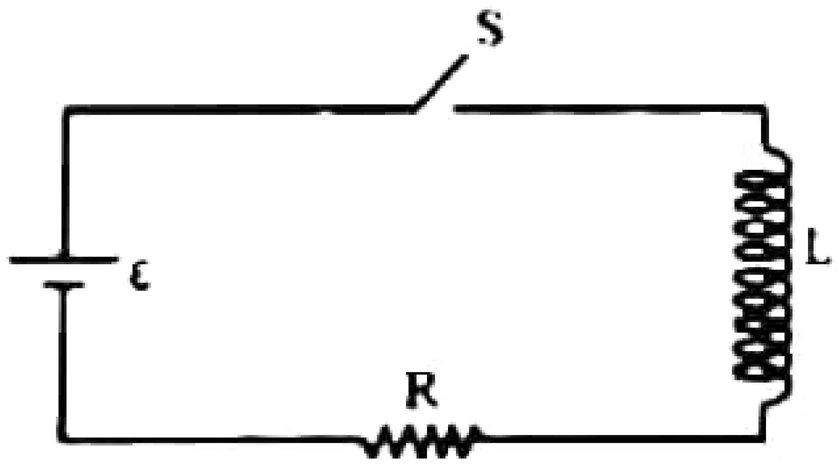
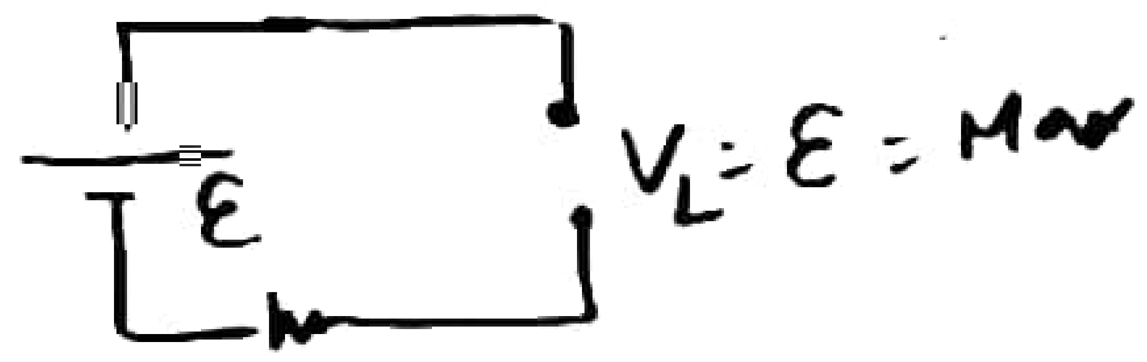
1.

Statement-1: In the figure, just after closing the switch the potential drop across inductor is maximum. Correct





Statement-2: The rate of change of current just after closing the switch is maximum.

$\frac{dI}{dt} = \frac{I_0}{\tau} e^{-t/\tau}$

at $t = 0$

$\frac{dI}{dt} = Max$

(A) Both Statements are correct.

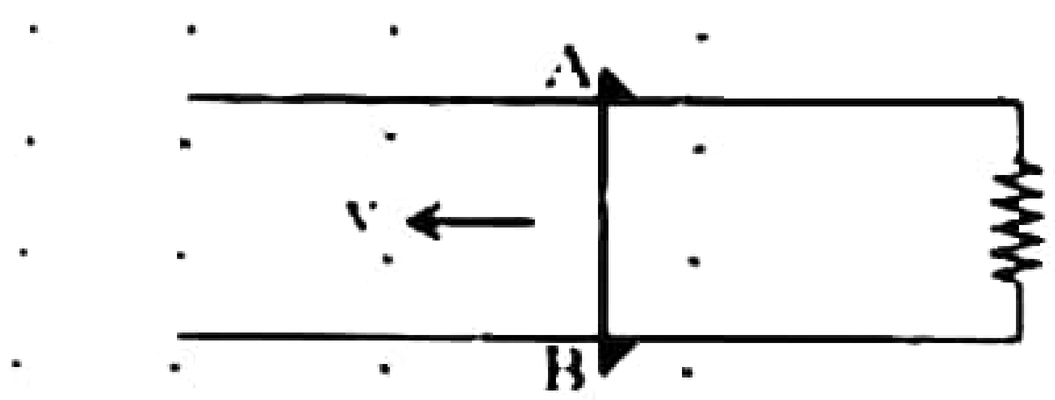
(B) Statement-1 is correct & Statement-2 is incorrect.

(C) Statement-1 is incorrect & Statement-2 is correct.

(D) Both Statements are incorrect.

2.

Consider the situation shown in figure. The wire AB is slid on the fixed rails with constant velocity v. If the wire AB is replaced by a semicircular wire, the magnitude of the induced current will-



(A) increase

(B) remain the same

(C) decrease

(D) increase or decrease depending on whether the semicircle bulges towards the resistance or away from it

3.

Consider the following statements-

(a) An emf can be induced by moving a conductor in a magnetic field.

(b) An emf can be induced by changing the magnetic field.

(A) Both a and b are true

(B) a is true but b is false

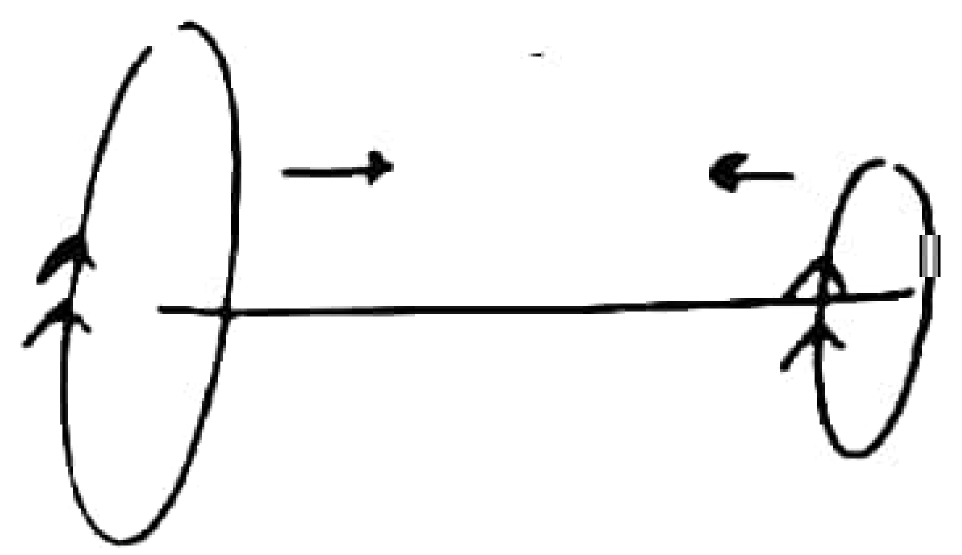
(C) b is true but a is false

(D) Both a and b are false

4.
Two circular coils A and B are facing each other as shown in figure. The current 'i' through A can be altered

(A) there will be repulsion between A and B if i is increased
(B) there will be attraction between A and B if i is increased
(C) there will be neither attraction nor repulsion when i is changed
(D) attraction or repulsion between A and B depends on the direction of current, it does not depend whether the current is increased or decreased

5.
Two identical coaxial circular loops carry a current i each circulating in the same direction. If the loops approach each other-
(A) the current in each loop will decrease
(B) the current in each loop will increase
(C) the current in each loop will remain the same
(D) the current in one loop will increase and in the other loop will decrease

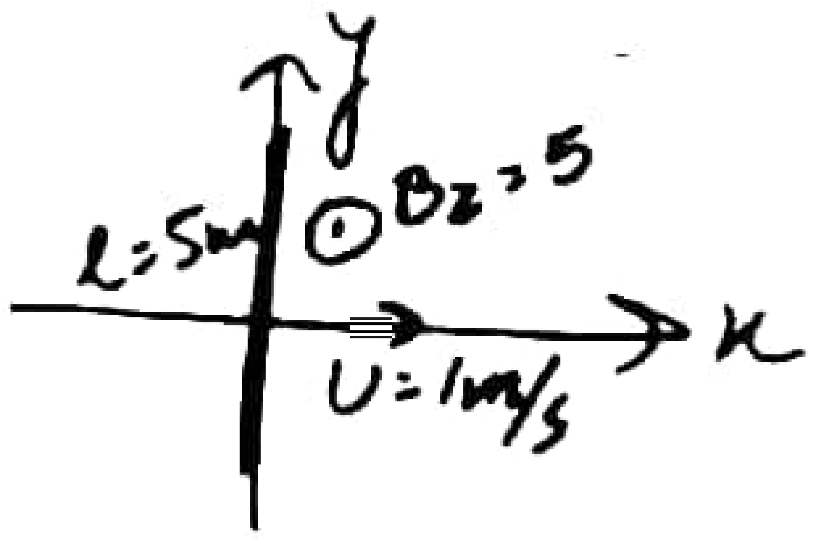


6.

A uniform magnetic field exists in region given by $\vec{B} = 3\hat{i} + 4\hat{j} + 5\hat{k}$. A rod of length 5 m is placed along y-axis is moved along x-axis with constant speed 1 m/sec. Then induced e.m.f. in the rod will be-

(A) zero (B*) 25 volt (C) 20 volt (D) 15 volt

$\vec{B} = 3\hat{i} + 4\hat{j} + 5\hat{k}$



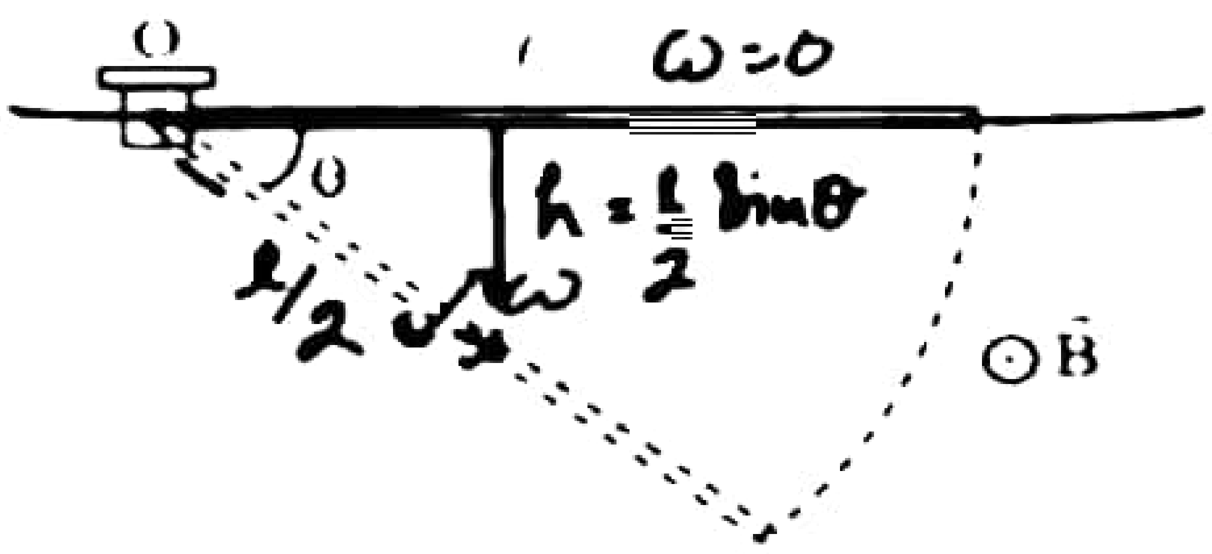
$\mathcal{E} = Blv$

$= 5 \times 5 \times 1$

$= 25 V$

7.

