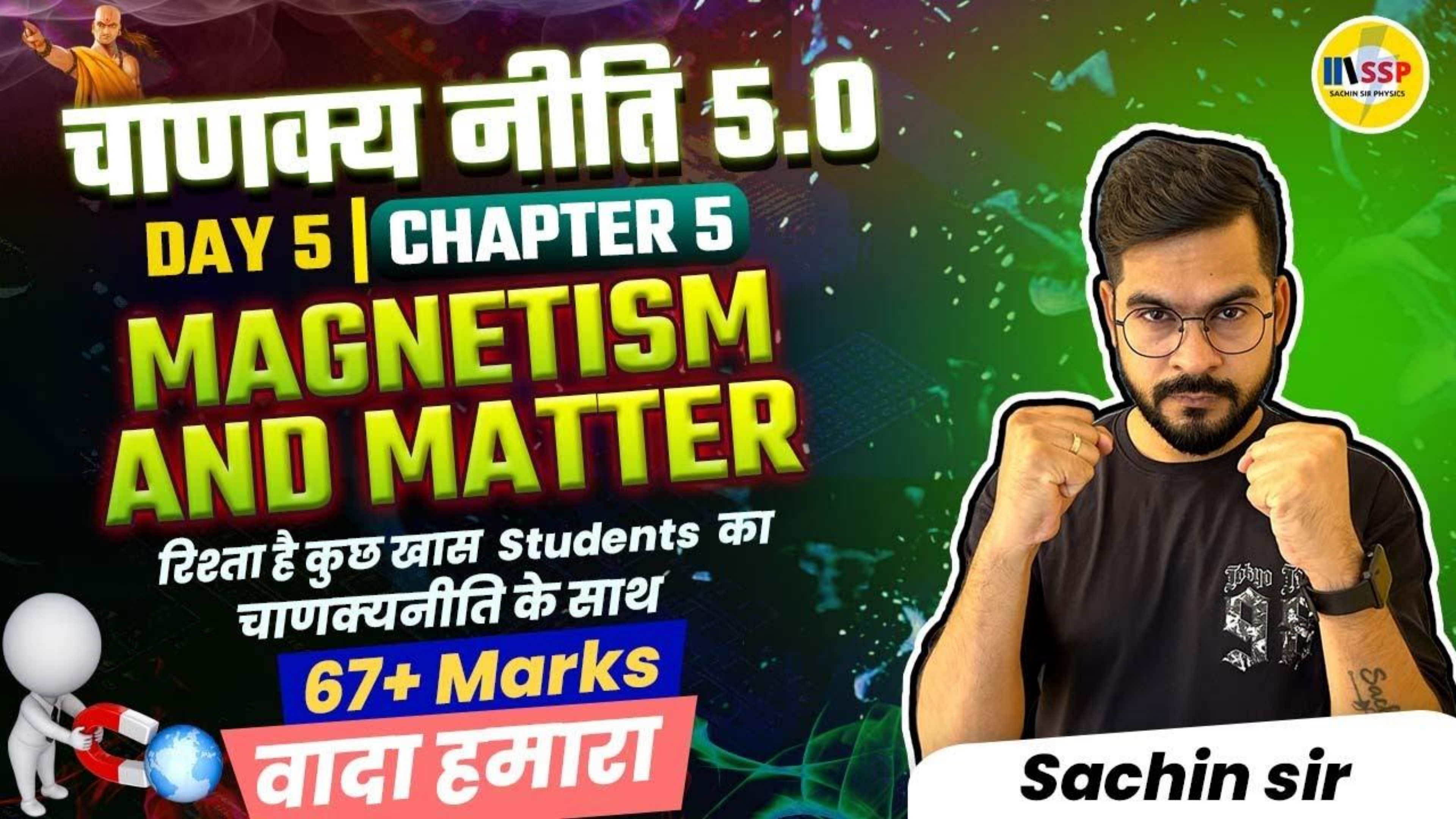
SSP
SACHIN SIR PHYSICS
चाणक्य नीति 5.0
DAY 5 | CHAPTER 5
MAGNETISM AND MATTER
रिश्ता है कुछ खास Students का चाणक्यनीति के साथ
67+ Marks
वादा हमारा
Sachin sir

