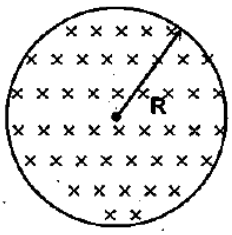
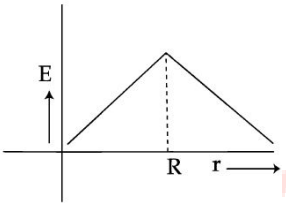
PHYSICS

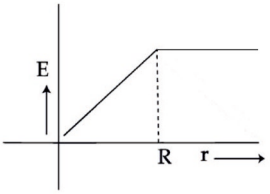
21. Figure shows a circular area of radius R where a uniform magnetic field $\vec{B}$ is going into the plane of paper and increasing in magnitude at a constant rate.

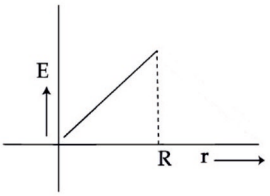


In that case, which of the following graphs, drawn schematically, correctly shows the variation of the induced electric field E(r)?

(1)


(2)


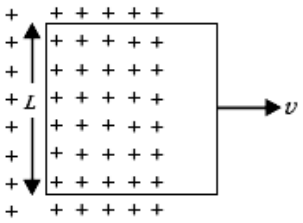
(3)


(4)


22. A coil is suspended in a uniform magnetic field, with the plane of the coil parallel to the magnetic lines of force. When a current is passed through the coil it starts oscillating. It is very difficult to stop. But if an aluminium plate is placed near to the coil, it stops. This is due to
    (1) development of air current when the plate is placed
    (2) induction of electrical charge on the plate
    (3) shielding of magnetic lines of force as aluminium is a paramagnetic material
    (4) electromagnetic induction in the aluminium plate giving rise to electromagnetic damping

23. Two coaxial solenoids are made by winding thin insulated wire over a pipe of cross-sectional area A = 10 cm^2 and length = 20 cm. If one of the solenoid has 300 turns and the other 400 turns, their mutual inductance is
    ($\mu_0 = 4\pi \times 10^{-7}$ Tm A^{-1})
    (1) $2.4\pi \times 10^{-5}$ H
    (2) $4.8\pi \times 10^{-4}$ H
    (3) $4.8\pi \times 10^{-5}$ H
    (4) $2.4\pi \times 10^{-4}$ H

24. A conducting square loop of side L and resistance R moves in its plane with a uniform velocity v perpendicular to one of its sides. A magnetic induction B constant in time and space, pointing perpendicular and into the plane at the loop exists everywhere with half the loop exists everywhere with half the loop outside the field, as shown in figure. The induced emf is



    (1) Zero
    (2) RvB
    (3) $\frac{vBL}{R}$
    (4) vBL

25. In an a.c circuit the voltage applied is E = E_0 sin ωt. The resulting current in the circuit $I = I_0 \sin\left(\omega t - \frac{\pi}{2}\right)$. The power consumption in the circuit is given by
    (1) $P = \sqrt{2}E_0I_0$
    (2) $P = \frac{E_0I_0}{\sqrt{2}}$
    (3) P = zero
    (4) $P = \frac{E_0I_0}{2}$

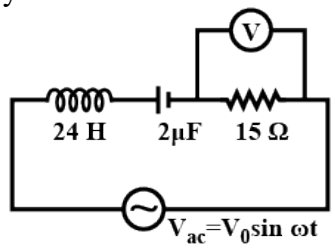
26. When resonance is produced in a series LCR circuit, then which of the following is not correct?
    (1) Current in the circuit is in phase with the applied voltage.

(2) Inductive and capacitive reactances are equal

(3) If R is reduced, the voltage across capacitor will increase.

(4) Impedance of the circuit is maximum

27. An LCR circuit as shown in the figure is connected to a voltage source V_{ac} whose frequency can be varied.

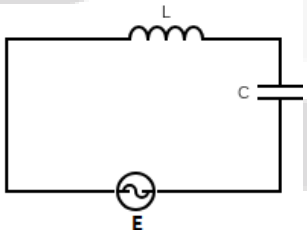


The frequency, at which the voltage across the resistor is maximum, is

(1) 902 Hz (2) 143 Hz

(3) 23 Hz (4) 345 Hz

28. In the circuit shown here, the voltage across E and C are respectively 300 V and 400 V. The voltage E of the ac source is



(1) 400 V

(2) 500 V

(3) 100 V

(4) 700 V

29. A fully charged capacitor C with initial charge q_0 is connected to a coil of self inductance L at t = 0. The time at which the energy is stored equally between the electric and the magnetic fields is

(1) $\frac{\pi}{4}\sqrt{LC}$ (2) $2\pi\sqrt{LC}$

(3) $\sqrt{LC}$ (4) $\pi\sqrt{LC}$

30. In an AC generator, a coil with N turns, all of the same area A and total resistance R, rotates with frequency ω in a magnetic field B. The maximum value of emf generated in the coil is

(1) NABRω (2) NAB

(3) NABR (4) NABω