A conducting rod of length l is hinged at point O. It is free to rotate in a vertical plane. The rod is released from the position shown. The potential difference between the two ends of the rod is proportional to-



(A) $l^{3/2}$ (B) l^2 (C) $\sin\theta$ (D*) $(\sin\theta)^{1/2}$

$K_i + U_i = K_f + U_f$

$0 + 0 = \frac{1}{2} \times \frac{1}{3} ml^2\omega^2 - mg\frac{l}{2}\sin\theta$

$\omega^2 = \frac{3g\sin\theta}{l}$

$\omega = \sqrt{\frac{3g\sin\theta}{l}}$

$\mathcal{E} = \frac{1}{2} Bl^2 \times \sqrt{\frac{3g\sin\theta}{l}}$

$\mathcal{E} \propto (\sin\theta)^{1/2}$

8.

Two coils A and B have coefficient of mutual inductance M = 2H. The magnetic flux passing through coil A change by 4 Weber in 10 seconds due to the change in current in B. Then-

(A) change in current in B in this time interval is 0.5 A

(B) the change in current in B in this time interval is 2A

(C) the change in current in B in this time interval is 8 A

(D) a change in current of 1 A in coil A will produce a change in flux passing through B by 4 Weber

$M = 2H$

A: $\Delta\phi_A = 4\,Wb$, $\Delta t = 10\,sec.$

B: $\frac{\Delta I_B}{\Delta t}$

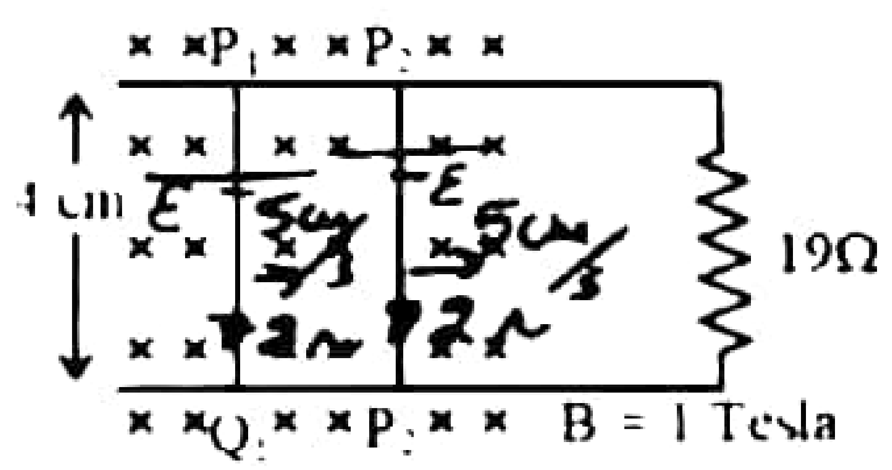
$\Delta\phi_A = M \cdot \Delta I_B$

$4 = 2 \times \Delta I_B$

$\boxed{\Delta I_B = 2A}$

9.

In figure wires P_1Q_1 and P_2Q_2, both are moving towards right with speed 5 cm/sec. Resistance of each wire is 2Ω. Then current through 19Ω resistor is –



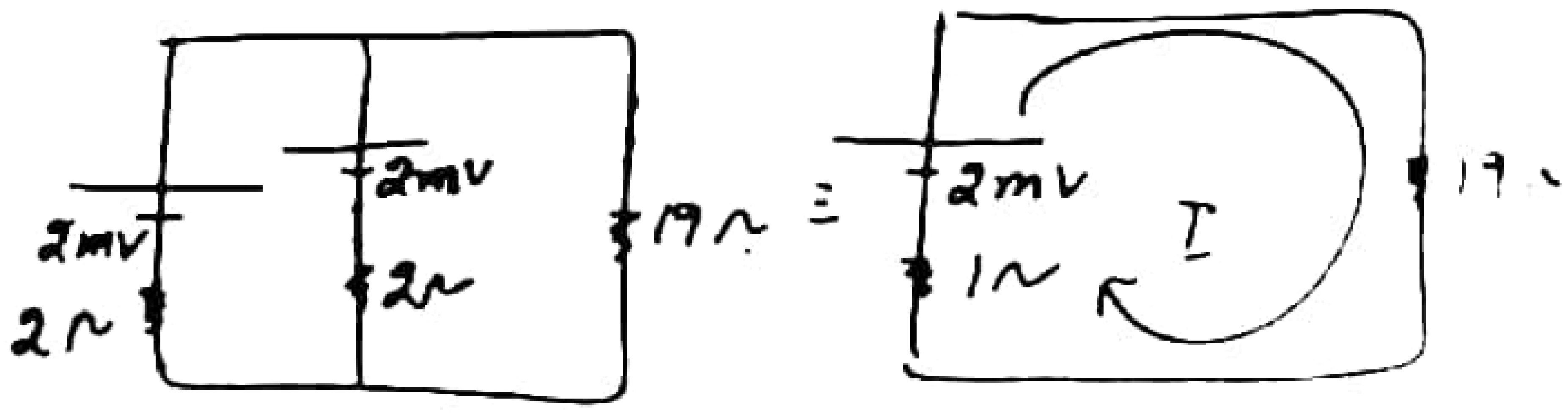
(A) (B) 0.1 mA (C) 0.2 mA (D) 0.3 mA

$\mathcal{E} = Blv$

$= 1 \times 4\,cm \times 5\,cm/s$

$= 20 \times 10^{-4}\,V$

$= 2\,mV$

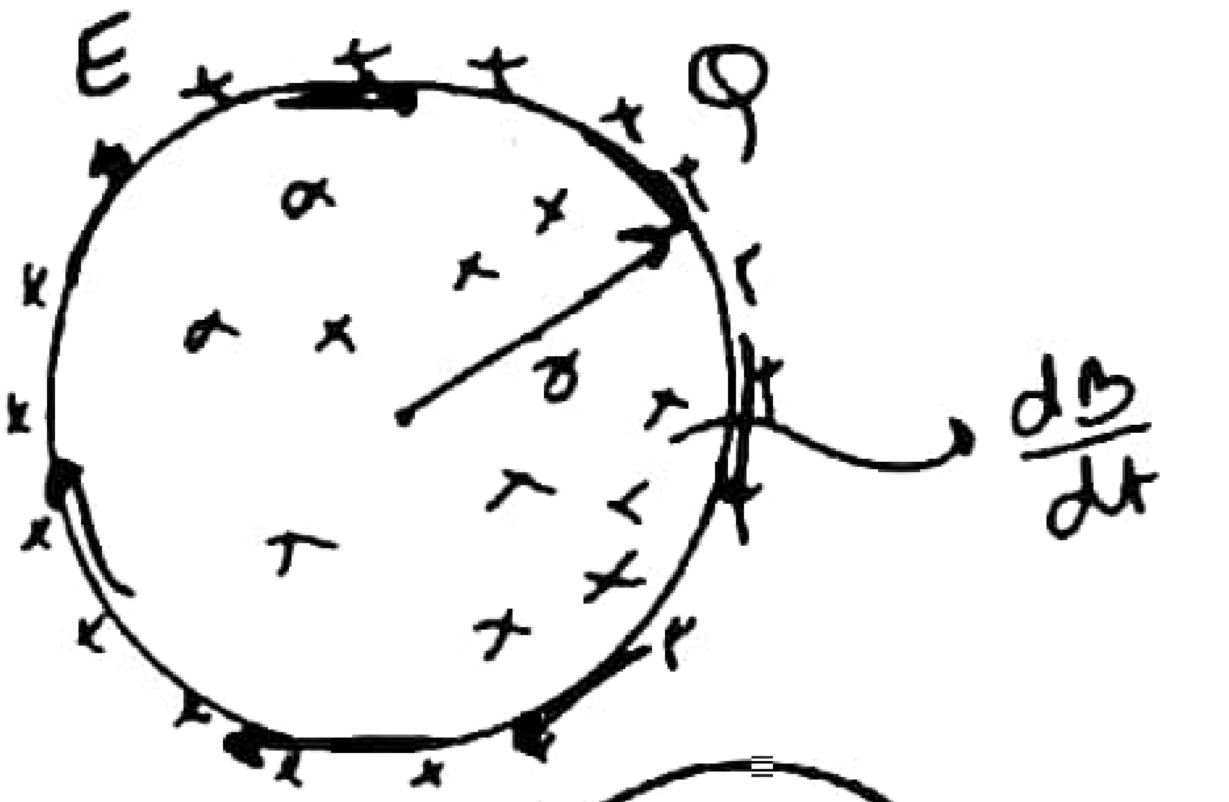


$I = \frac{V}{R} = \frac{2\,mV}{20\,\Omega} = 0.1\,mA$

10.

A non conducting ring of radius r has a charge Q. A magnetic field perpendicular to the plane of the ring changes at the rate $\frac{dB}{dt}$. The torque experienced by the ring is-

(A) zero (B) $Qr^2 \frac{dB}{dt}$ (C) $\frac{1}{2} Qr^2 \frac{dB}{dt}$ (D) $\pi r^2 Q \frac{dB}{dt}$



$\tau = QEr$

$E = \frac{A}{l}\frac{d\phi}{dt} = \frac{\pi r^2}{2\pi r}\frac{d\phi}{dt} = \frac{r}{2}\frac{d\phi}{dt}$

$\tau = Q\frac{r}{2}\frac{dB}{dt}\cdot r = \frac{Q r^2}{2}\frac{dB}{dt}$

11.

A metal rod moves at a constant velocity in a direction perpendicular to its length. A constant, uniform magnetic field exists in space in a direction perpendicular to the rod as well as its velocity. Select the correct statement (s) from the following

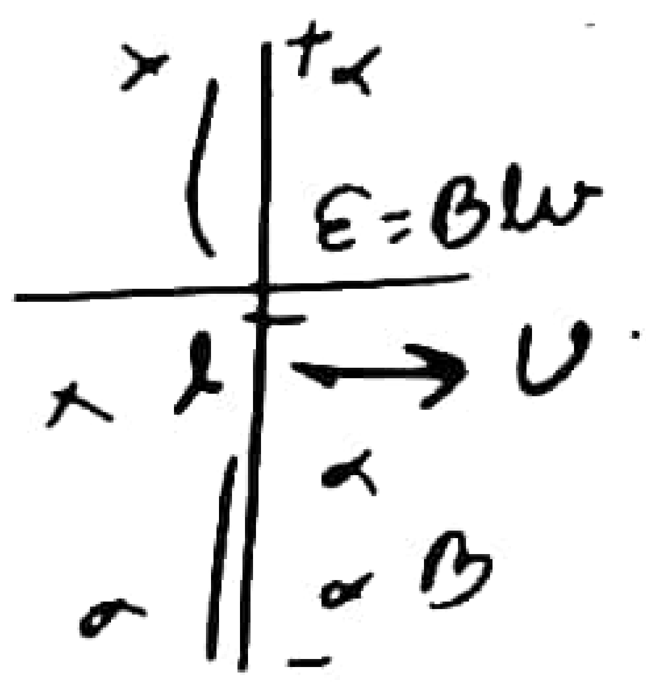
(A) The entire rod is at the same electric potential ✗

(B*) There is an electric field in the rod. ✓

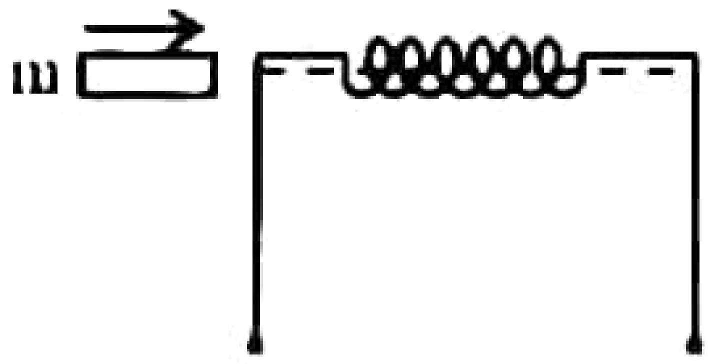
(C) The electric potential is highest at the centre of the rod and decreases towards its ends ✗

