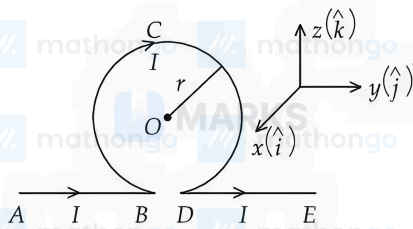


Q1. JEE Main 2026 (21 January Shift 2)

An infinitely long straight wire carrying current I is bent in a planer shape as shown in the diagram. The radius of the circular part is r . The magnetic field at the centre O of the circular loop is :



(1) $-\frac{\mu_0}{2\pi} \frac{I}{r} (\pi - 1) \hat{i}$
 (3) $-\frac{\mu_0}{2\pi} \frac{I}{r} (\pi + 1) \hat{i}$

(2) $\frac{\mu_0}{2\pi} \frac{I}{r} (\pi - 1) \hat{i}$
 (4) $\frac{\mu_0}{2\pi} \frac{I}{r} (\pi + 1) \hat{i}$

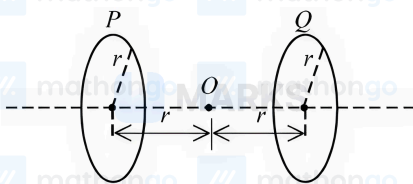
Q2. JEE Main 2026 (28 January Shift 2)

A long cylindrical conductor with large cross section carries an electric current distributed uniformly over its cross-section. Magnetic field due to this current is :

- A. maximum at either ends of the conductor and minimum at the midpoint
- B. maximum at the axis of the conductor
- C. minimum at the surface of the conductor
- D. minimum at the axis of the conductor
- E. same at all points in the cross-section of the conductor

Choose the correct answer from the options given below :

- (1) A, D Only
- (2) D Only
- (3) E Only
- (4) B, C Only

Q3. JEE Main 2026 (24 January Shift 2)

Two identical circular loops P and Q each of radius r are lying in parallel planes such that they have common axis. The current through P and Q are I and $4I$ respectively in clockwise direction as seen from O . The net magnetic field at O is:

(1) $\frac{3\mu_0 I}{4\sqrt{2}r}$ towards Q
 (3) $\frac{3\mu_0 I}{4\sqrt{2}r}$ towards P

(2) $\frac{\mu_0 I}{4\sqrt{2}r}$ towards Q
 (4) $\frac{\mu_0 I}{4\sqrt{2}r}$ towards P

Q4. JEE Main 2026 (23 January Shift 2)

The current passing through a conducting loop in the form of equilateral triangle of side $4\sqrt{3}$ cm is 2 A. The magnetic field at its centroid is $\alpha \times 10^{-5}$ T. The value of α is _____.

(Given : $\mu_0 = 4\pi \times 10^{-7}$ SI units)

- (1) $2\sqrt{3}$ (2) $\frac{\sqrt{3}}{2}$ (3) $3\sqrt{3}$ (4) $\sqrt{3}$

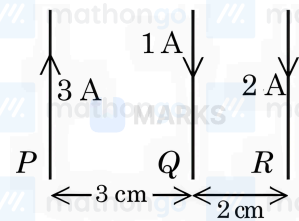
Q5. JEE Main 2026 (21 January Shift 1)

A current carrying solenoid is placed vertically and a particle of mass m with charge Q is released from rest. The particle moves along the axis of solenoid. If g is acceleration due to gravity then the acceleration (a) of the charged particle will satisfy :

- (1) $a > g$ (2) $0 < a < g$
(3) $a = 0$ (4) $a = g$

Q6. JEE Main 2026 (28 January Shift 1)

Three long straight wires carrying current are arranged mutually parallel as shown in the figure. The force experienced by 15 cm length of wire Q is _____.



