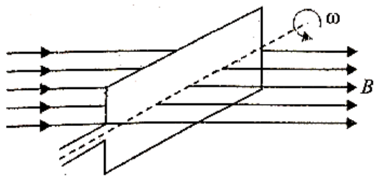
CPP REVISION-2

EMI

FIITJEE
KKP / MYP CENTRE

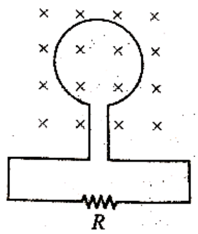
SINGLE CORRECT OPTION TYPE

1. A rectangular coil of single turn, having area A, rotates in a uniform magnetic field B with an angular velocity ω about an axis perpendicular to the field. If initially the plane of the coil is perpendicular to the field, then the average induced emf when it has rotated through 90° is



(A) $\frac{\omega BA}{\pi}$ (B) $\frac{\omega BA}{2\pi}$ (C) $\frac{\omega BA}{4\pi}$ (D) $\frac{2\omega BA}{\pi}$

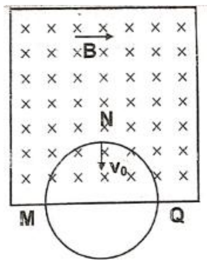
2. In figure, the flux through the loop perpendicular to the plane of the coil and directed into the paper is varying according to the relation $\phi = 6t^2 + 7t + 1$ where ϕ is in milliweber and t is in seconds. The magnitude of the emf inducted in the loop at $t = 2s$ and the direction of induced current through R are



(A) 39 mV; right to left (B) 39 mV; left to right
(C) 31 mV; right to left (D) 31 mV; left to right

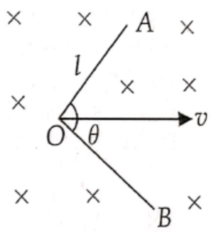
3. Lenz's law is a consequence of the law of conservation of
(A) charge (B) momentum (C) energy (D) mass

4. A thin circular ring of radius R is falling with its plane vertical in a horizontal magnetic induction B. At the position MNQ the speed of ring is v_0. What is the potential difference developed across the ring?



(A) $2Bv_0R$ (B) Bv_0R
(C) $\frac{Bv_0R}{2}$ (D) $\frac{Bv_0R}{4}$

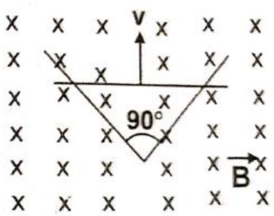
5. A rod AOB of length 2l bent into an angle θ is moved with a velocity v as shown. The potential difference across AB is



(A) $Blv\sin\theta$ (B) $2Blv\sin\left(\frac{\theta}{2}\right)$
(C) $2Bv\sin\theta$ (D) $Blv\sin\left(\frac{\theta}{2}\right)$

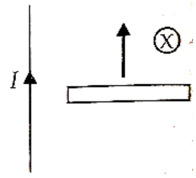
6. A circular metal plate of radius R is rotating with a uniform angular velocity ω with its plane perpendicular to a uniform magnetic field B. Then find the emf developed between the centre and the rim of the plate.
(A) $\frac{\omega BR^2}{2}$ (B) $\frac{2\omega BR^2}{2}$ (C) $\frac{\omega BR^2}{4}$ (D) none of these

7. Two straight conducting rails for a right angle where their ends are joined. A conducting bar in contact with the rails starts at the vertex at time $t = 0$ and moves with constant velocity v along them as shown in figure. A magnetic field $\vec{B}$ is directed into the page. The induced emf in the circuit at any time t is proportional to



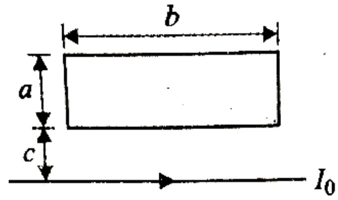
(A) t° (B) t^2 (C) v (D) v^2

8. A copper rod moves with a constant velocity v parallel to a long straight wire carrying a current I. Calculate the induced emf in the rod, if the ends of the rod from the wire are at distances 'a' and 'b'



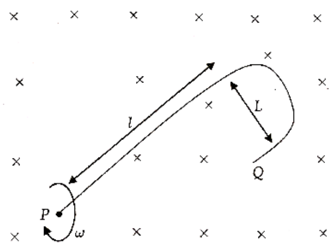
(A) $\frac{\mu_0 Iv}{2\pi}\ln\left(\frac{b}{a}\right)$ (B) $\frac{\mu_0 Iv}{2\pi(b-a)}$ (C) $\frac{\mu_0 Iv(a-b)}{2\pi}$ (D) $\frac{\mu_0 Iv}{2(b-a)}$