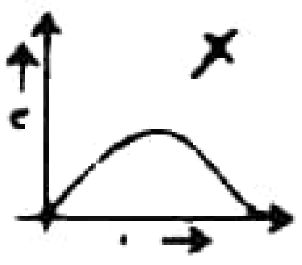
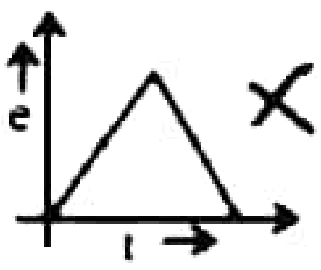
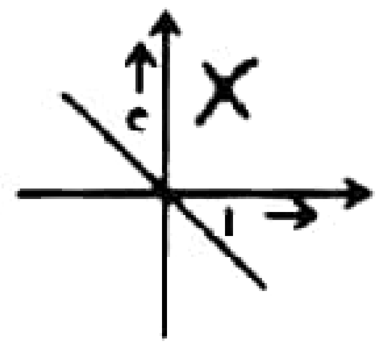
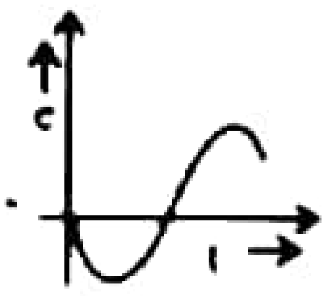
(D) The electric potential is lowest at the centre of the rod, and increases towards its ends ✗

Sol



12.
A small magnet is moving with constant velocity along the axis of a coil as shown in the figure. Then correct graph between induced emf and time is –



(A)  (B)  (C)  (D) 

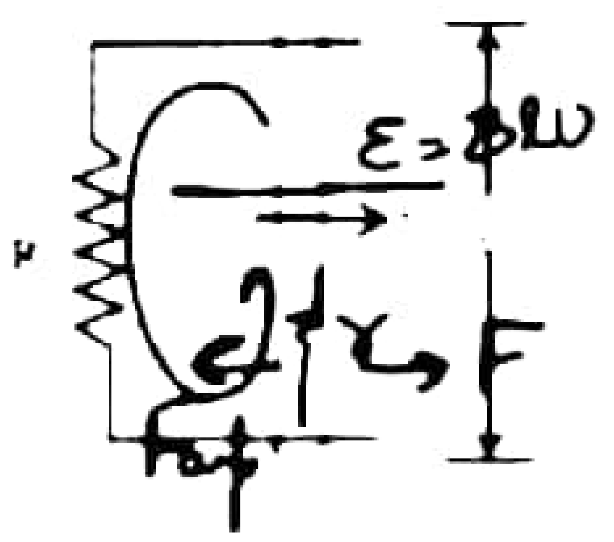
13.
A thin circular ring of area A is held perpendicular to a uniform magnetic field of induction B. A small cut is made in ring and a galvanometer is connected across the ends such that total resistance of the circuit is R. When the ring is suddenly squeezed to zero area, the charge flowing through the galvanometer is -

(A) $\frac{BR}{A}$ (B) $\frac{AB}{R}$ (C) ABR (D) $\frac{B^2A}{R^2}$

$q_{flown} = \frac{\Delta\phi}{R} = \frac{BA - 0}{R}$

$= \frac{BA}{R}$

14.
[illegible] rod of resistance r moves uniformly with a constant speed v. If the rod keep moving uniformly, then the amount of force required is –



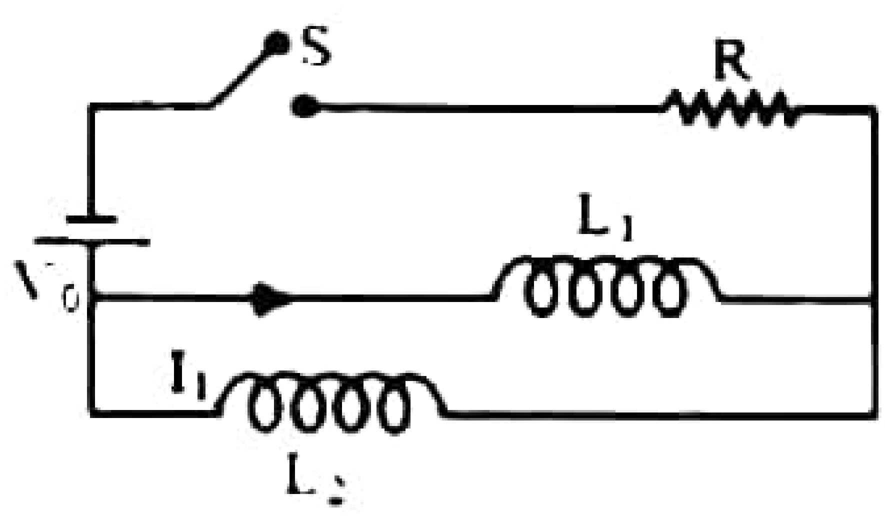
(A) [illegible] (B) [illegible] (C) [illegible] (D) zero

$$I = \frac{B\ell v}{R+r}$$

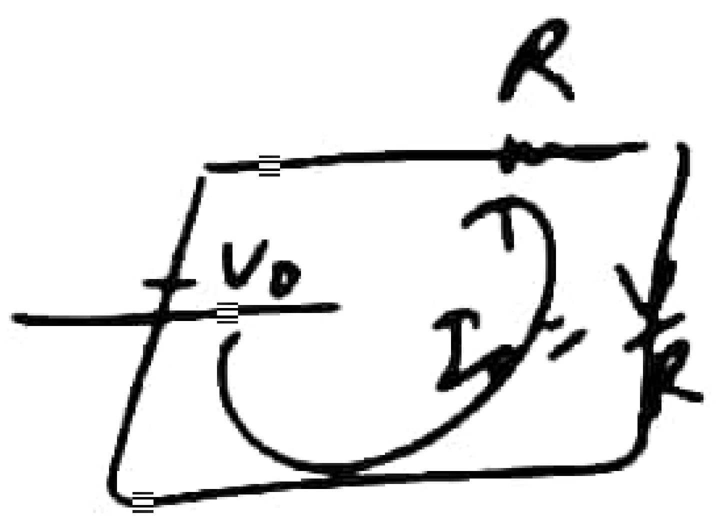
$$F_{mf} = BI\ell = \frac{B^2\ell^2 v}{(R+r)}$$

$$F = F_{mf} = \frac{B^2\ell^2 v}{(R+r)}$$

15.
Find the steady state current through L_1 in the Fig. –



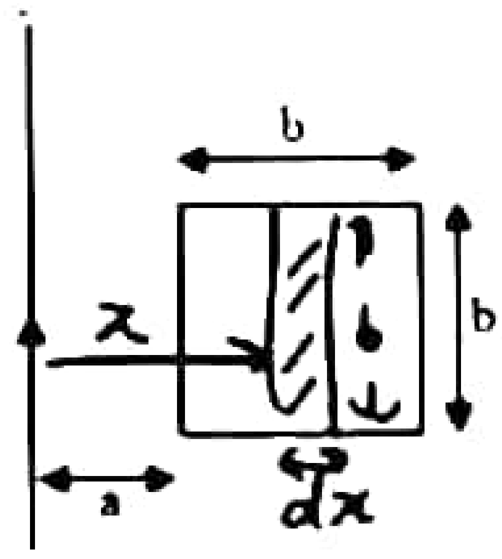
(A) $\frac{V}{R}$ (B) $\frac{V_0 L_1}{R(L_1 + L_2)}$ (C) $\frac{V_0 L_2}{R(L_1 + L_2)}$ (D) None of these



$$I_1 = \frac{L_2}{L_1+L_2} \times I_0 = \left(\frac{L_2}{L_1+L_2}\right)\frac{V_0}{R}$$

16.

Mutual inductance in Fig. shown is –



(A) Zero (B) $\frac{\mu_0 b}{2\pi}\log_e \frac{a}{b}$ (C) $\frac{\mu_0 b}{2\pi}\log_e\left(1+\frac{b}{a}\right)$ (D) $\frac{\mu_0 b}{2\pi}\log_e\left(1+\frac{a}{b}\right)$

$d\phi = B\,dA$

$\int d\phi = \int_a^{a+b} \frac{\mu_0}{4\pi}\frac{2I}{x}\, b\,dx$

$\phi = \frac{\mu_0 I b}{2\pi}\int_a^{a+b}\frac{dx}{x}$

$\phi = \frac{\mu_0 I b}{2\pi}\log_e\left(\frac{a+b}{a}\right) = MI$

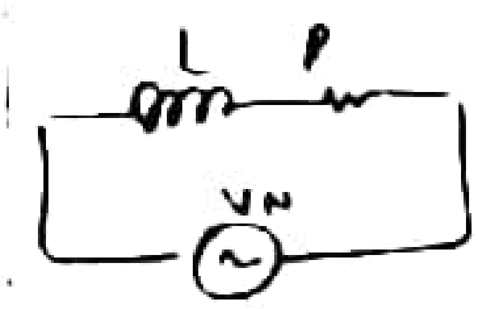
$M = \frac{\mu_0 b}{2\pi}\log\left(1+\frac{b}{a}\right)$

17.

Match the Column:

	Column-I		Column-II
(A)	To increase current in a series RL circuit P, S	(P)	decrease R
(B)	To increase phase angle in a series RL circuit P, R	(Q)	increase R
(C)	To decrease the phase angle in a series RL circuit Q, S	(R)	Increase frequency
(D)	To decrease the current in a series RL circuit Q, R	(S)	Decrease frequency

(A) A → P, S; B → P, R; C → Q, S; D → Q, R
(B) A → P, S; B → Q, R; C → Q, S; D → P, R
(C) A → Q, S; B → P; C → R, S; D → P
(D) A → R, S; B → P; C → Q, R; D → S



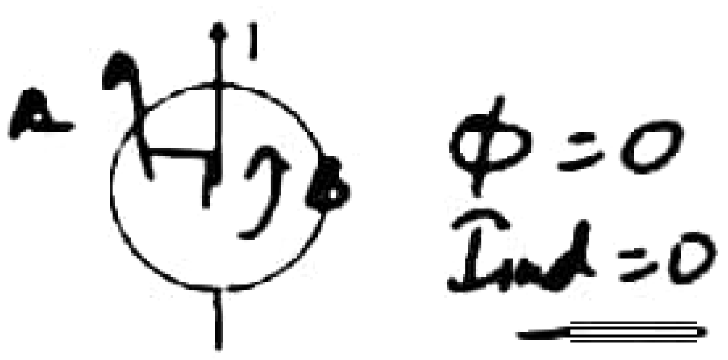
$I = \frac{V_N}{\sqrt{R^2+(\omega L)^2}}$ I↑) R↓, ω↓; I↓) R↑, f↑

$\tan\Delta\phi = \frac{X_L}{R} = \frac{\omega L}{R}$

$\tan\Delta\phi(\uparrow)$ ω↑) R↓)

18.

