PHYSICS

BOOKS - DC PANDEY PHYSICS (HINGLISH)

ALTERNATING CURRENT

Example

1. Show that average heat produced during a cycle of AC is same as produced by DC with $i = i_{\text{rms}}$.

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2. If the current in an AC circuit is represented by the equation, $i = 5\sin\left(300t - \frac{\pi}{4}\right)$

Here t is in second and in an ampere, calculate

(a) peak and rms value of current

(b) frequecne of AC

(c) average current.

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3. A 100Ω resistasnce is connected in series with a $4H$ inductor. The voltage across the resistor is $V_R = (2.0V)\sin(10^3 rad/s)t$:

(a) Find the expessinocircuit current

(b) Find the inductive reactance

(c) derive an expression for the voltage across the inductor,

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4. An alternating emf 200 virtual volts at $50Hz$ is connected to a circuit resistance 1ω and inductance $0.01H$. What is the phase difference between the current and the emf in the circuit? Also, find the virtual current in the circuit.

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5. A resistance and inductance are connected in series across a voltage,

$V = 283 \sin 314t$

The current is found to be $4 \sin(314t - \pi / 3)$. Find the value of the inductance and resistance.

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6. Find the voltage across the various elements, i.e., resistance, capacitance and inductance which are in series and having values $100\Omega, 1\mu F$ and $2.0H$, respectively. Given emf is

$V = 100\sqrt{2} \sin 1000t$ volt

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7. A $750Hz, 20V$ source is connected to as resistance of 100Ω an inductance of $0.1803H$ and a capacitance of $10\mu F$ all in sereis.Calculate the time in which the resistance (thermalcapacity $2J/.^{\circ}C$) wil get heated by $10^{\circ}C$.

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8. In an $L-C-R$ ereis circuit $R=150\Omega, L=0.0750H$ and $C=0.0180\mu F$. The source has voltage amplitude $V=150V$ and a frequencey equal to the resonacne frequency of the circuit.

(a) What is the power factor ?

(b) What is the average power delivered by the source?

(c) The capacitor is replaced by one with $C = 0.0360 \mu F$ and the source frequency is adjusted to the new resonance value. Then, what is the average power delivered by the source?

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Example Type 1

1. A current of $4A$ flows in a coil when connected to a $12V DC$ source. If the same coil is connected to a $12V, 50rad/sAC$ source, a current of $2.4A$ flows in the circuit. Determine the inductance of the coil. Also, find the power developed in the circuit if a$2500 \mu F$ capacitor is connected in series with the coil.

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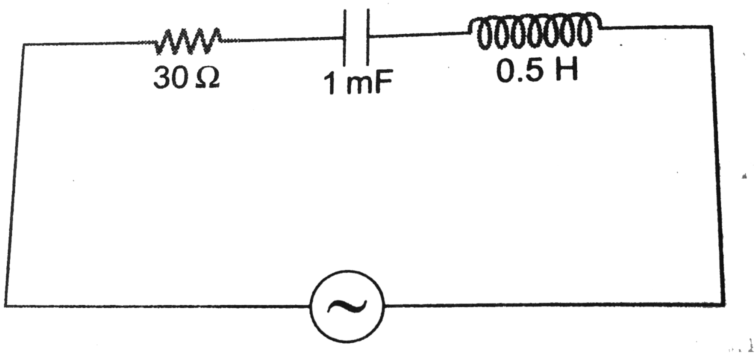
Example Type 2

1.



In the diagram shown in figure, V function is given. Find other four functions of time I, V_C, V_R and V_L. Also, find power consumed in the circuit, V is given in volts and ω in rad/s.

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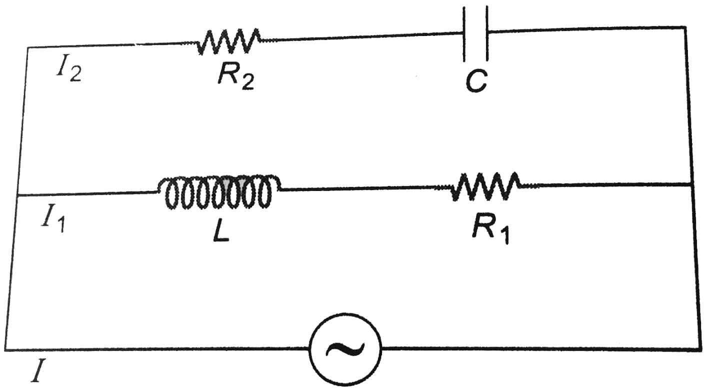
Example Type 3

1. In the circuit shown in figure



$R_1 = 30\Omega$, $R_2 = 40\Omega$, $L = 0.4H$ and $C = \frac{1}{3} mF$.

Find seven function of time I, I_1, I_2, V_{R_1}, V_L, V_{R_2} and V_C.