($\mu_0 = 4\pi \times 10^{-7}$ T.m/A)

- (1) 6×10^{-6} N towards P (2) 6×10^{-7} N towards P
(3) 6×10^{-7} N towards R (4) 6×10^{-6} N towards R

Q7. JEE Main 2026 (28 January Shift 1)

The magnetic field at the centre of a current carrying circular loop of radius R is 16μ T. The magnetic field at a distance $x = \sqrt{3}R$ on its axis from the centre is _____ μ T.

- (1) 4 (2) 2 (3) $2\sqrt{2}$ (4) 8

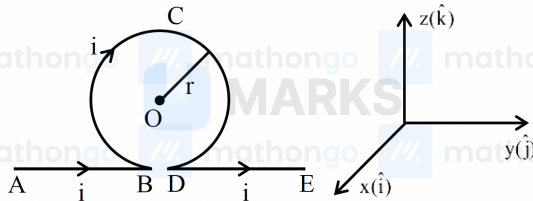
Q8. JEE Main 2026 (24 January Shift 1)

A short bar magnet placed with its axis at 30° with an external field of 800 Gauss, experiences a torque of 0.016 N.m. The work done in moving it from most stable to most unstable position is $\alpha \times 10^{-3}$ J. The value of α is _____.

ANSWERS AND SOLUTIONS

1. (1) 2. (2) 3. (1) 4. (3) 5. (4) 6. (4) 7. (2) 8. 64

1.



(1)

$$\vec{B}_0 = \vec{B}_{AB} + \vec{B}_{DE} + \vec{B}_{BCD}$$

$$= \frac{\mu_0 i}{4\pi} \hat{i} + \frac{\mu_0 i}{4\pi} \hat{i} - \frac{\mu_0 i}{2r} \hat{i}$$

$$= \frac{\mu_0 i}{2\pi} \hat{i} - \frac{\mu_0 i}{2r} \hat{i}$$

$$= \frac{\mu_0 i}{2\pi} (1 - \pi) \hat{i}$$

$$= -\frac{\mu_0 i}{2\pi} (\pi - 1) \hat{i}$$

2. (2) For a long cylindrical conductor with uniform current distribution, apply Ampere's law to find the magnetic field.

At distance r from the axis (inside the conductor, $r < R$): $B(r) = \frac{\mu_0 I r}{2\pi R^2}$ (proportional to r)

At the axis ($r = 0$): $B = 0$ (minimum)

At the surface ($r = R$): $B = \frac{\mu_0 I}{2\pi R}$ (maximum)

Analyzing the statements:

A. Maximum at ends and minimum at midpoint - FALSE. This describes behavior along the axis, but the magnetic field depends on radial distance, not axial position.

B. Maximum at the axis of the conductor - FALSE. The field is zero at the axis.

C. Minimum at the surface of the conductor - FALSE. The field is maximum at the surface.

D. Minimum at the axis of the conductor - TRUE. The field is zero at $r = 0$, making it the minimum.

E. Same at all points in the cross-section - FALSE. The field varies from 0 at the axis to maximum at the surface.

Only D is correct.

3. (1) Two identical circular loops P and Q, each of radius r , are separated by distance r along their common axis.

Current in P is I and in Q is $4I$ (both clockwise as seen from O).

Point O is at the midpoint. The magnetic fields from each loop at O:

$$B_1 = \frac{\mu_0 I R^2}{2(R^2 + R^2)^{3/2}} \text{ (from P, pointing toward Q)}$$

$$B_2 = \frac{4\mu_0 I R^2}{2(R^2 + R^2)^{3/2}} \text{ (from Q, pointing toward P)}$$

$$B_{\text{net}} = B_2 - B_1 = \frac{3\mu_0 I R^2}{2(2R^2)^{3/2}} = \frac{3\mu_0 I}{4\sqrt{2}R}$$

Direction: towards Q.

4. (3) For an equilateral triangle of side a , the distance of the centroid from any side is $r = \frac{a}{2\sqrt{3}}$.