A wire carrying current I, lie on the axis of a conducting ring. The direction of the induced current in the ring, when I is decreasing at a steady rate is-



(A) clockwise

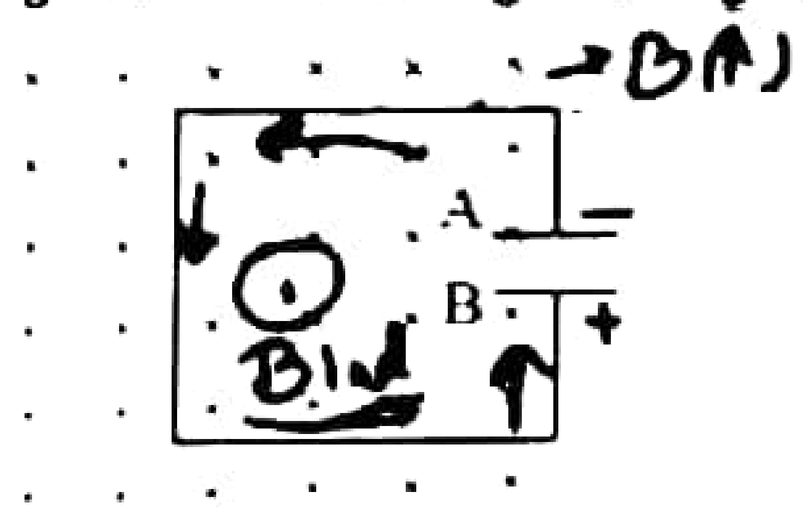
(B) anticlockwise

(C) alternatively clock and anticlockwise

(D) no induced current flow in the ring

19.

A magnetic field is directed normally downwards through a metallic frame as shown in the figure. On increasing the magnetic field-



(A) plate B will be positively charged

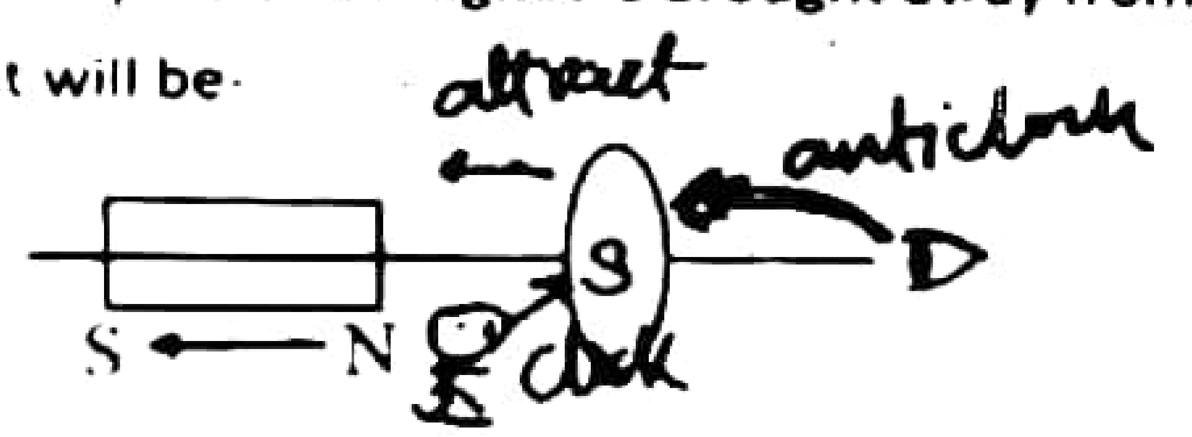
(B) plate A will be positively charged

(C) none of the plates will be positively charged

(D) all of the above

20.

The north pole of a magnet is brought away from a coil, then the direction of induced current will be-



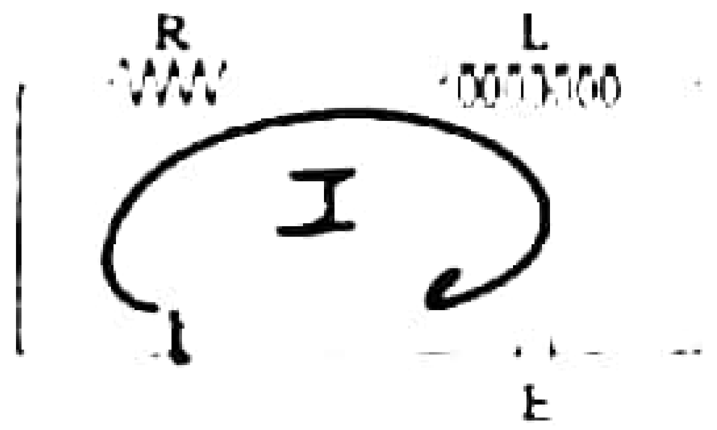
(A) in the clockwise direction

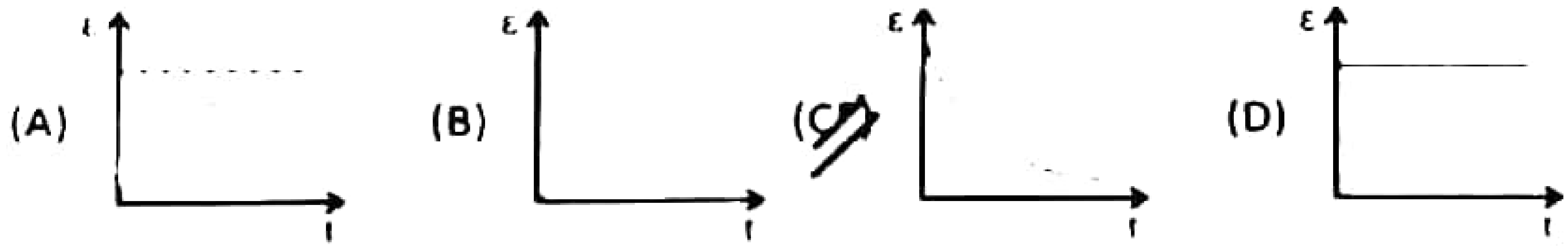
(B) in the anticlockwise direction

(C) initially in the clockwise and then anticlockwise direction

(D) initially in the anticlockwise and then clockwise direction.

21.
Plot the variation of emf across the inductor with respect time-



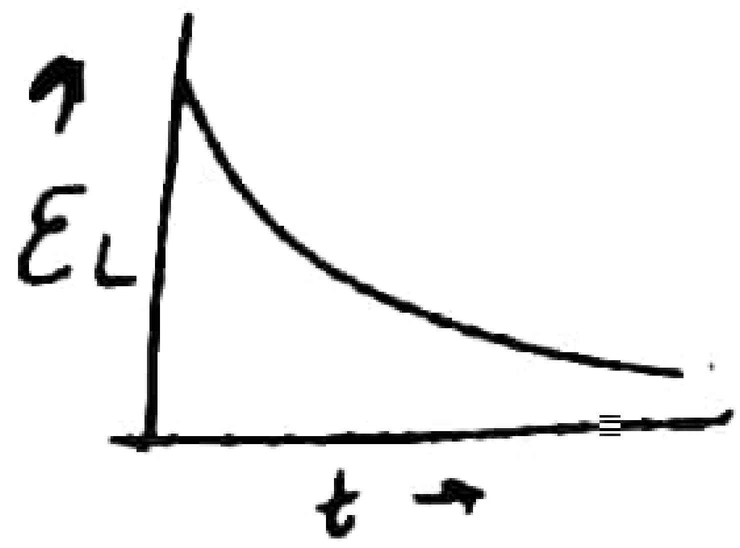


$$I = I_0(1 - e^{-t/\tau})$$

$$\mathcal{E}_L = \left(\frac{I_0 L}{\tau}\right) e^{-t/\tau}$$

$$\mathcal{E}_L = L\frac{dI}{dt}$$

$$\mathcal{E}_L = I_0 L \left(0 + \frac{1}{\tau} e^{-t/\tau}\right)$$



22.
In an inductor of self-inductance L=2 mH, current changes with time according to relation- $I = t^2 e^{-t}$

At what time e.m.f. is zero ?

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

Sol^n $\mathcal{E}_L = L\frac{dI}{dt} = 0$

$$\frac{dI}{dt} = 0$$

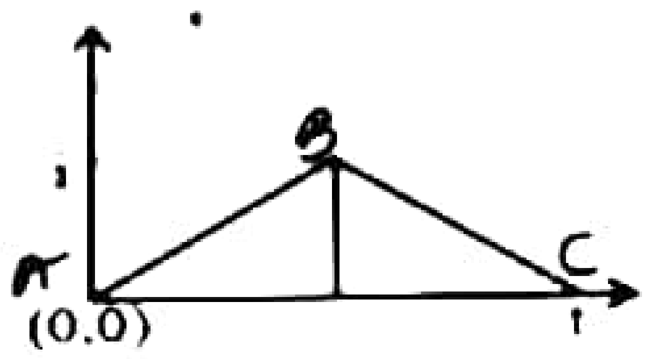
$$2t e^{-t} + (-1)e^{-t} t^2 = 0$$

$$\boxed{t = 2 \text{ sec}}$$

23.

[redacted]

The current in an inductance coil varies with time 't' according to following graph



$\mathcal{E} = L\left(\frac{dI}{dt}\right)$

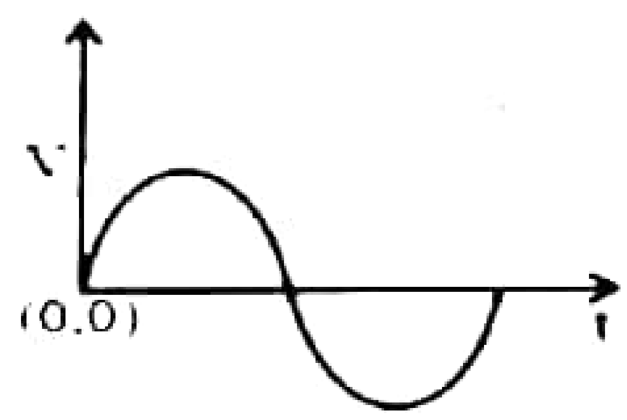
$= L \times$ slope.

Which one of the following graph shows the variations of voltage in the coil ?

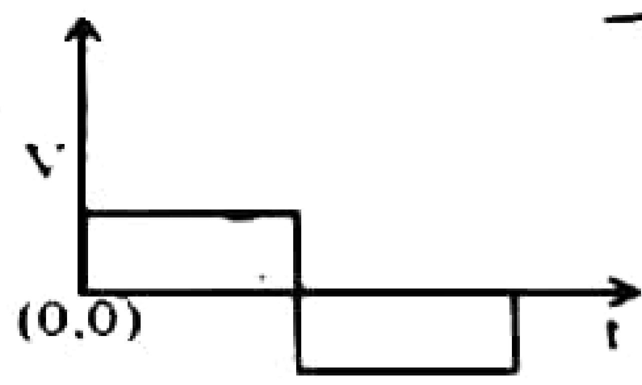
A to B Slope = Const
$\mathcal{E}_L$ = +ve Const

B to C : Slope = −ve const
$\mathcal{E}$ = −ve Const

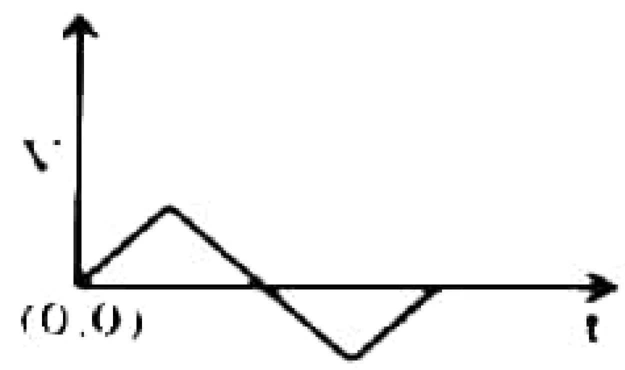
(A)



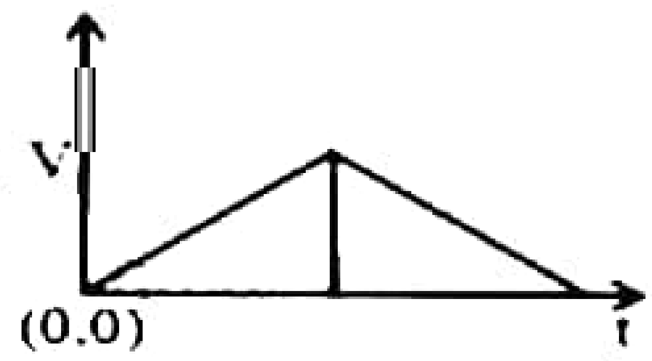
(B)



(C)

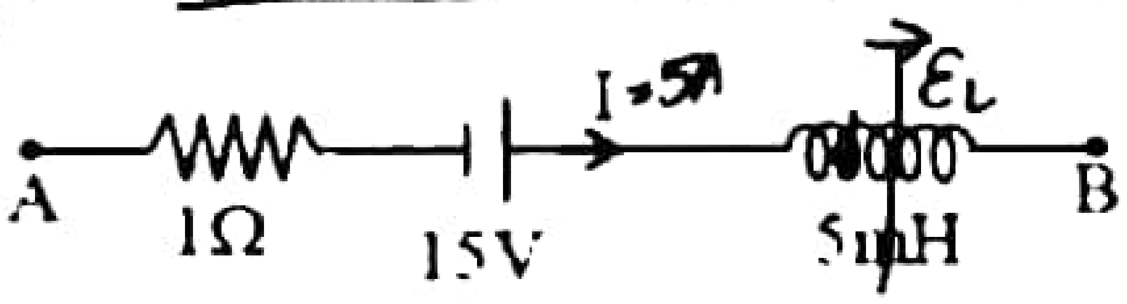


(D)



24.