Also total power consumed in the circuit. In the given potential function V is in volts and omega in rad/s.

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Miscellaneous Examples

1. An AC circuit consists of a 220Ω resistance andn a $0.7H$ choke. Find the power obsorbed from $220V$ and $50Hz$ source connected in this circuti if the resistance and choke are joined

(a) In series

(b) in parallel.

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2. A sinusoidal voltage of frequency $60Hz$ and peak value $150V$ is applied to a series $L-R$ circuit, where $R=20\Omega$ and $L=40mH$

(a) compute T, ω, X_L, Z and ϕ

(b) Compute the amplitudes of current V_R and V_L

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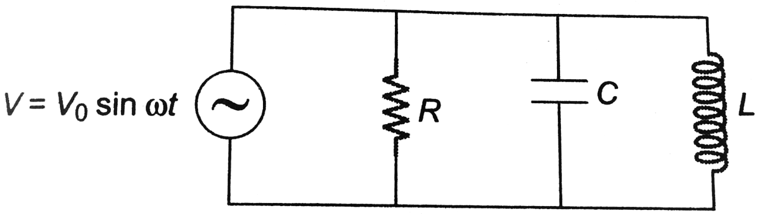
3. For the circuit shown in figureure, find the instaneous current through each element.



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4. An $L-C-R$ series circuit with 100Ω resisance is connected to an AC source of $200V$ and angular frequency $300 rad/s$. When only the capacitance is removed, the current lags behind the voltage by 60°.

When only the inductance is removed the current leads the voltage by 60°. Calculate the current and the power dissipated in the $L-C-R$ circuit

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5. A series $L-C-R$ circuit containing a resistance of 120Ω has resonance frequency $4\times10^{5} rad/s$. At resonance the voltages across resistance and inductance are $60V$ and $40V$, respectively. Find the values of L and C .At what angular frequency the current in the circuit lags the voltage by $\pi/4$?

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6. A Choke coil is needed to operate an arc lamp at $160V$ ("rms") and $50Hz$. The lamp has an effective resistnce of 5Ω when running at $10A(\text{rms})$. Calculate the inductance of the choke coil. If the same arc lamp is to be operated on $160V(DC)$, what additional resistance is required ? Compare the power loses in both cases.

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Exercise 28.1

1. (a) What is the reactance of a $2.00H$ inductor at a frequency of $50.0Hz$?

(b) What is the inductance of an inductor whose reactance is 2.00Ω at $50.0Hz$?

(c) What is the reactance of a $2.00\mu F$ capacitor at a frequency of $50.0Hz$?

(d) What is the capacitance of a capacitor whose reactance is 2.00Ω at $50.0Hz$?

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2. An electric lamp which runs at $100V DC$ and consumes $10A$ current is connected to AC mains at $150V, 50Hz$ cycles with a choke coil in series. Calculate the inductance and drop of voltage across the choke. Neglect the resistance of choke.

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3. A circuit operating at $\frac{360}{2\pi}Hz$ contains a $1\mu F$ capacitor and a 20Ω. resistor. How large an inductor must be added in series to make the phase angle for the circuit zero? Calculate the current in the circuit if the applied voltage is $120V$.

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Exercise 28.2

1. If a 0.03 H inductor, a 10Ω resistor and a $2\mu F$ capacitor are connected in series. At what frequency will they resonate? What will be the phase angle at resonance?

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2. An arc lamp consumes $10A$ at $40V$. Calculate the power factor when it is connected with a suitable value of choke coil required to run the arc lamp on AC mains of $200V(\text{rms})$ and $50Hz$.

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Level 1 Assertion-Reason

1. Assertion: In an AC circuit, potential difference across the capacitor may be greater than the applied voltage.

Reason : $V_C = IX_C$, wheereas $V = IZ$ and X_C can be greater than Z also.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: A

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2. Assertion : In series $L-C-R$ circuit, voltage will lead the current function for frequency greater than the resonance frequency.

Reason : At resonance frequency, phase difference between current function and voltage function is zero.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: B

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3. Assertion : Resonance frequency will decrease in $L-C-R$ series circuit if a dielectric slab is inserted in between the plates of the capacitor.

Reason : By doing so, capacity of capacitor will increase.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: A

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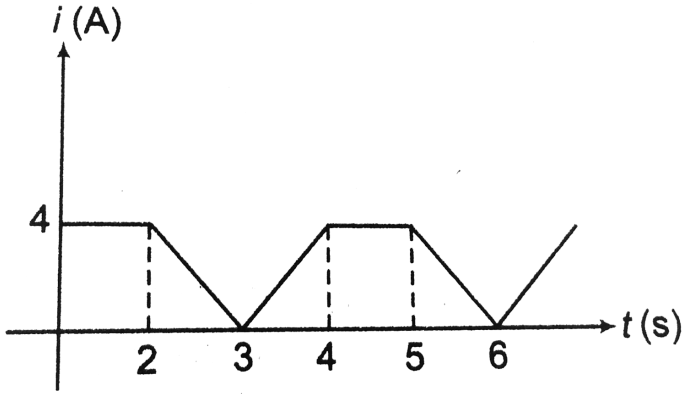
4. Assertion : Average value of current in the given graph is $3A$.