Magnetism & Matter

DAY 5»

Date Sheet announced

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Magnetism & Matter

-

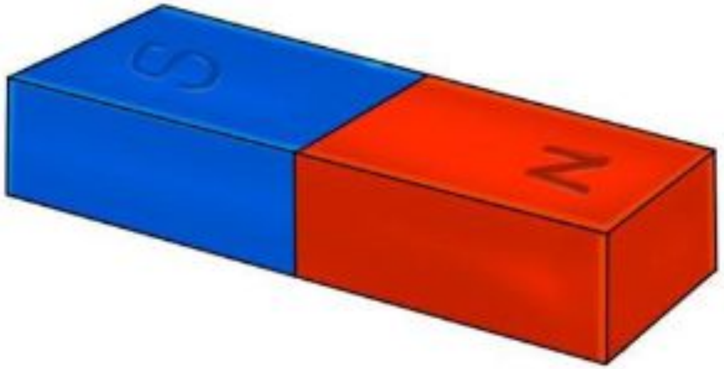
1 Question :- 1 Marks

1 Question :- 2 Marks { CBSE Sample Paper

THE BAR MAGNET

Rectangular bar magnet:

Rectangular bar magnets find applications in manufacturing and engineering industries as they have magnetic strength and field greater than the other magnets.



Q. A bar magnet is broken into three parts X,Y and Z as shown in figure. Which of the following diagrams shows the correct poles in X,Y and Z?

A


B


C


D


Q. A bar magnet is broken into three parts X,Y and Z as shown in figure. Which of the following diagrams shows the correct poles in X,Y and Z?

A


B

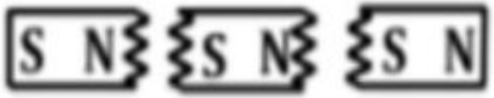

C


D


Solution:

When a magnet is broken down into three small parts X, Y and Z, each part is still a magnet and the direction of the magnetic force remains the same.

And hence, north and south pole in each part will be as shown in the option D.



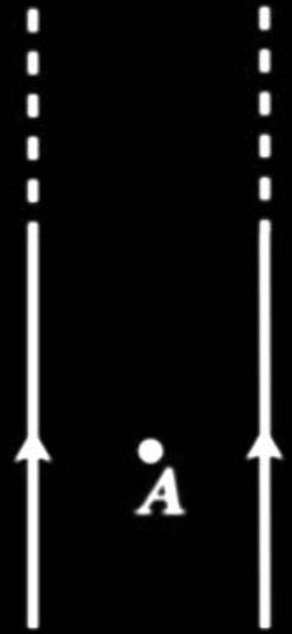
Q. If the two wires carry same current in the same direction then the magnitude of magnetic field at point A (A is equidistant from both the wires) is, if magnetic field by one wire at that point is B.