The network shown in figure is part of a complete circuit. If at a certain instant the current (I) is 5 A, and decreasing at a rate of 10^3 A/s, then $V_B - V_A$ =



(A) 15 V (B) 10 V (C) 5 V (D) 20 V

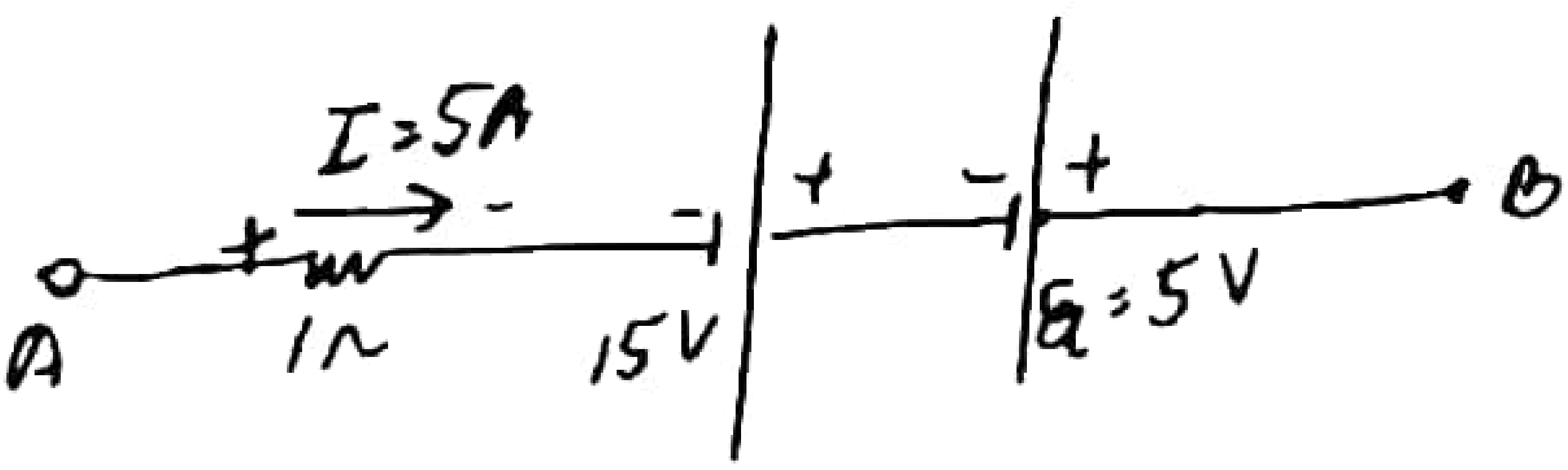
$\mathcal{E}_L = L\frac{dI}{dt}$

$= 5mH \times 10^3 A/s$

$= 5$ Volt

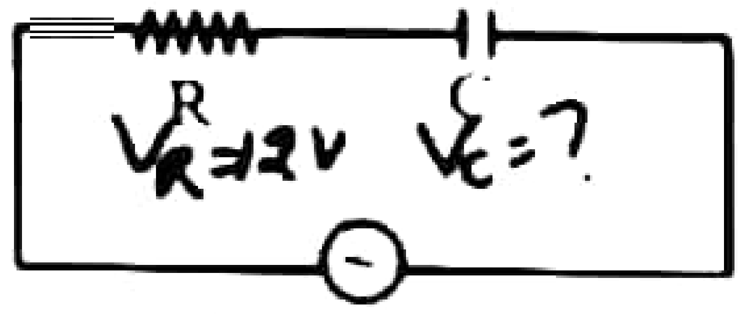
$V_B - V_A = 5 + 15 - 5$

$= 15$ Volt



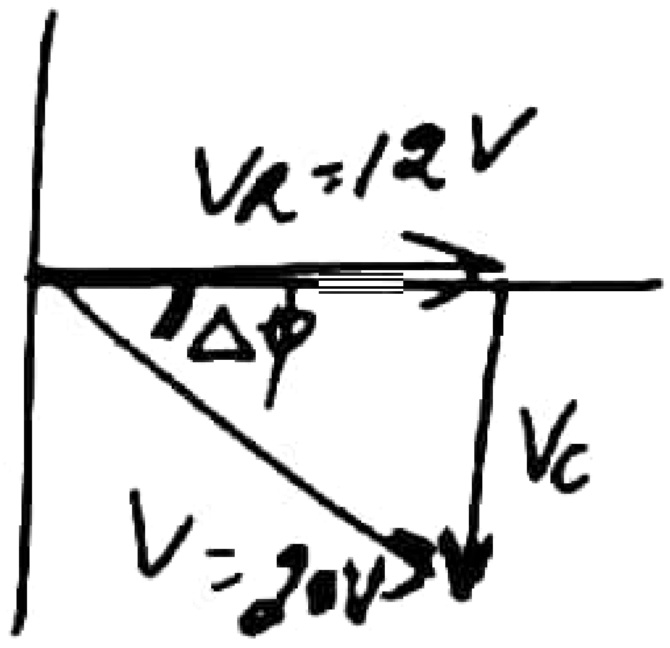
25.

A 50 Hz ac source of 20 volts is connected across R and C as shown in figure. The voltage across R is 12 volt. The voltage across C is –



$f = 50 Hz$
$V = 20 V$

(A) 8 V
(B) 16 V
(C) 10 V
(D) not possible to determine unless values of R and C are given

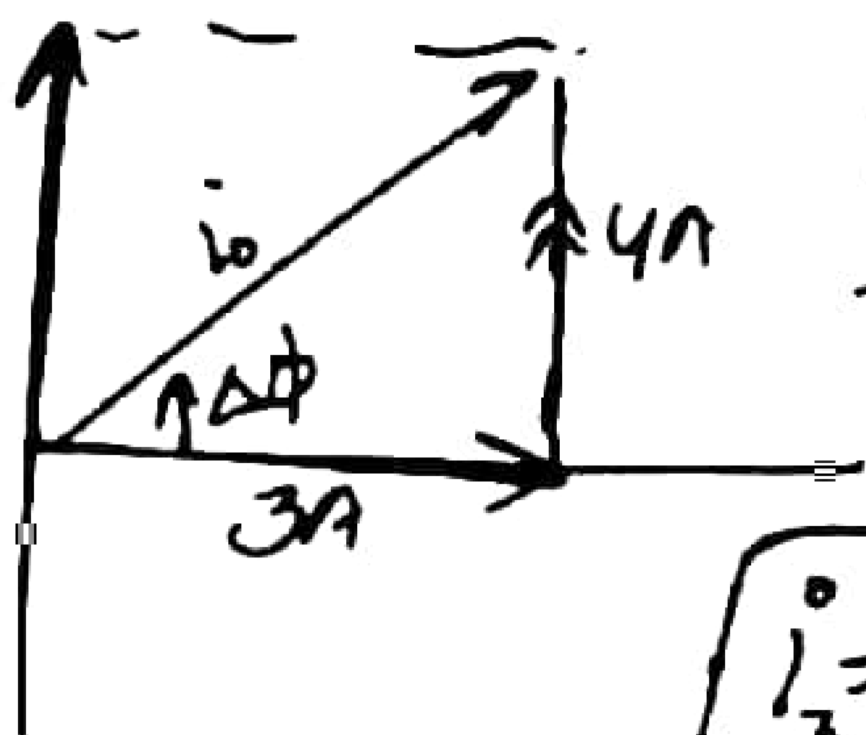


$$20^2 = V_C^2 + (12)^2$$
$$V_C^2 = 256$$
$$V_C = 16 \text{ volt}$$

26.

If $i_1 = 3 \sin \omega t$ and $i_2 = 4 \cos \omega t$, then i_3 is –

(A) $5 \sin (\omega t + 53°)$ (B) $5 \sin (\omega t + 37°)$
(C) $5 \sin (\omega t + 45°)$ (D) $5 \cos (\omega t + 53°)$



$$i_0 = 5A$$
$$\tan\Delta\phi = \frac{4}{3}$$
$$\Delta\phi = 53$$
$$i_3 = 5 \sin(\omega t + 53)$$

27.

In a circuit an A.C. current and a D. C. current are supplied together. The expression of the instantaneous current is given as : $i = 3 + 6 \sin \omega t$

Then the rms value of the current is –

(A) 3 (B) 6 (C) $3\sqrt{2}$ (D) $3\sqrt{3}$ ✓

D/4 $\overline{I^2} = \overline{9} + 36\,\overline{\sin^2\omega t} + 36\,\overline{\sin\omega t}$

$\overline{I^2} = 9 + 36 \times \frac{1}{2} + 0$ (= 9 + 18)

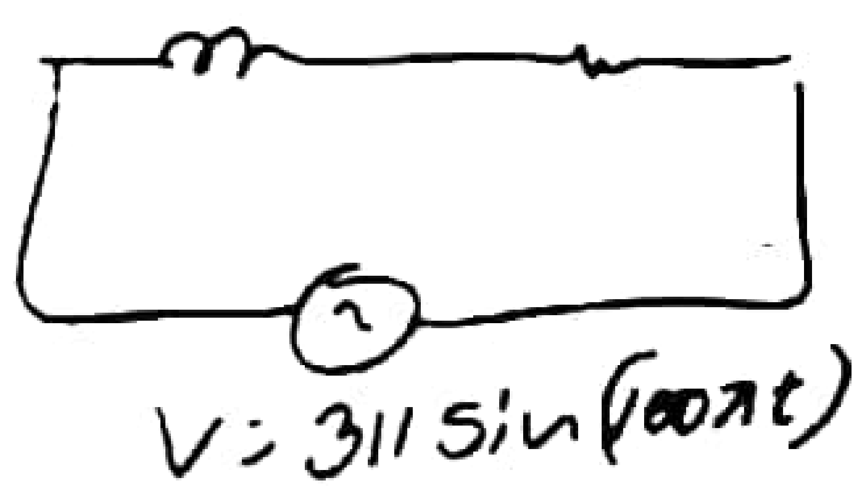
$\overline{I^2} = 27$

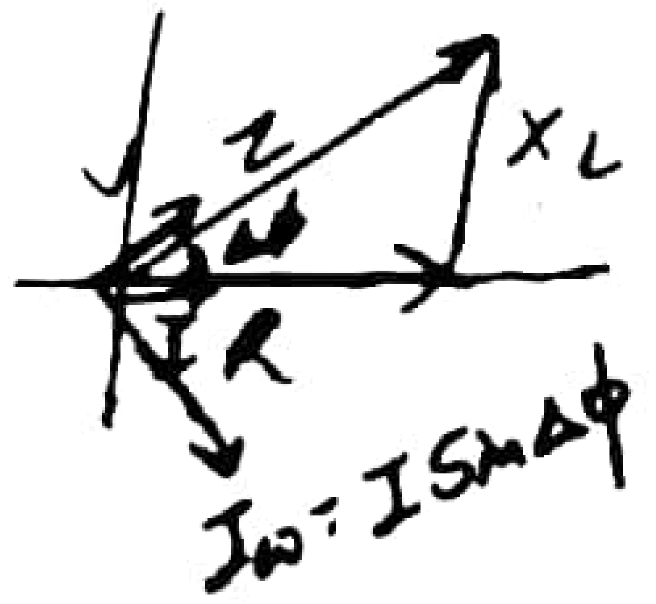
$I_{rms} = \sqrt{\overline{I^2}} = \sqrt{27} = 3\sqrt{3}\,A$

28.