Reason average value can't be greater than the peak value of any function.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: B

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5. Assertion : In series $L-C-R$ circuit, if a ferromagnetic rod is inserted inside an inductor, incr current in the circuit may ease or decrease.

Reason : By doing so X_L will increase.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: A::B

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6. Assertion potential difference across, resistor, capacitor and inductor each is $10V$. Then, voltage function and current functions should be in phase.

Reason At this condition current in the circuit should be maximum.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: B

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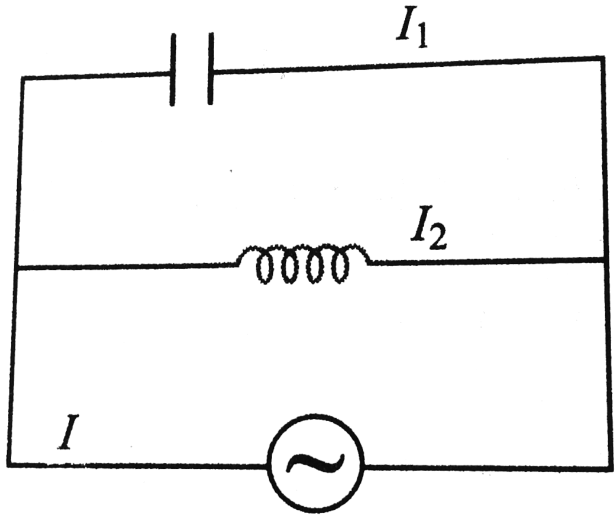
7. Assertion At some given instant I_1 and I_2 both are $2A$ each. Then, I at this should be zero.



Reason : There is a phase difference of I_1 and I_2functions.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: A

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8. Assertion : Peak value of current in AC through a resistance of 10Ω is $2A$. Then, power consumed by the resistance should be $20W$.

Reason : Power in AC is $P = I_{\text{rms}}^2 R$

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: A::B

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9. Assertion : An inductor coil normally produces more current with DC source compared to an AC source of same value of rms voltage.

Reason : In DC source, applied voltage remains constant with time.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: B

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10. Assertion : In an $L - R$ series circuit in AC, current in the circuit will decrease with increase in frequency.

Reason : Phase difference between current function and voltage function will increase with increase in frequency.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: B

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11. Assertion : In series $L-C-R, AC$ circuit, current and voltage are in same phase at resonance.

Reason : In series $L-C-R, AC$ circuit, resonant frequency does not depend on the value of resistance. Hence, current at resonance does not depend on resistance.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: C

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Level - 1 Objective

1. The term $\cos\phi$ in an AC circuit is called

A. form factor

B. phase factor

C. power factor

D. quality factor

Answer: C

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2. A DC ammeter cannot measure alternating current because

A. AC changes its direction

B. DC instruments will measure the average value

C. AC can damage the DC instrument

D. AC produces more heat

Answer: B

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3. As the frequency of an alternating current increases, the impedance of the circuit

A. increases continuously

B. decreases continuously

C. remains constant

D. none of these

Answer: D

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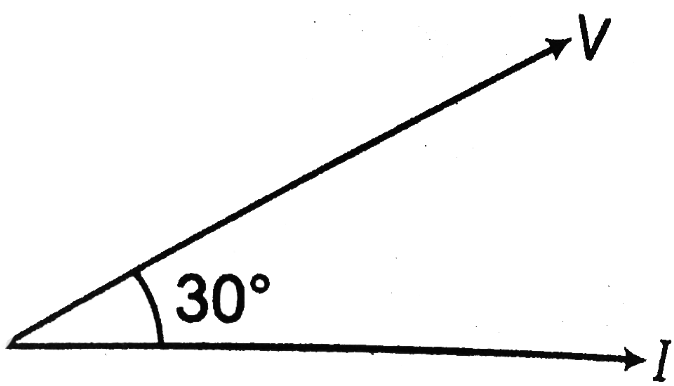
4. Phasor diagram of a series AC circuit is shown in figure.

