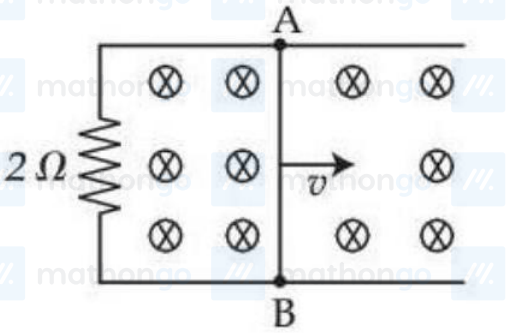
Q1. 21 January Shift 1

A conducting circular loop of area 1.0 m^2 is placed perpendicular to a magnetic field which varies as $B = \sin(100t)$ Tesla. If the resistance of the loop is 100Ω, then the average thermal energy dissipated in the loop in one period is ____ J.

(1) π^2 (2) π (3) $\frac{\pi}{2}$ (4) 2π

Q2. 21 January Shift 1

A 1 m long metal rod AB completes the circuit as shown in figure. The area of circuit is perpendicular to the magnetic field of 0.10 T. If the resistance of the total circuit is 2Ω then the force needed to move the rod towards right with constant speed (v) of 1.5 m/s is ____ N.



(1) 5.7×10^{-2} (2) 7.5×10^{-2} (3) 7.5×10^{-3} (4) 5.7×10^{-3}

Q3. 22 January Shift 1

Three identical coils C_1, C_2 and C_3 are closely placed such that they share a common axis. C_2 is exactly midway. C_1 carries current I in anti-clockwise direction while C_3 carries current I in clockwise direction. An induced current flows through C_2 will be in clockwise direction when

(1) C_1 moves away from C_2 and C_3 moves towards C_2

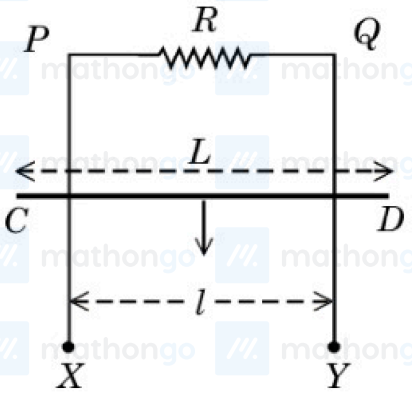
(2) C_1 and C_3 move with equal speeds away from C_2

(3) C_1 moves towards C_2 and C_3 moves away from C_2

(4) C_1 and C_3 move with equal speeds towards C_2

Q4. 22 January Shift 1

$XPQY$ is a vertical smooth long loop having a total resistance R where PX is parallel to QY and separation between them is l. A constant magnetic field B perpendicular to the plane of the loop exists in the entire space. A rod CD of length $L(L > l)$ and mass m is made to slide down from rest under the gravity as shown in figure. The terminal speed acquired by the rod is ____ m/s. (g = acceleration due to gravity)



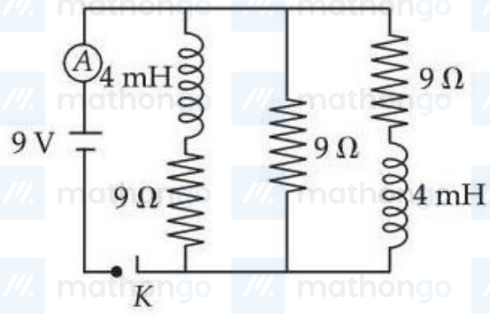
(1) $\frac{8mgR}{B^2l^2}$ (2) $\frac{2mgR}{B^2L^2}$ (3) $\frac{m\,gR}{B^2l^2}$ (4) $\frac{2mgR}{B^2l^2}$

Q5. 22 January Shift 1

Inductance of a coil with 10^4 turns is 10 mH and it is connected to a dc source of 10 V with internal resistance of 10Ω. The energy density in the inductor when the current reaches $\left(\frac{1}{e}\right)$ of its maximum value is $\alpha\pi \times \frac{1}{e^2}$ J/m^3. The value of α is ____. ($\mu_0 = 4\pi \times 10^{-7}$Tm/A).

Q6. 22 January Shift 2

Figure shows the circuit that contains three resistances (9Ω each) and two inductors (4 mH each). The reading of ammeter at the moment switch K is turned ON, is ____ A.



(1) 2 (2) 1 (3) zero (4) 3

Q7. 22 January Shift 2

A conducting circular loop is rotated about its diameter at a constant angular speed of 100rad/s in a magnetic field of 0.5 T perpendicular to the axis of rotation. When the loop is rotated by 30° from the horizontal position, the induced EMF is 15.4 mV. The radius of the loop is ____ mm. (Take $\pi = \frac{22}{7}$)

Q8. 23 January Shift 1

A 20 m long uniform copper wire held horizontally is allowed to fall under the gravity ($g = 10\ \mathrm{m/s^2}$) through a uniform horizontal magnetic field of 0.5 Gauss perpendicular to the length of the wire. The induced EMF across the wire when it travells a vertical distance of 200 m is ____ mV.

(1) $20\sqrt{10}$ (2) $0.2\sqrt{10}$ (3) $200\sqrt{10}$ (4) $2\sqrt{10}$

Q9. 23 January Shift 1

A simple pendulum made of mass 10 g and a metallic wire of length 10 cm is suspended vertically in a uniform magnetic field of 2 T. The magnetic field direction is perpendicular to the plane of oscillations of the pendulum. If the pendulum is released from an angle of 60° with vertical, then maximum induced EMF between the point of suspension and point of oscillation is ____ mV. (Take $\mathrm{g = 10\ m/s^2}$)

Q10. 23 January Shift 2

Suppose a long solenoid of 100 cm length, radius 2 cm having 500 turns per unit length, carries a current $I = 10\sin(\omega \mathrm{t})\mathrm{A}$, where $\omega = 1000\mathrm{rad./s}$. A circular conducting loop (B) of radius 1 cm coaxially slided through the solenoid at a speed $v = 1\ \mathrm{cm/s}$. The r.m.s. current through the loop when the coil B is inserted 10 cm inside the solenoid is $\alpha/\sqrt{2}\mu$ A. The value of α is ____.

[Resistance of the loop $= 10\Omega$]

(1) 197 (2) 80 (3) 100 (4) 280

Q11. 23 January Shift 2

A circular loop of radius 7 cm is placed in uniform magnetic field of 0.2 T directed perpendicular to plane of loop. The loop is converted into a square loop in 0.5 s. The EMF induced in the loop is ____ mV.

(1) 13.2 (2) 1.32 (3) 8.25 (4) 6.6

ANSWER KEYS

1. (2)	**2.** (3)	**3.** (3)	**4.** (3)	**5.** 20	**6.** (2)	**7.** 14	**8.** (2)
9. 100	**10.** (1)	**11.** (2)					