The series combination of resistance R and inductance L is connected to an alternating source of e.m.f. $e = 311 \sin (100\, \pi t)$. If the value of wattless current is 0.5A and the impedance of the circuit is 311 Ω, the power factor will be –

(A) $\frac{1}{2}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\frac{1}{\sqrt{2}}$ ✓ (D) $\frac{1}{\sqrt{5}}$





$V_0 = I_0 Z$

$311 = I_0 \times 311$

$I_0 = 1A$

$0.5A = \frac{1}{\sqrt{2}} \times \sin\Delta\phi$

$\frac{1}{2} = \frac{1}{\sqrt{2}} \sin\Delta\phi$

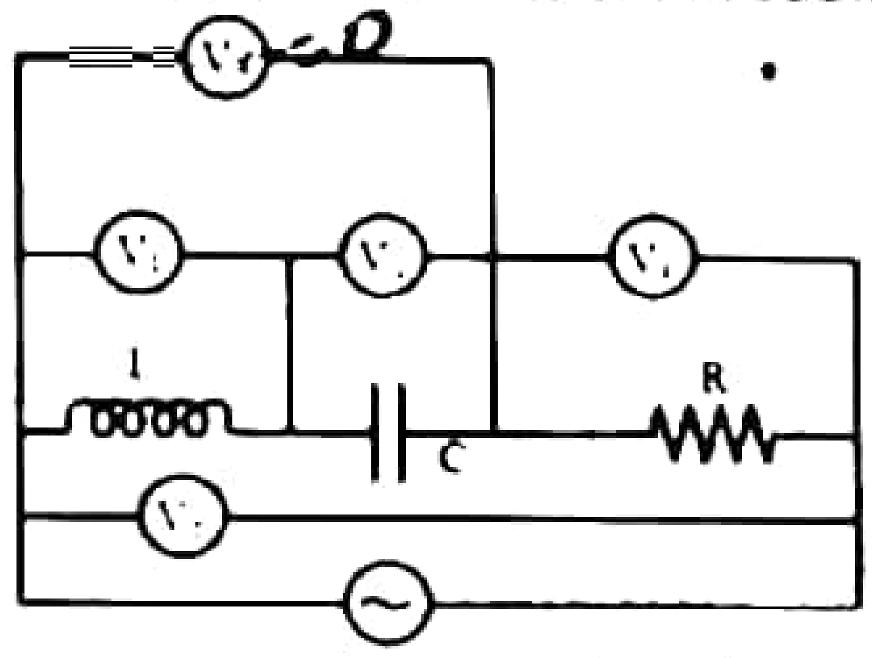
$\sin\Delta\phi = \frac{1}{\sqrt{2}}$

$\Delta\phi = 45$

$\cos\Delta\phi = \frac{1}{\sqrt{2}}$

29.

In the adjoining A.C. circuit the voltmeter whose reading will be zero at resonance is-



(A) V_1 (B) V_2 (C) V_3 (D) V_4

30.

Statement-1 The number of turns in secondary coil of a transformer is 10 times the number of turns in primary. An output voltage of 15 V can be obtained using a cell of 1.5 V. incorrect

Statement-2 This is because in a transformer, $\frac{E_s}{E_p} = \frac{n_s}{n_p}$ correct

$N_s = 10 N_p$

$V_p = 1.5$ V cell DC

$V_s = 15$ V

(A) Both Statements are correct.

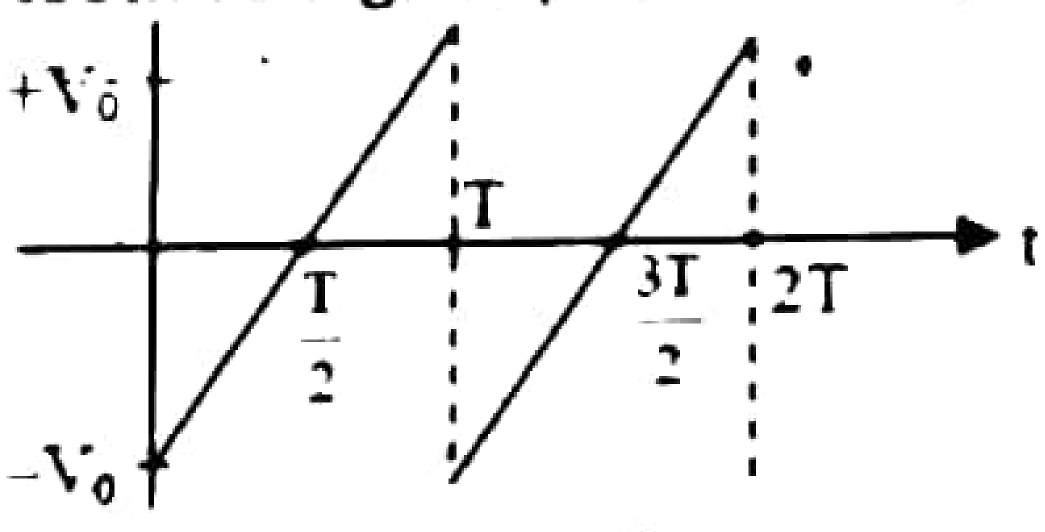
(B) Statement-1 is correct & Statement-2 is incorrect.

(C*) Statement-1 is incorrect & Statement-2 is correct.

(D) Both Statements are incorrect.

31.

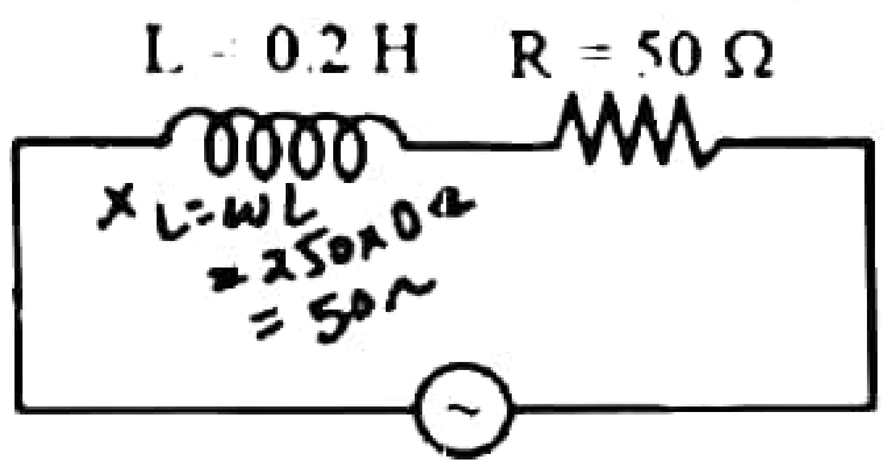
Rms value of the saw-tooth voltage of peak value V_0 as shown in figure –



(A) $\frac{V_0}{2}$ (B) $\frac{V_0}{\sqrt{2}}$ (C) $\frac{V_0}{3}$ (D) $\frac{V_0}{\sqrt{3}}$

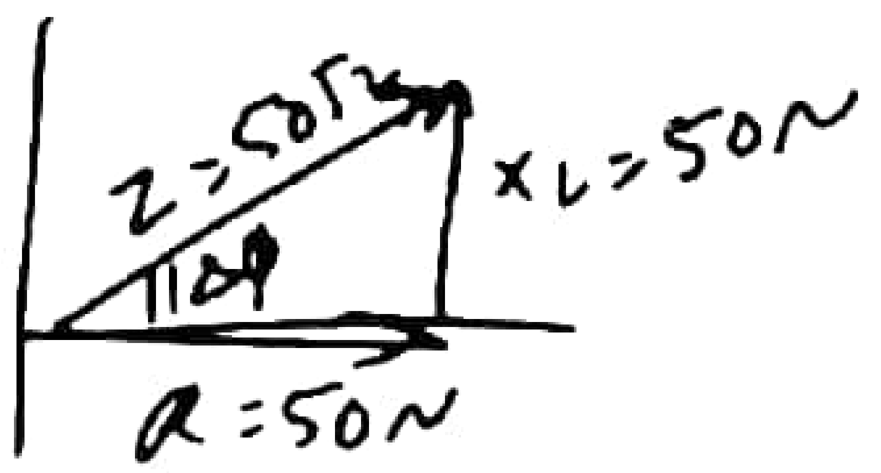
32.

In the given circuit the average power developed is –



V = 200 sin(250 t) volt

(A) $50\sqrt{2}$ watt (B) 200 watt (C) $150\sqrt{2}$ watt (D) $200\sqrt{2}$ watt



$V_0 = I_0 Z$

$200 = I_0 \times 50\sqrt{2}$

$I_0 = 2\sqrt{2}$ A

$I_{rms} = \frac{I_0}{\sqrt{2}} = 2A$

$\bar{P} = I_{rms}^2 R$

$= 4 \times 50$

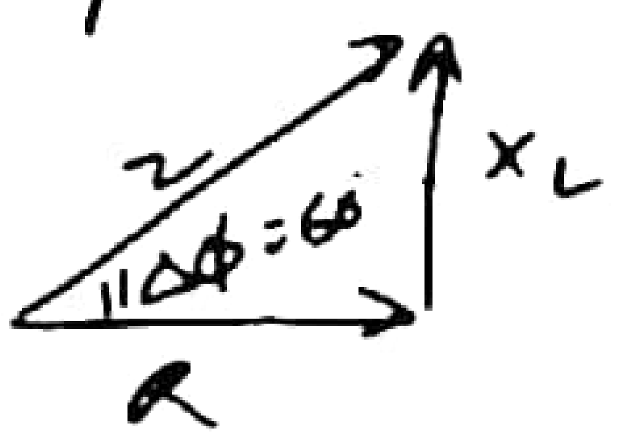
$= 200W$

33.