Then,



A. The circuit must be containing resistor and capacitor only

B. The circuit must be containing resistor and inductor only

C. The circuit must be containing all three elements L, C and R

D. The circuit cannot have only capacitor and inductor

Answer: D

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5. The rms value of an alternating current

A. is equal to 0.707 times peak value

B. is equal to 0.636 times peak value

C. is equal sqrt2 times the peak value

D. none of the above

Answer: A

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6. In an AC circuit, the applied potential difference and the current flowing are given by

$V = 20 \sin 100tvo < , I = 5 \sin\left(100t - \frac{\pi}{2}\right)$ amp

The power consumption is equal to

A. $1000W$

B. $40W$

C. $20W$

D. zero

Answer: D

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7. The impedasnce of sereis $L-C-R$ circuit in an AC circuit is

A. $\sqrt{R+(X_L-X_C)}$

B. $\sqrt{R^2+(X_L^2+X_C^2)}$

C. R

D. none of these

Answer: D

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8. If V_0 and I_0 are the peak current and voltage across the resistor in a series $L-C-R$ circuit, then the power dissipated in the circuit is $(powerfac \to r = \cos\theta)$

A. $\frac{V_0 I_0}{2}$

B. $\frac{V_0 I_0}{\sqrt{2}}$

C. $V_0 I_0 \cos\theta$

D. $\frac{V_0 I_0}{2}\cos\theta$

Answer: D

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9. A generator produces a time varying voltage given by $V = 240 \sin 120t$, where t is in second. The rms voltage and frequency are

A. $170V$ and $19Hz$

B. $240V$ and $60Hz$

C. $170V$ and $60Hz$

D. $120V$ and $19Hz$

Answer: A

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10. An $L-C-R$ series circuit has a maximum current of $5A$. If $L=0.5H$ and $C=8\mu F$, then the angular frequency of AC voltage is

A. $500 rad / s$

B. $5000 rad / s$

C. $400 rad / s$

D. $250 rad / s$

Answer: A

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11. The current and voltage functions in an AC circuit are

$$i = 100 \sin 100t mA, V = 100 \sin\left(100t + \frac{\pi}{2}\right) V$$

The power disspitated in the circuit is

A. $10W$

B. $2.5W$

C. $5W$

D. $5kW$

Answer: B

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12. A capacitor becomes a perfect insulator is

A. alternating current

B. direct current

C. both a and b

D. none of above

Answer: B

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13. For an alternating voltave $V = 10 \cos 100\pi t$ volt, the instantenous voltage at $t = \frac{1}{600}$s is

A. $1V$

B. $5V$

C. $5\sqrt{3}V$

D. $10V$

Answer: C

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14. In a purely resistive AS circuit,

A. voltage leads current

B. voltge lags current

C. voltage and current are in same phase

D. nothing can be said

Answer: C

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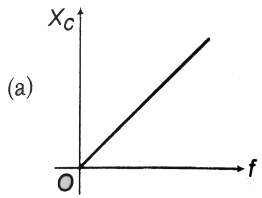
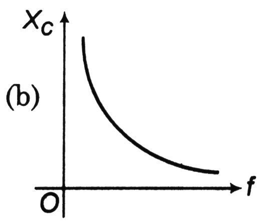
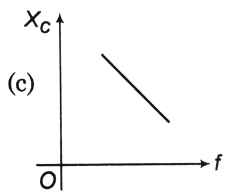
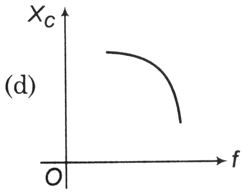
15. Identify the graph which correctly reperesents the variation of capacitive reactance X_C with frequency

A. 

B. 

C. 

D. 

Answer: B

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16. In an AC circuit, the impedance is $\sqrt{3}$ times the reactance, then the phase angle is

A. 60°

B. 30°

C. zero

D. none of these

Answer: D

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17. Voltage applied to an AC circuit and current flowing in it is given by

$V = 200\sqrt{2}\sin\left(\omega t + \frac{\pi}{4}\right)$ and $i = -\sqrt{2}\cos\left(\omega t + \frac{\pi}{4}\right)$

Then, power consumed in the circuited will be

A. $200W$

B. $400W$

C. $200\sqrt{2}W$

D. none of these

Answer: D

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18. A current of $4A$ flows in a coil when connected to a $12VDC$ source. If the same coil is connected to a $12V, 50rad/sAC$ source, a current of $2.4A$ flows in the circuit. Determine the inductance of the coil. Also, find the power developed in the circuit if a$2500\mu F$ capacitor is connected in series with the coil.