A 0

B B

C 2B

D B/2



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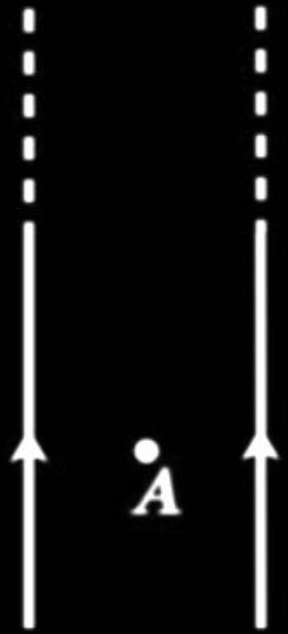
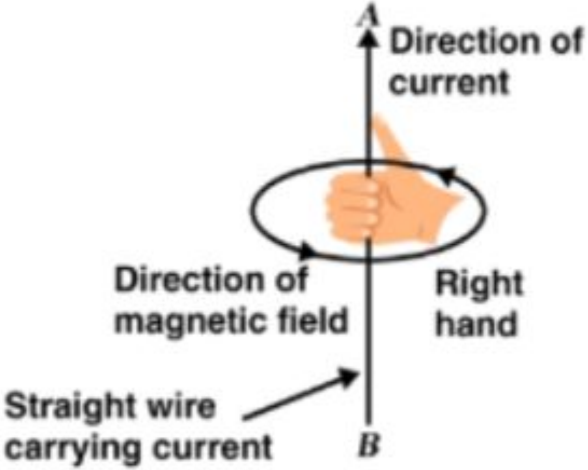
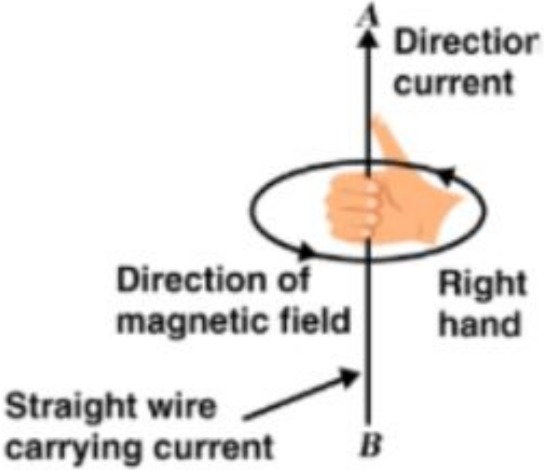


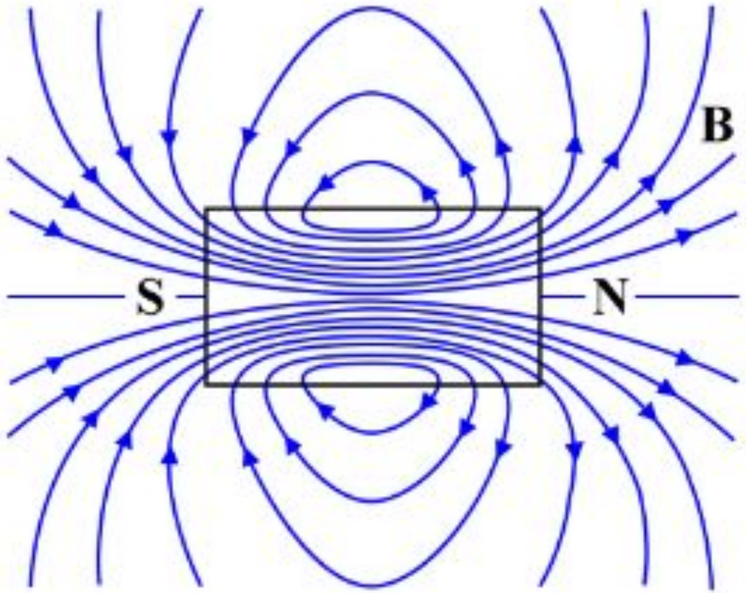
Solution:

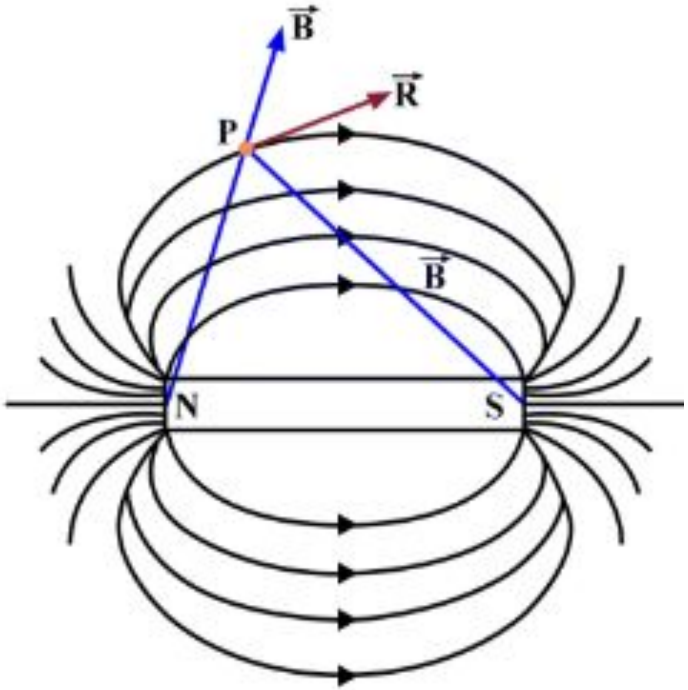
Right hand thumb rule states that if we point our thumb in the direction of the current and curl our fingers around the conductor, then the direction in which fingers move give the direction of magnetic field.





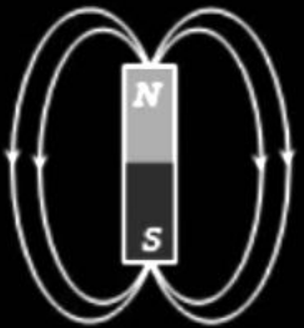
Magnetic field lines properties



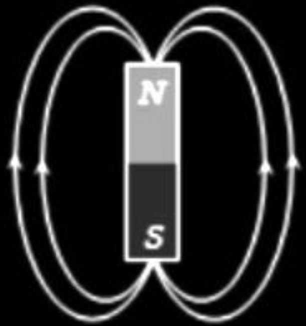


Q. The magnetic field lines due to a bar magnet are correctly shown in

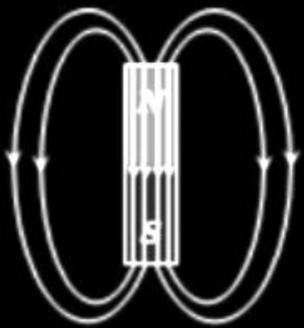
A



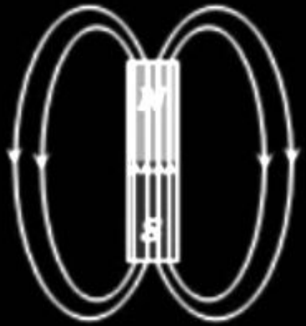
C



B



D



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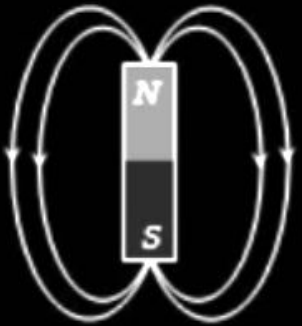
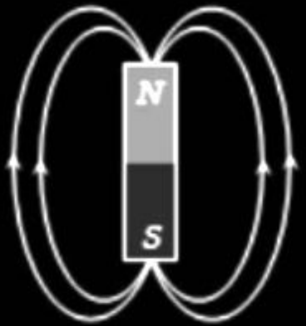
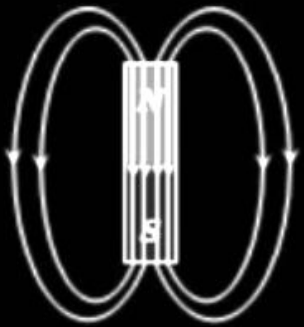


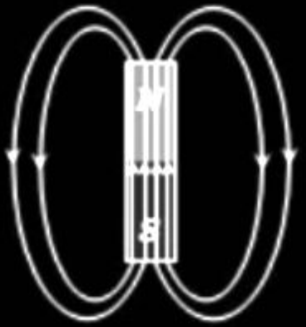
C



B



D



Solution:

Magnetic field lines always starts from north pole and end at south pole outside the magnet and starts from north pole ends at north pole inside the magnet.