An LCR series circuit with 100 Ω resistance is connected to an AC source of 200 V and angular frequency 300 radians per second. When only the capacitance is removed, the current lags behind the voltage by 60º. When only the inductance is removed, the current leads the voltage by 60º. Then the current and power dissipated in LCR circuit are respectively

(A) 1A, 200 watt (B) 1A, 400 watt (C) 2A, 200 watt (D) 2A, 400 watt

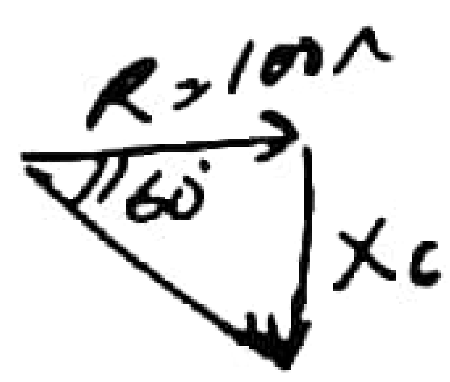
Cap removed



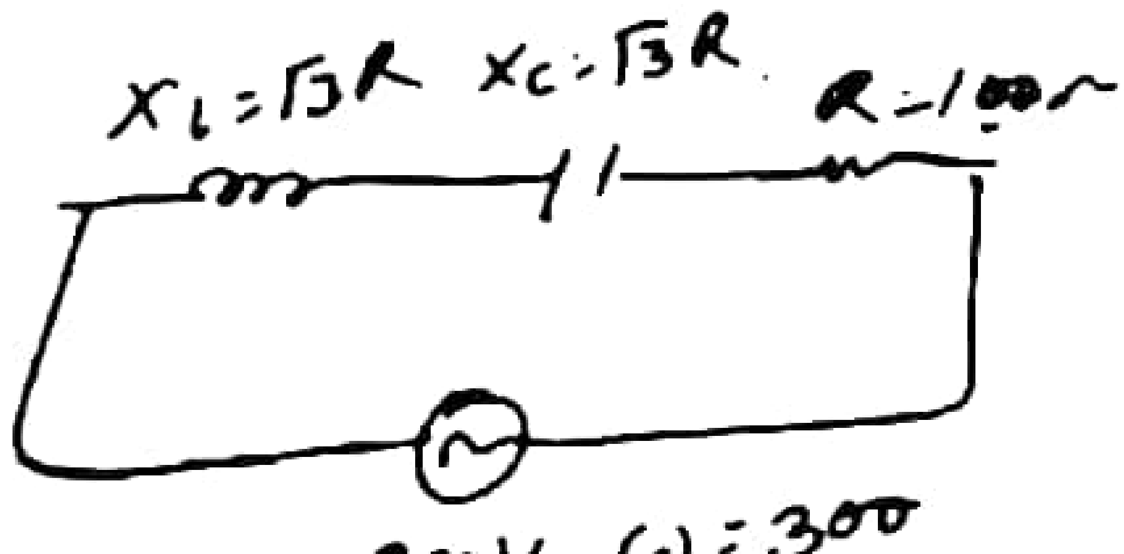
$\tan 60 = \frac{X_L}{R}$

$X_L = \sqrt{3}R$

Ind Removed



$X_C = \sqrt{3}R$



$V = I Z$

$200 = I \times 100$

$I = 2A$

$\bar{P} = I_{rms}^2 R$

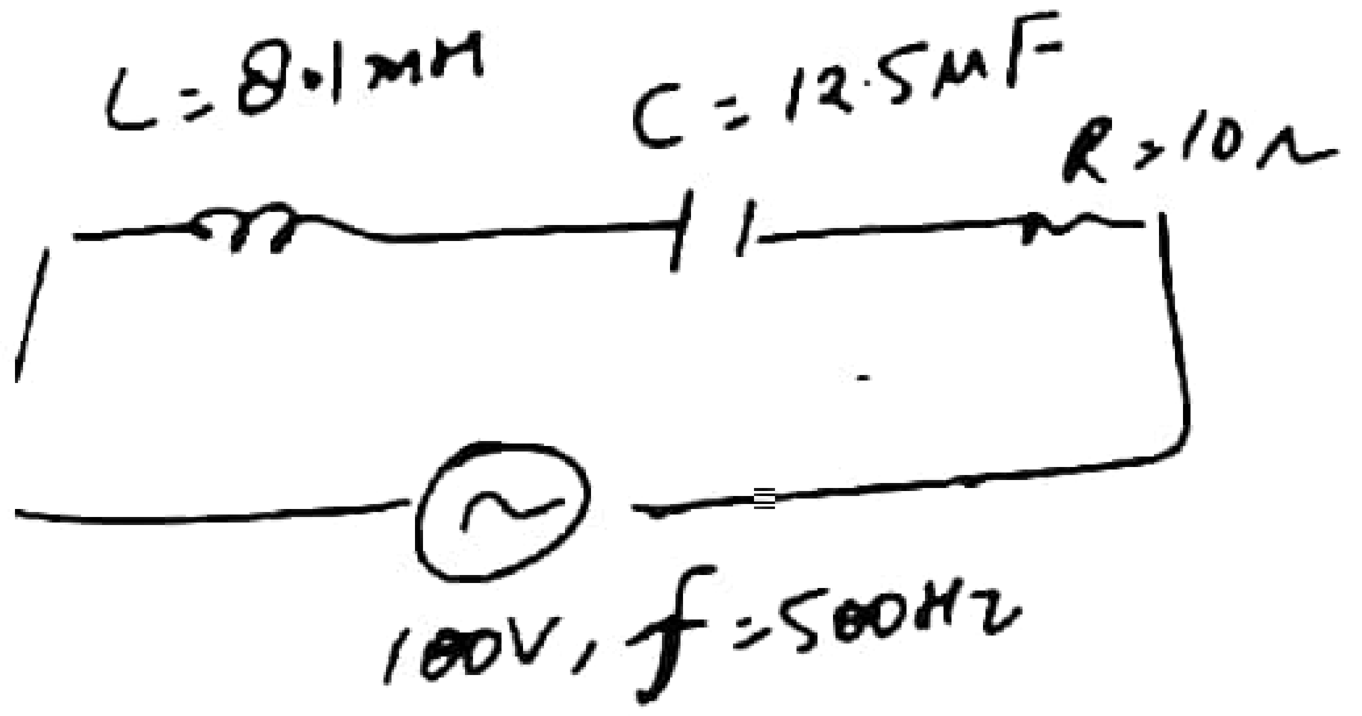
$= 4 \times 100$

$= 400W$

34.

A 100 volt AC source of frequency 500 Hz is connected to a L–C-R circuit with L = 8.1 mH, C = 12.5 μF and R = 10 Ω, all connected in series. The potential difference across the resistance is -

(A) 100 V (B) 200 V (C) 300 V (D) 400 V



$X_L = \omega L$
$= 2\pi f \times 8.1\times10^{-3}$
$= 2\times3.14\times500\times8.1\times10^{-3}$
$= 25.4\ \Omega$

$X_C = \frac{1}{\omega C}$
$= \frac{1}{2\pi f C}$
$= \frac{10^6}{2\pi\times500\times12.5}$
$= 25.4\ \Omega$

$V_N = V_R = 100\text{ V}$

35.

In an ac circuit, the current is given by i = 4 sin (100πt + 30º) ampere. The current becomes maximum first time (after t = 0) at t equal to -

(A) (1/200) sec (B) (1/300) sec

(C) (1/50) sec (D) None of the above

$4\sin\left(100\pi t + \frac{\pi}{6}\right) = 4$

$\sin\left(100\pi t + \frac{\pi}{6}\right) = 1$

$100\pi t + 30 = 90$

$100\pi t = \frac{\pi}{3}$

$t = \frac{1}{300}$

36.
If instantaneous value of current is

$I = 10 \sin(314\, t)$ A,

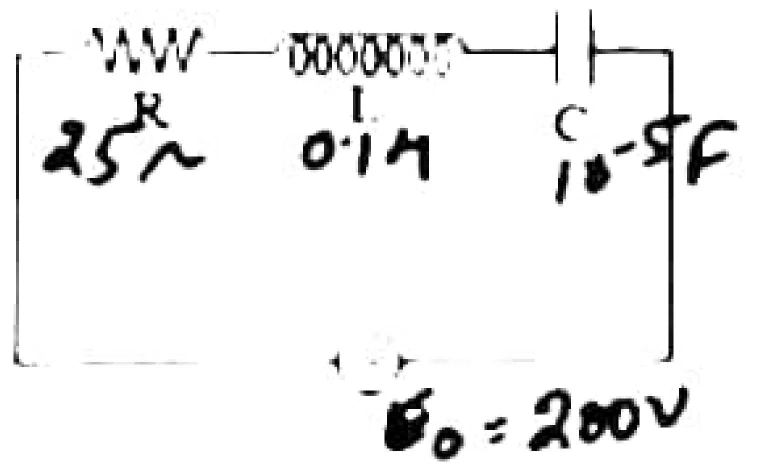
then the average current for the half cycle will be -

(A) 10 A (B) 7.07 A (C) 6.37 A (D) 3.53 A

$$\bar{I} = \frac{2I_0}{\pi}$$

$$= \frac{2 \times 10}{\pi} = 6.37\,A$$

37.
If E_0 = 200 volt, R = 25 ohm. L = 0.1 H and C = 10^{-5} F and the frequency is variable, then the current at f = 0 and f = ∞ will be respectively -



(A) 0 A, 8 A (B) 8 A, 0 A (C) 8 A, 8 A (D) 0 A, 0 A

f = 0 I = 0

f = ∞ I = 0

38.

The electric resonance is sharp in L-C-R circuit if in the circuit -

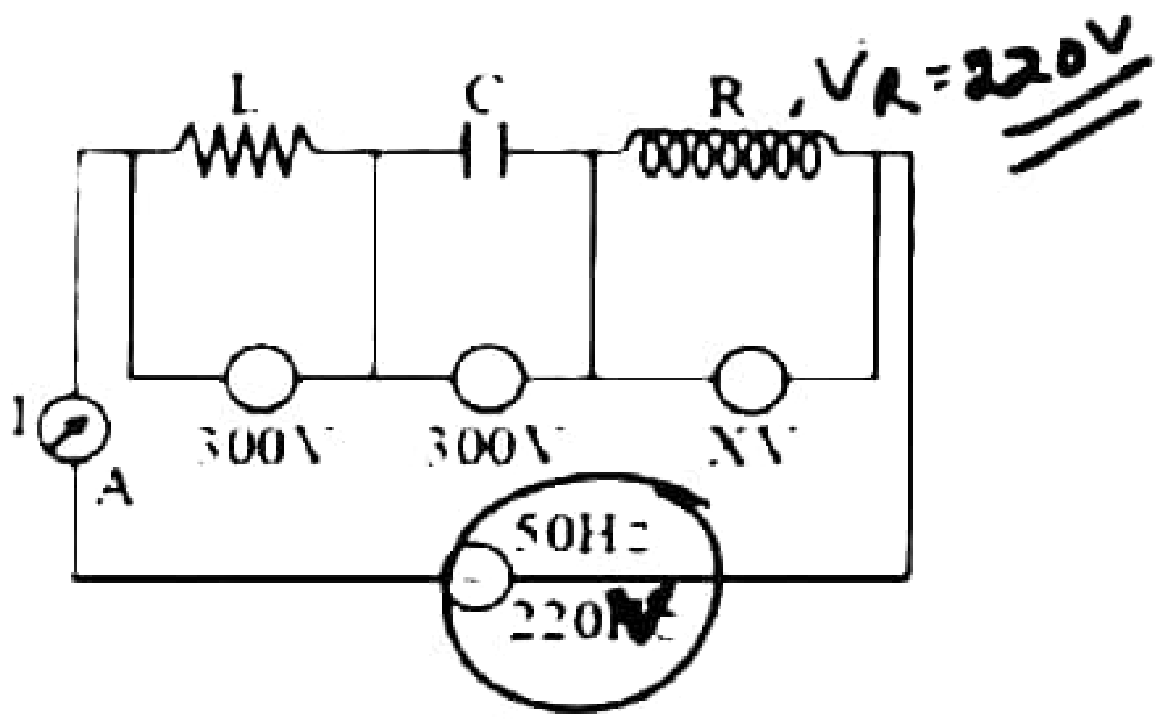
(A) R is greater (B) R is smaller

(C) R = X_L or X_C (D) Does not depend on R

$$\text{Sharpness} = \frac{1}{R}\sqrt{\frac{L}{C}}$$

39.

If R = 100 Ω then the value of X and I in the given circuit will be -



(A) 800 V, 2A (B) 300 V, 2A (C) 220 V, 2.2A (D) 100 V, 2A

$V = IR$

$220V = I \times 100$

$I = 2.2A$

40.