A. $\left(\frac{\pi}{\sqrt{3}}\right)H$

B. $\left(\frac{\sqrt{3}}{\pi}\right)H$

C. $\left(\frac{2}{\pi}\right)H$

D. none of these

Answer: B

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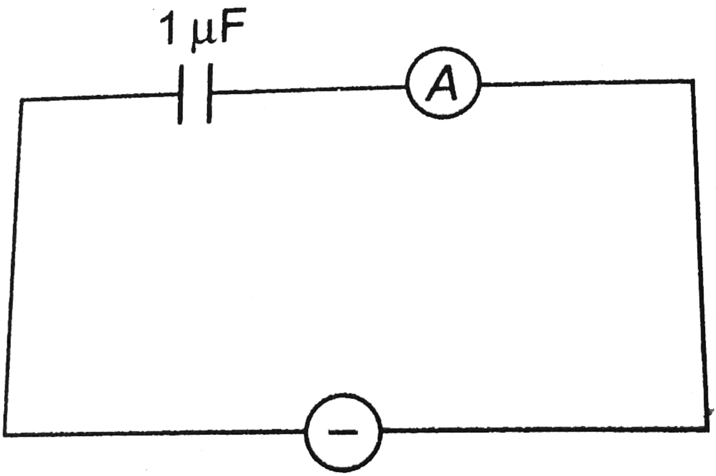
19. In the circuit shown in figureure, the reading of the AC ammeter is



A. $20\sqrt{2}mA$

B. $40\sqrt{2}mA$

C. $20mA$

D. $40mA$

Answer: C

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20. An AC voltage is applied acrss a series combination of L and R. If the voltage drop across the resistor and inductor are $20V$ and $15V$ respectiely, then applied peak voltage is

A. $25V$

B. $35V$

C. $25\sqrt{2}V$

D. $5\sqrt{7}V$

Answer: C

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21. For wattless power is an AC circuit, the phase angle between the current and voltagge is

A. 0°

B. 90°

C. 45°

D. not possible

Answer: B

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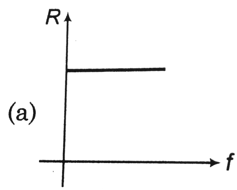
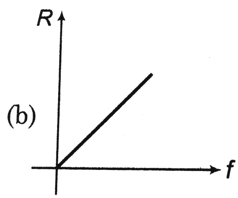
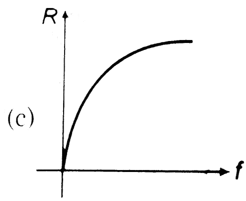
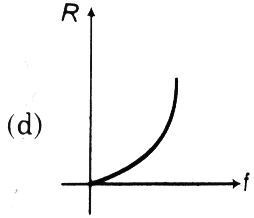
22. The correct variation of resistance R with frequency f is given by

A. 

B. 

C. 

D. 

Answer: A

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23. If L and R be the inductance and resistance of the choke coil, then indentify the correct statement

A. L is very high compact to R

B. R is very high compared to L

C. Both L and R are high

D. Both L and R are low

Answer: A

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24. When an AC signal of frequency $1kHz$ is applied across a coil of resistance 100Ω, then the applied voltage leads the current by 45°. The inductance of the coil is

A. $16mH$

B. $12mH$

C. $8mH$

D. $4mH$

Answer: A

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25. The frequency of an alternating current is $50Hz$. The minimum time taken by it is reaching from zero to peak value is

A. $5ms$

B. $10ms$

C. $20ms$

D. $50ms$

Answer: A

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26. The current and voltage functions in an AC circuit are

$$i = 100 \sin 100t mA, V = 100 \sin\left(100t + \frac{\pi}{3}\right)V$$

The power disspitated in the circuit is

A. zero

B. $100w$

C. $220w$

D. $440w$

Answer: C

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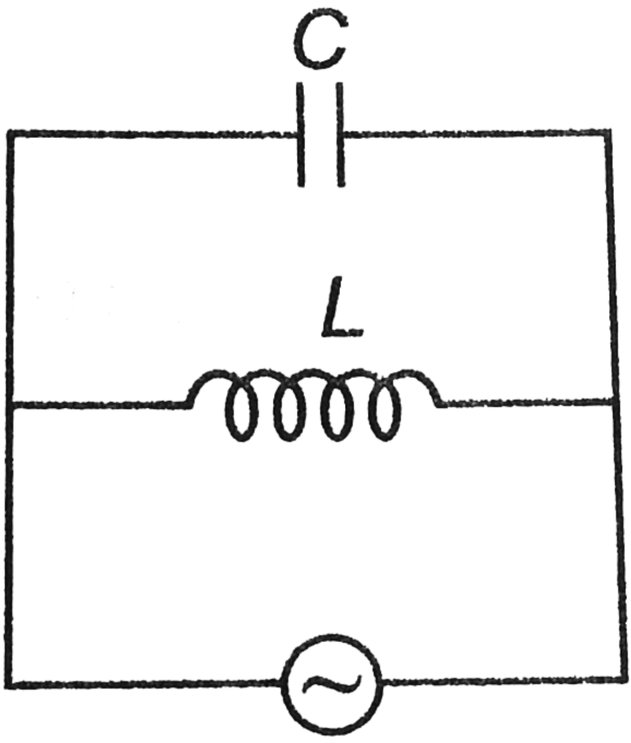
27. In the AC network shown in figureure the rms current flowing through the inductor and capacitor are $0.6A$ and $0.8A$, respectively. Then the current coming out of the source is