Given side $a = 4\sqrt{3} \text{ cm} = 4\sqrt{3} \times 10^{-2} \text{ m}$.

$$\text{So, } r = \frac{4\sqrt{3} \times 10^{-2}}{2\sqrt{3}} = 2 \times 10^{-2} \text{ m}.$$

The magnetic field at the centroid due to one side of the triangle is $B_1 = \frac{\mu_0 I}{4\pi r} (\sin \theta_1 + \sin \theta_2)$.

For an equilateral triangle, $\theta_1 = \theta_2 = 60^\circ$.

$$B_1 = \frac{10^{-7} \times 2}{2 \times 10^{-2}} (\sin 60^\circ + \sin 60^\circ) = 10^{-5} \times \left(\frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2} \right) = \sqrt{3} \times 10^{-5} \text{ T}.$$

The total magnetic field at the centroid due to all three sides is $B = 3B_1 = 3\sqrt{3} \times 10^{-5} \text{ T}$.

Comparing with $B = \alpha \times 10^{-5} \text{ T}$, we get $\alpha = 3\sqrt{3}$.

5. (4) Inside a solenoid, magnetic field $\vec{B}$ is uniform and parallel to the axis.

Particle moves along the axis, so velocity $\vec{v}$ is parallel to $\vec{B}$.

Magnetic force $\vec{F} = Q(\vec{v} \times \vec{B}) = 0$ (since $\vec{v} \parallel \vec{B}$)

Only gravity acts on the particle.

Acceleration $a = g$

6. (4) The force per unit length between parallel wires is $F/L = \frac{\mu_0 I_1 I_2}{2\pi d}$.

Force on Q from P (opposite currents, repulsive towards R): $\frac{F_{QP}}{L} = \frac{4\pi \times 10^{-7} \times 3 \times 1}{2\pi \times 0.03} = 2 \times 10^{-5} \text{ N/m}$.

Force on Q from R (same currents, attractive towards R): $\frac{F_{QR}}{L} = \frac{4\pi \times 10^{-7} \times 1 \times 2}{2\pi \times 0.02} = 2 \times 10^{-5} \text{ N/m}$.

Total force per unit length towards R: $4 \times 10^{-5} \text{ N/m}$.

For 0.15 m length: $F = 4 \times 10^{-5} \times 0.15 = 6 \times 10^{-6} \text{ N}$ towards R.

7. (2) The magnetic field at the center of a circular loop is $B_{\text{center}} = \frac{\mu_0 I}{2R} = 16\mu \text{ T}$.

On the axis at distance x from center: $B(x) = \frac{\mu_0 I R^2}{2(R^2 + x^2)^{3/2}}$.

$$\text{At } x = \sqrt{3}R: B(\sqrt{3}R) = \frac{\mu_0 I R^2}{2(R^2 + 3R^2)^{3/2}} = \frac{\mu_0 I R^2}{2(4R^2)^{3/2}} = \frac{\mu_0 I}{16R}.$$

$$\text{The ratio: } \frac{B(\sqrt{3}R)}{B_{\text{center}}} = \frac{1/16R}{1/2R} = \frac{1}{8}.$$

$$\text{Therefore: } B(\sqrt{3}R) = \frac{1}{8} \times 16\mu = 2\mu \text{ T}.$$

8. (64) For a magnetic dipole in an external field, torque is $\tau = mB \sin \theta$

$$\text{At } 30^\circ: 0.016 = m \times 0.08 \times \sin 30^\circ$$

$$0.016 = m \times 0.08 \times 0.5$$

$$m = 0.4 \text{ A} \cdot \text{m}^2$$

Work done from most stable (aligned, 0°) to most unstable (anti-aligned, 180°) position equals the change in potential energy:

$$W = U_{0^\circ} - U_{180^\circ} = -mB \cos 0^\circ - (-mB \cos 180^\circ) = -mB - mB = 2mB$$

$$W = 2 \times 0.4 \times 0.08 = 0.064 \text{ J} = 64 \times 10^{-3} \text{ J}$$

Therefore, $\alpha = 64$