In resonating circuit value of inductance and capacitance is 0.1H and 200 μF. For same resonating frequency if value of inductance is 100H then necessary value of capacitance in μF will be -

(A) 4 (B) 0.2 (C) 2 (D) 0.3

f = same.

$L_1 C_1 = L_2 C_2$

$0.1 \times 200 = 100 \times C_2$

$C_2 = 0.2\ \mu F$.

41.

A choke coil of negligible resistance carries 5 mA current when it is operated at 220 V. The loss of power in the choke coil is -

(A) Zero (B) 11 W (C) 44×10^3 W (D) 1.1 W

42.

In an A.C. circuit, $i = 5 \sin (100t - \frac{\pi}{2})$ ampere an A,V, $V = 200 \sin (100\ t)$ volt. The power loss in the circuit will be -

(A) 20 volt (B) 40 volt (C) 1000 watt (D) 0 watt

$\bar{P} = V_{rms} I_{rms} \cos\phi$

$= \frac{200}{\sqrt{2}} \times \frac{5}{\sqrt{2}} \cos\frac{\pi}{2} = 0$

43.
A d.c. voltage with appreciable riple expressed as $V = V_1 + V_2 \cos \omega t$ is applied to a resistor R. The amount of heat generated per second is given by -

(A) $\frac{V_1^2 + V_2^2}{2R}$ (B) $\frac{2V_1^2 + V_2^2}{2R}$ (C) $\frac{V_1^2 + 2V_2^2}{2R}$ (D) None of these

b) $\overline{V^2} = \overline{V_1^2} + \overline{V_2^2 \cos^2 \omega t} + 2V_1V_2\overline{\cos \omega t}$

$\overline{V^2} = V_1^2 + \frac{V_2^2}{2} = \frac{2V_1^2 + V_2^2}{2}$

$V_{rms} = \sqrt{\overline{V^2}} = \sqrt{\frac{2V_1^2 + V_2^2}{2}}$

$P = \frac{V_{rms}^2}{R}$

$P = \frac{2V_1^2 + V_2^2}{2R}$

44.
In LCR series AC circuit, the phase angle between current and voltage is-

(A) any angle between 0 and ± π / 2

(B) π / 2

(C) π

(D) any angle between 0 and π

45.
In a transformer, number of turns in the primary are 140 and that in the secondary are 280. If current in primary is 4 A, then that in the secondary is -

(A) 4 A (B) 2 A (C) 6 A (D) 10 A

$N_p = 140$ $I_p = 4A$

$N_s = 280$ $I_s = ?$

$\frac{N_p}{N_s} = \frac{I_s}{I_p}$

$\frac{140}{280_2} = \frac{I_s}{4}$

$I_s = 2A$

46.

Statement-1: An e.m.f is induced in a closed loop where magnetic flux is varied. The induced E is not a conservating field. Correct

Statement-2: The line integral of $\vec{E}.d\vec{l}$ around the closed loop is non-zero. correct

(A) Both Statements are correct.

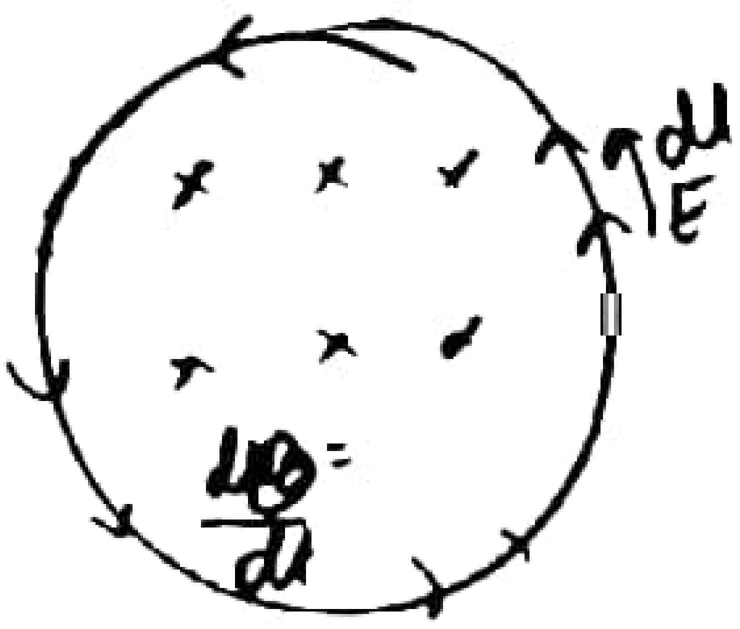
(B) Statement-1 is correct & Statement-2 is incorrect.

(C) Statement-1 is incorrect & Statement-2 is correct.

(D) Both Statements are incorrect.

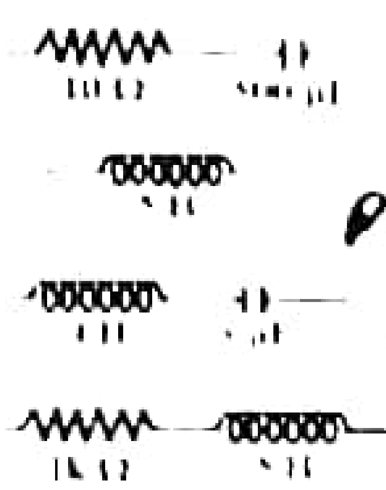
Sol.

$\int \vec{E}\cdot\vec{dl} \neq 0$ correct



47.

Four different circuit components are given in each situation of column I and all the components are connected across an ac source of same angular frequency ω = 200 rad/sec. The information of phase difference between the current and source voltage in each situation of column I is given in column II



Column-I		Column II
(A)	Q, P	(P) the magnitude of required phase difference is π/2
(B)	P, S	(Q) the magnitude of required phase difference is π/4
(C)	P, R	(R) the current leads in phase to source voltage
(D)	Q, S	(S) the current lags in phase to source voltage
		(T) the magnitude of required phase π/3

(A) A → Q,R ; B → P,S ; C → P,R ; D → Q,S

(B) A → P,S ; B → Q,R ; C → P,T ; D → Q,S

(C) A → P,R ; B → P,T ; C → P,Q ; D → Q,T

(D) A → Q,S ; B → P,Q ; C → P,S ; D → Q,T

A) R = 10Ω C = 500μF

$\tan\phi = \frac{X_C}{R} = \frac{1}{\omega CR}$

$\tan\phi = \frac{1}{200 \times 500 \times 10^{-6} \times 10} = 1$

$\angle\phi = \pi/4$

B) E, π/2, I

C) $X_L = 200 \times 4 = 800\Omega$

$X_C = \frac{1}{\omega C} = \frac{10^6}{200 \times 3} = \frac{10000}{6}$

$X_C > X_L$ I $E_C \cdot E_L$

d) E, I $\tan\phi = \frac{200 \times 5}{1000} = 1$

48.

A coil having inductance and L and resistance R is connected to a battery of emf ε at $t = 0$. If t_1 and t_2 are time for 90% and 99% completion of current growth in the circuit, then $\frac{t_1}{t_2}$ will be-

(A*) 1: 2 (B) 2: 1 (C) $\frac{\log_e 10}{2}$ (D) $2\log_e 10$

$I = I_0(1 - e^{-t/\tau})$

$e^{-t/\tau} = \frac{I_0 - I}{I_0}$

$t = \tau \log_e \frac{I_0}{(I_0 - I)}$

$t_1 = \tau \log \frac{I_0}{I_0 - \frac{90 I_0}{100}} = \tau \log_e 10$

$t_2 = \tau \log_e \frac{I_0}{I_0 - \frac{99 I_0}{100}}$

$t_2 = \tau \log 100$

$t_2 = 2\tau \log 10$

$t_2 = 2t_1$

$\frac{t_1}{t_2} = \frac{1}{2}$

49.

Statement-1 When a current flow in the coil of a transformer then its core becomes hot. Correct

Statement-2 The core of transformer is made of iron correct

(A*) Both Statements are correct.

(B) Statement-1 is correct & Statement-2 is incorrect.

(C) Statement-1 is incorrect & Statement-2 is correct.

(D) Both Statements are incorrect.

50.

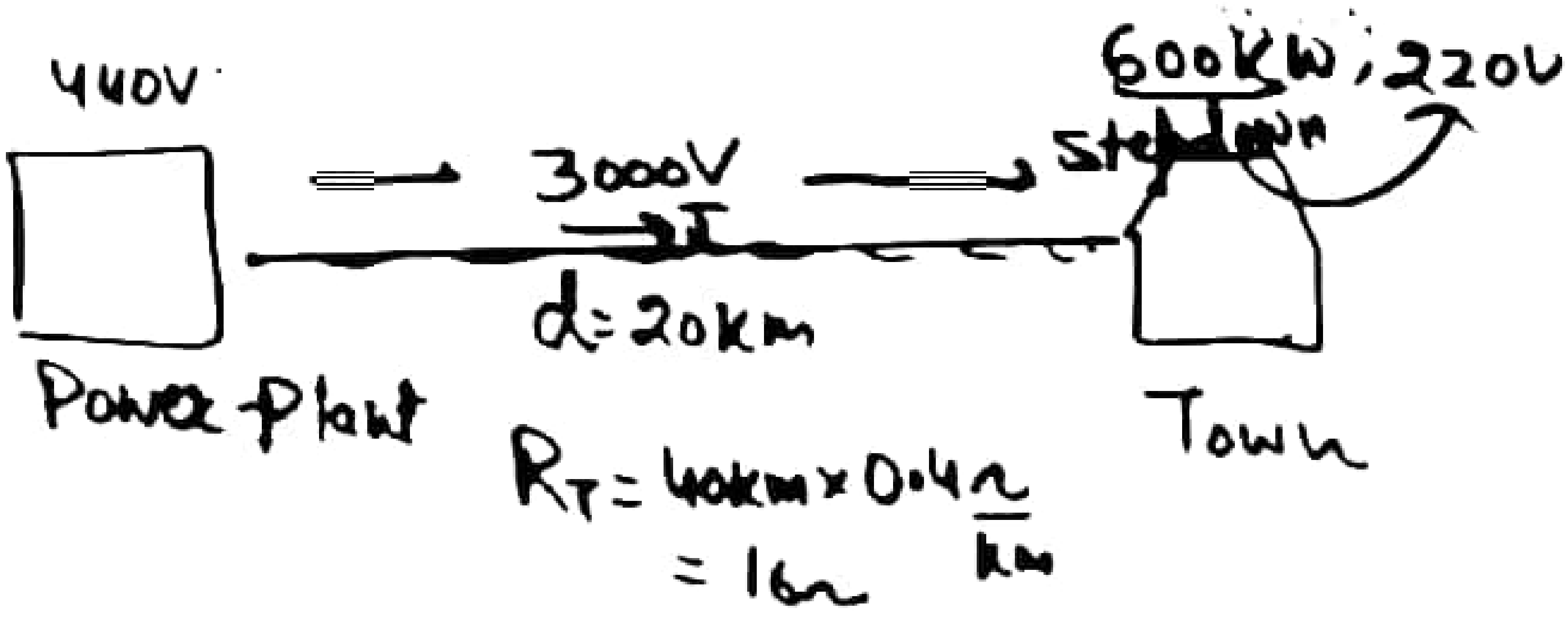
A town situated 20km away from a power plant generating power at 440 V, requires 600 kW of electric power at 220 V. The resistance of the two wire line carrying power is 0.4 Ω per km. The town gets power from the line through a 3000   220V step down transformer at a substation in the town. Find the line power losses in the form of heat

(A) 500 KW

(B*) 640 KW ✓

(C) 800 KW

(D) None of these



$P = VI$

$I = \frac{600 \times 10^3}{3000}$

$I = 200A$

$P_d = I^2 R$

$= 4 \times 10^4 \times 16$

$= 64 \times 10^4 W$

$P_d = 640kW$