A. $1.0A$

B. $1.4A$

C. $0.2A$

D. none of the above

Answer: C

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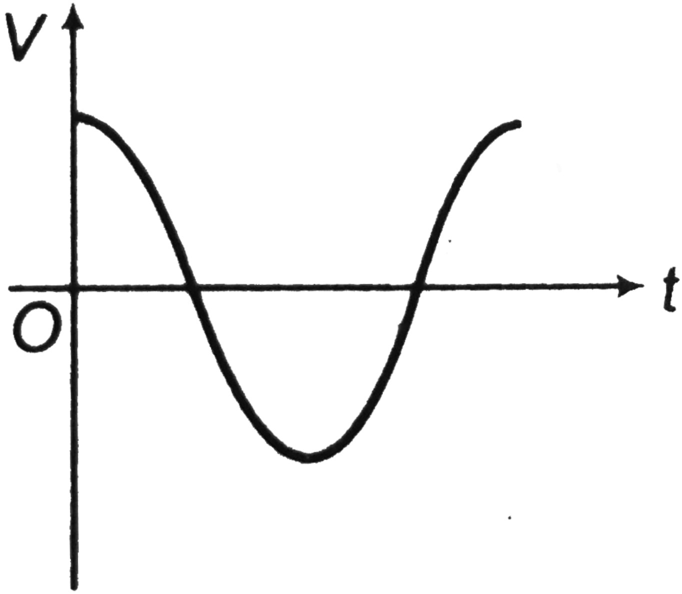
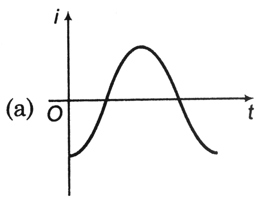
28. The figure represents the voltage applied across a pure inductor. The diagram which correctly represents the variation of current i with time t is given by



A.



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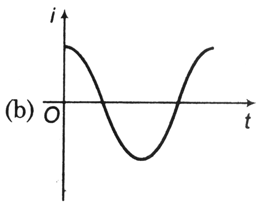
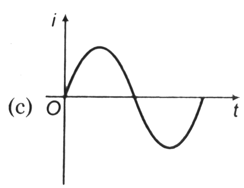
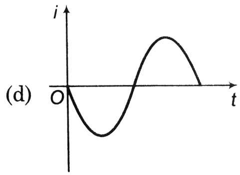


C.



D. 

Answer: C

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29. A steady current of magnitude I and an AC current of peak value I are allowed to pass through identical resistors for the same time. The ratio of heat produced in the two resistors will be

A. $2:1$

B. $1:2$

C. $1:1$

D. none of these

Answer: A

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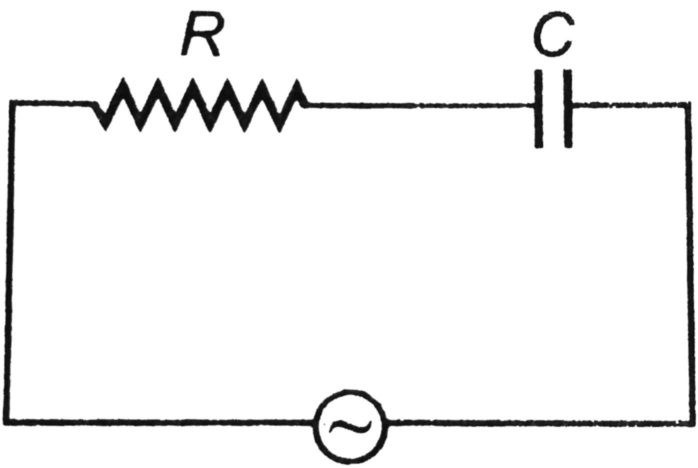
30. A $50 Hz AC$ source of $20V$ is connected across R and C as shown in figureure.



The voltage across R is $12V$. The voltage across C is

A. $8V$

B. $16V$

C. $10V$

D. not possible to determine unless value of R and C are given

Answer: B

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Level - 1 Subjective

1. A 300Ω resistor, a $0.250H$ inductor, and a $8.00\mu F$ capacitor are in series with an Ac with voltage amplitude

$120V$ and angular frequency $400 rad / B$.

(a) What is the current amplitude?

(b) Wheat is the phase angle of the source voltage with respect to the current? Does the source Lag, or lead the current?

(c) What are the voltage amplitudes across the resistor, inductor, and capacitor ?

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2. A series circuit has an impedance of 60.0Ω and a power factor of 0.720 at $50.0Hz$. The source voltage lags the current.

(a) What circuit element, an inductor or a capacitor, should be placed in series with the circuit to raise its power factor?

(b) What size element will raise the power factor to unity?