9. A rectangular loop of side a and b has a resistance R and lies at a distance 'c' from an infinite straight wire carrying current I_0. The current decreases to zero in time t_0. $I(t)=I_0\left[\frac{t_0-t}{t_0}\right]$. $0<t<t_0$. The charge flowing through the rectangular loop is



(A) $\mu_0 I_0 t_0$ (B) $\mu_0 I_0 \frac{ab}{c^2} t_0$ (C) $\frac{\mu_0 b I_0}{2\pi R}\ell n\left(\frac{a+c}{c}\right)$ (D) $\frac{\mu_0 I_0 t_0}{R}\ell n\left(\frac{ab}{c^2}\right)$

10. When a 'J' shaped conducting rod is rotating in its own plane with constant angular velocity ω, about one of its ends P, in a uniform magnetic field B as shown then the magnitude of induced emf across it will be



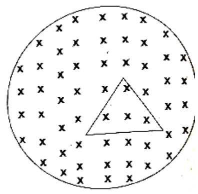
(A) $B\omega\sqrt{L^2+l^2}$ (B) $\frac{1}{2}B\omega L^2$

(C) $\frac{1}{2}B\omega\left(L^2+l^2\right)$ (D) $\frac{1}{2}B\omega l^2$

11. A coil having n turns and resistance $R\,\Omega$ is connected with a galvanometer of resistance $4R\,\Omega$. This combination is moved in time t seconds from a magnetic field W_1 and weber to W_2 weber. The induced current in the circuit is

(A) $-\frac{(W_2-W_1)}{5Rnt}$ (B) $-\frac{(W_2-W_1)}{Rnt}$ (C) $-\frac{n(W_2-W_1)}{5Rt}$ (D) $-\frac{n(W_2-W_1)}{Rt}$

12. An equilibrium triangular loop having a resistance R and length of each side l is placed in a magnetic field which is varying at $\frac{dB}{dt}=1\,T/s$. The induced current in the loop will be

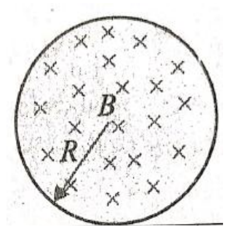


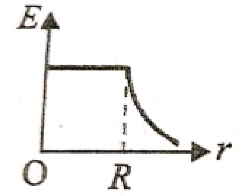
(A) $\frac{\sqrt{3}}{4}\frac{l^2}{R}$ (B) $\frac{4}{\sqrt{3}}\frac{l^2}{R}$ (C) $\frac{\sqrt{3}}{4}\frac{R}{l^2}$ (D) $\frac{4}{\sqrt{3}}\frac{R}{l^2}$

13. The magnetic field in a region is given by $\vec{B}=\frac{B_0}{L}y(\hat{k})$ where L is a fixed length. A conducting rod of length L lies along the Y-axis between the origin and the point $(0,L,0)$. If the rod moves with a velocity $v=v_0\vec{i}$, find the emf induced between the ends of the rod.

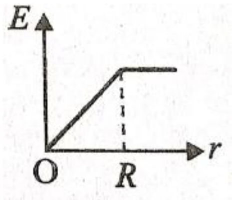
(A) $\frac{B_0 v_0 \ell}{2}$ (B) $B_0 v_0 \ell$ (C) $\frac{B_0 v_0 \ell}{4}$ (D) $\frac{B_0 v_0 \ell}{6}$

14. A uniform magnetic field is confined in a cylindrical region of radius R. Induction of magnetic field is increasing at a constant rate $\frac{dB}{dt} = \alpha$. Strength of induced electric field (E) varies with distance r from the axis of cylindrical region as

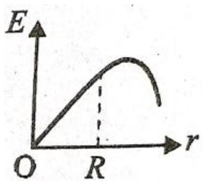




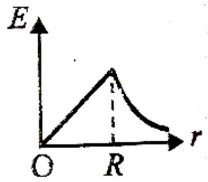
(A)



(B)



(C)



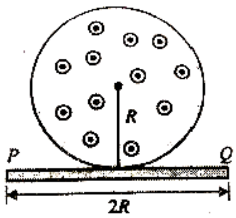
(D)

15. In a region space, magnetic field exists in a cylindrical region of radius a centered at origin with magnetic field along negative z-direction. The field is given by $\vec{B} = -B_0 t\hat{k}$. The force experienced by a stationary charge q placed at $(r,0,0)$, where $r > a$, is

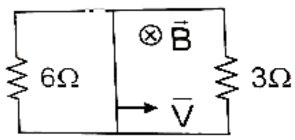
(A) qB_0 (B) $\frac{qB_0a^2}{2r}$ (C) $\frac{qB_0r}{2}$ (D) zero

16. Magnetic field in a cylindrical region is given by $B = \alpha t$. Find emf across rod PQ as shown in figure.

(A) αR^3 (B) $\pi\alpha R^2$
(C) $\frac{\pi}{2}\alpha R^2$ (D) $\frac{\pi}{4}\alpha R^2$