The dipole in a uniform magnetic field

$$T = 2\pi\sqrt{\frac{\mathcal{I}}{mB}}$$

or $$B = \frac{4\pi^2 \mathcal{I}}{m T^2}$$

$$\mathcal{I}\frac{d^2\theta}{dt^2} = -mB\,\theta$$

or, $$\frac{d^2\theta}{dt^2} = -\frac{mB}{\mathcal{I}}\theta$$

$$U_m = \int \tau(\theta)d\theta$$

$$= \int mB\sin\theta\, d\theta = -mB\cos\theta$$

$$= -\mathbf{m}.\mathbf{B}$$

Solution:

$m = NiA$ (Which is independent of Magnetic Field)

The electrostatic analog

$$\mathbf{E} \rightarrow \mathbf{B},\ \mathbf{p} \rightarrow \mathbf{m},\ \frac{1}{4\pi\varepsilon_0} \rightarrow \frac{\mu_0}{4\pi}$$

In particular, we can write down the equatorial field ($\mathbf{B}_E$) of a bar magnet at a distance r, for $r >> l$, where l is the size of the magnet:

$$\mathbf{B}_E = -\frac{\mu_0 \mathbf{m}}{4\pi r^3} \tag{5.7}$$

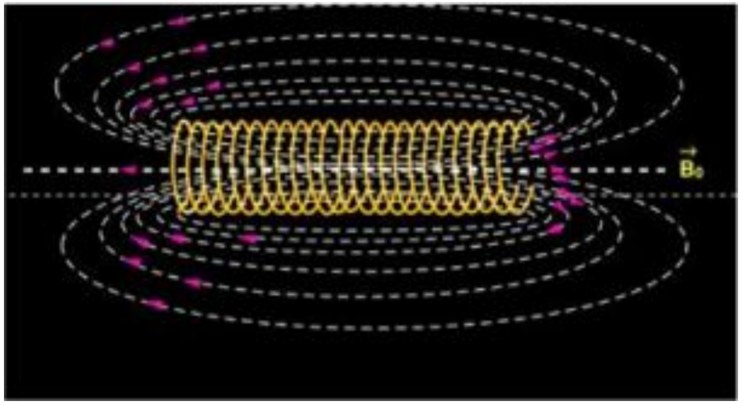
Likewise, the axial field ($\mathbf{B}_A$) of a bar magnet for $r >> l$ is:

$$\mathbf{B}_A = \frac{\mu_0}{4\pi}\frac{2\mathbf{m}}{r^3} \tag{5.8}$$

Equation (5.8) is just Eq. (5.2) in the vector form. Table 5.1 summarises the analogy between electric and magnetic dipoles.

	Electrostatics	Magnetism
	$1/\varepsilon_0$	μ_0
Dipole moment	$\mathbf{p}$	$\mathbf{m}$
Equatorial Field for a short dipole	$-\mathbf{p}/4\pi\varepsilon_0 r^3$	$-\mu_0\,\mathbf{m}\ /\ 4\pi\, r^3$
Axial Field for a short dipole	$2\mathbf{p}/4\pi\varepsilon_0 r^3$	$\mu_0\, 2\mathbf{m}\ /\ 4\pi\, r^3$
External Field: torque	$\mathbf{p} \times \mathbf{E}$	$\mathbf{m} \times \mathbf{B}$
External Field: Energy	$-\mathbf{p}\cdot\mathbf{E}$	$-\mathbf{m}\cdot\mathbf{B}$

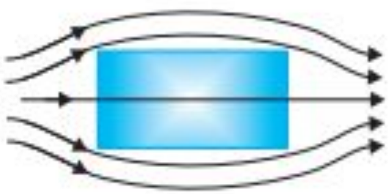
MAGNETISATION AND MAGNETIC INTENSITY

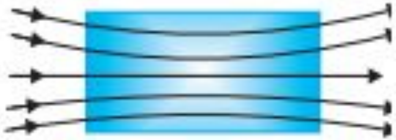


$B = B_0 + B_m$ (in presence of magnetic core)