Watch Video Solution

3. Voltage and current for a circuit with two elements in series are expressed as

$$V(t) = 170\sin\left(6280t + \frac{\pi}{3}\right)vo <$$

$$i(t) = 8.5\sin\left(6280t + \frac{\pi}{2}\right)amp$$

(a) Plot the two waveforms.

(b) Determine the frequency in Hz.

(c) Determine the power factor starting its nature.

(d) What are the values of the elements?

Watch Video Solution

4. A $5.00H$ inductor with negligible resistance is connected across an AC source. Voltage amplitude is kept constant at $60.0V$ but whose frequency can be varied. Find the current amplitude when the angular frequency is

(a) $100 rad/s$

(b) $1000 rad/s$

(c) $10000 rad/s$

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5. A 100Ω resistasnce is connected in series with a $4H$ inductor. The voltage across the resistor is $V_R = (2.0V)\sin(10^3 rad/s)t$:

(a) Find the expession of circuit current

(b) Find the inductive reactance

(c) derive an expression for the voltage across the inductor,

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6. An $L-C-R$ series circuit with $L=0.120H, R=240a$, and $C=7.30\mu F$ carries an rms current of $0.450A$ with a frequency of $400Hz$.

(a) What are the phase angle and power factor for this circuit?

(b) What is the impedance of the circuit?

(c) What is the rms voltage of the source?

(d) What average power is delivered by the source?

(e) What is the average rate at which electrical energy is converted to thermal energy in the resistor?

(f) What is the average rate at which electrical energy is dissipated (converted to other forms) in the capacitor?

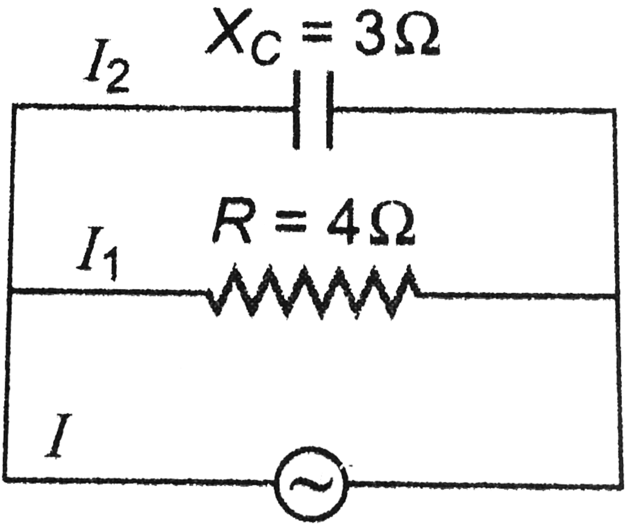
(g) In the inductor ?

Watch Video Solution

Level- 2 Single Correct

1. A capacitor and resistor are connected with an AC source as shown in figureure. Reactance of capacitor is $X_C = 3\Omega$ and resistance of resistor is 4Ω. Phase difference between current I and

$I_1 is \left[\tan^{-1}\left(\frac{3}{4}\right) = 37^\circ\right]$



A. 90°

B. zero

C. 53°

D. 37°

Answer: C

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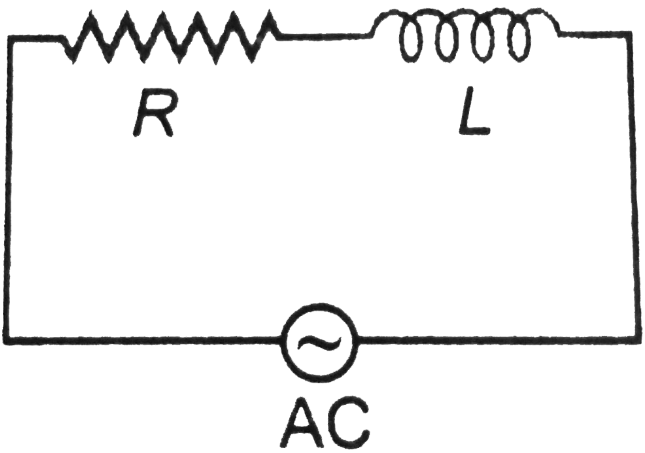
2. A circuit contains resistance R and an inductance L in series. An alternating voltage $V = V_0 \sin \omega t$ is applied across it. The currents in R and L respectively will be