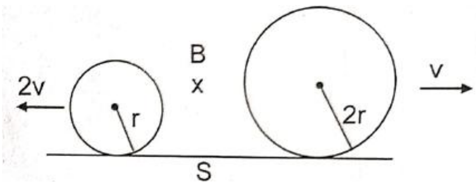


17. A rectangular loop with a sliding connector of length $\ell = 1.0\text{m}$ is situated in a uniform magnetic field $B = 2T$ perpendicular to the plane of loop. Resistance of connector is $r = 2\Omega$. Two resistance of 6Ω and 3Ω are connected as shown in figure. Find the external force (N) required to keep the connector moving with a constant velocity $v = 2\text{m/s}$.



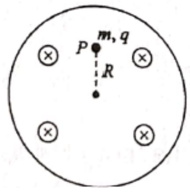
(A) 4 (B) 3 (C) 2 (D) 1

18. Two conducting rings of radii r and 2r move in opposite directions with velocities 2v and v respectively on a conducting surface S. There is a uniform magnetic field of magnitude B perpendicular to the plane of the rings. The potential difference between the highest points of the two rings is



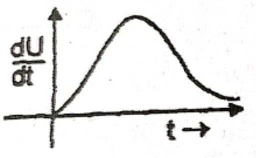
(A) zero (B) 2rvB (C) 4rvB (D) 8rvB

19. A charge q of mass m is lying in a cylindrical region of magnetic field at point P. If magnetic field in the region is given by B and P is at distance R from centre of region, find speed of charge if the magnetic field is suddenly switched off

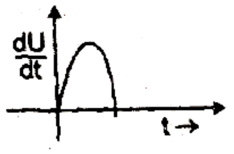


(A) $\frac{qRB}{m}$ (B) $\frac{2qRB}{3m}$ (C) $\frac{qRB}{2m}$ (D) $\frac{qRB}{3m}$

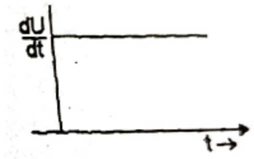
20. Rate of increment of energy in an inductor with time in series LR circuit getting charge with battery of e.m.f. E is best represented by: [inductor has initially zero current]



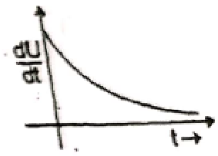
(A)



(B)



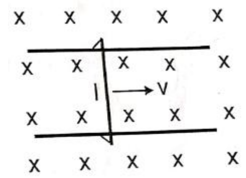
(C)



(D)

NUMERICAL BASED

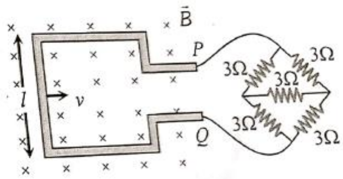
21. Figure shows a wire resistance R sliding on two parallel conducting rails placed at a separation ℓ. A magnetic field B exists in a direction perpendicular to the plane of the rails. Force is necessary to keep the wire moving at a constant velocity v is



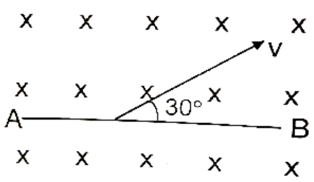
22. A metallic metre stick moves with a velocity of 2 m/s in a direction perpendicular to its length and perpendicular to a uniform magnetic field of magnitude 0.2 T. Find the emf induced between the ends of the stick.

23. A conducting circular loop is placed in a uniform magnetic field of 0.02 T, with its plane perpendicular to the field. If the radius of the loop starts shrinking at a constant rate of 1.0 mm/s, then find the emf induced in the loop, at the instant when the radius is 4 cm. (in millivolts)

24. A square metallic wire loop of side 0.1 m and resistance of 1Ω is moved with a constant velocity in a magnetic field of $2\ \text{wb/m}^2$ as shown in figure. The magnetic field is perpendicular to the plane of the loop, loop is connected to a network of resistances. What should be the velocity of loop so as to have a steady current of 1 mA in loop (in cm/sec)



25. A conducting rod AB of length $\ell = 1\text{m}$ is moving at a velocity $v = 4\text{m/s}$ making an angle $30°$ with its length. A uniform magnetic field $B = 2\text{T}$ exists in a direction perpendicular to the plane of motion. Then $v_A - v_B =$



KEY

1.	D	**2.**	D	**3.**	C	**4.**	A	**5.**	B
6.	A	**7.**	D	**8.**	A	**9.**	C	**10.**	C
11.	C	**12.**	A	**13.**	D	**14.**	D	**15.**	C
16.	D	**17.**	C	**18.**	A	**19.**	B	**20.**	A
21.	0	**22.**	0.4	**23.**	5	**24.**	2	**25.**	4

❉ *Wish You all the Best* ❉