MAGNETIC PROPERTIES OF MATERIALS

Diamagnetism


(a)


(b)

MAGNETIC PROPERTIES OF MATERIALS

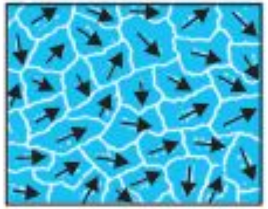
Paramagnetism

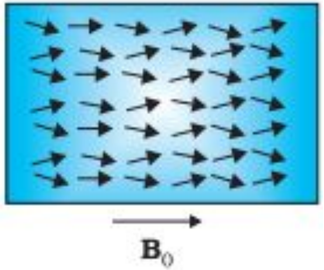
$$M = C\frac{B_0}{T}$$

$$\chi = C\frac{\mu_0}{T}$$

MAGNETIC PROPERTIES OF MATERIALS

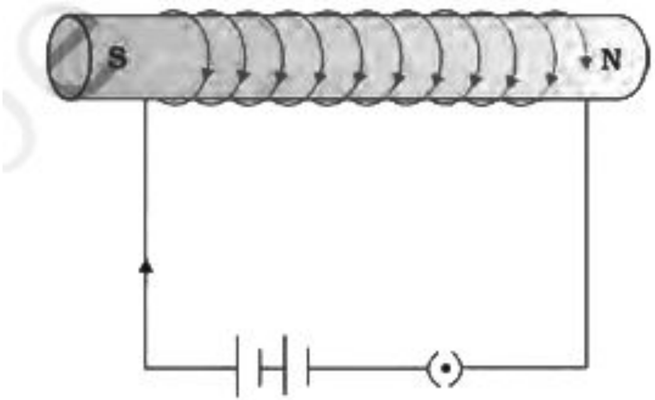
Ferromagnetism


(a)



$$\chi = \frac{C}{T - T_c} \quad (T > T_c)$$

PERMANENT MAGNETS AND ELECTROMAGNETS



Complete

Formulae *Revision*

Magnetism

Magnetism and matter

Magnetic dipole moment

$$\vec{M} = q_m l$$

Potential energy

$$U = -\vec{M} \cdot \vec{B}$$

Work

$$W = MB(\cos\theta_1 - \cos\theta_2)$$

For horizontal and vertical component of earth's magnetic field

$$\frac{B_V}{B_H} = \tan\delta$$

Magnetic intensity is $\vec{H} = \frac{\vec{B}}{\mu_0} = \frac{\vec{B}}{\mu}$

Magnetic Susceptibility $\chi_m = \frac{M}{H}$

Miscellaneous

Q

A coil of ‘N’ turns and radius ‘R’ carries a current ‘I’. It is unwound and rewound to make a square coil of side ‘a’ having same number of turns (N). Keeping the current ‘I’ same, find the ratio of the magnetic moments of the square coil and the circular coil.

3m (2013)

Magnetic moment due to a circular coil,

$$NIA = NI\,(\pi R^2) \qquad \ldots(i)$$

Magnetic moment due to square coil,

$$NIA = NI\left(\frac{2\pi R}{4}\right)^2$$

∵ Circumference of a circle of radius is $2\pi R$, which makes 4 sides of a square

Hence one side of a square $= \frac{2\pi R}{4} = \frac{\pi R}{2}$

$$\text{Ratio} = \frac{(M)_{sq}}{(M)_{cir}} = \frac{\frac{NI(\pi^2 R^2)}{4}}{NI(\pi R^2)}$$

$$= \frac{\pi}{4} = \frac{3.14}{4} = \frac{32}{40} = \frac{4}{5} = \mathbf{4:5} \; [\because 3.14 \approx 3.2$$

Answer

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Thank You Bachha

See you in Next class!