A. $I_R = I_0 \cos \omega t, I_L = I_0 \cos \omega t$

B. $I_R = -I_0 \sin \omega, I_L = I_0 \cos \omega t$

C. $I_R = I_0 \sin \omega, I_L = -I_0 \cos \omega t$

D. none of the above

Answer: D

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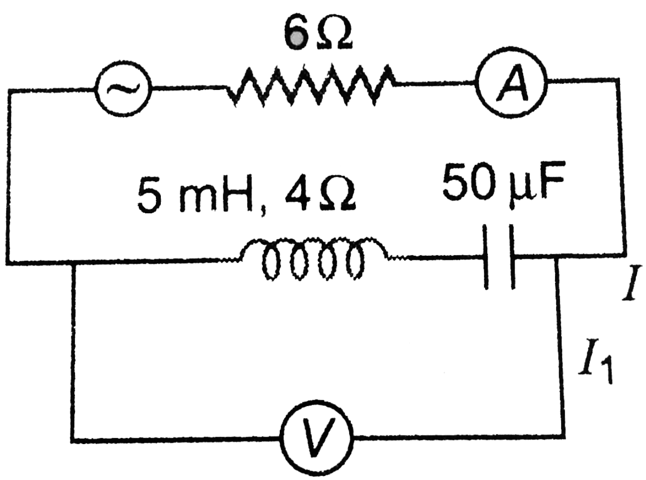
3. In the circuit shown in figure the AC source gives a voltage $V = 20\cos(2000t)$. Neglecting source resistance, the voltmeter and and ammeter readings will be



A. $0V, 2.0A$

B. $0V, 1.4A$

C. $5.6V, 1.4A$

D. $8V, 2.0A$

Answer: C

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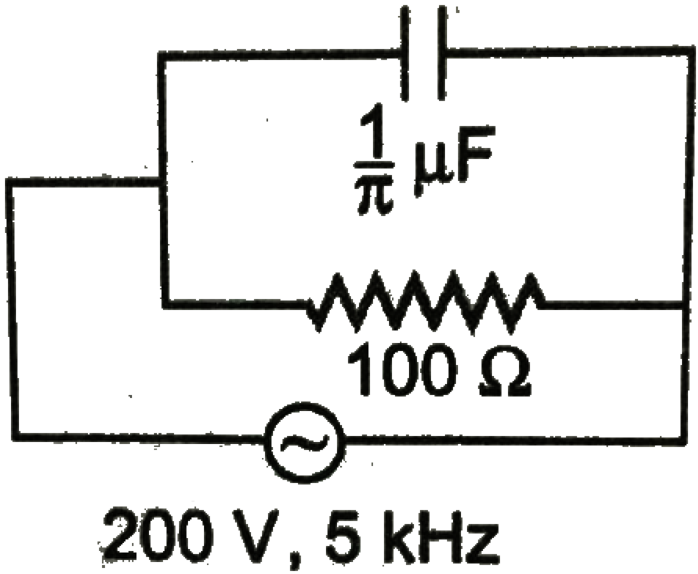
4. A signal generator supplies a sine wave of $200V, 5kHz$ to the circuit shown in the figure. Then, choose the wrong statement.



A. The current in te resistive brance is $0.2A$

B. the current in the capacitive branch is $0.126A$

C. Total line current is $\approx 0.283A$

D. Current in both the branches is same

Answer: B

Watch Video Solution

5. A complex current wave is given by $i = 95 + 5 \sin 100 \omega t) A$. Its given value over one time period is given as

A. $10A$

B. $5A$

C. $\sqrt{50}A$

D. 0

Answer: B

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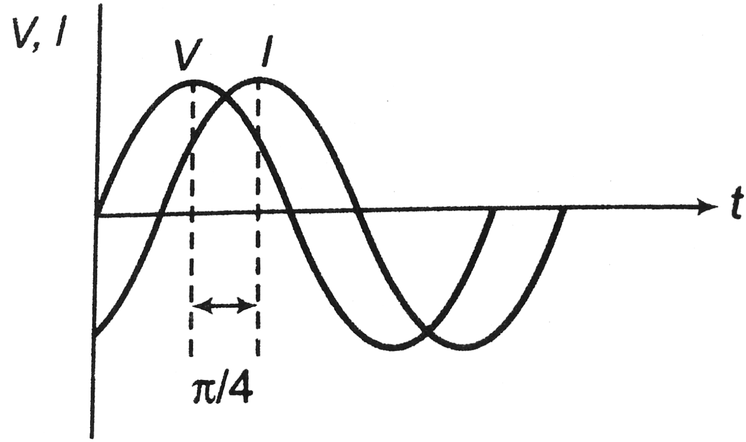
6. An Ac voltage $V = V_0 \sin 100t$ is applied to the circuit, the phase difference between current and voltage is found to be $\frac{\pi}{4}$, then



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A. $R = 100\Omega, C = 1\mu F$

B. $R = 1\Omega, C = 10\mu F$

C. $R = 410k\Omega, L = 1H$

D. $R = 1k\Omega, L = 10H$

Answer: B

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7. In series $L-C-R$ circuit, voltage drop across resistance is $8V$, across inductor is $6V$ and across capacitor is $12V$. Then,

A. voltage of the source will be leading in the circuit

B. voltage drop across each element will be less than the applied voltage

C. power factor of the circuit will be $\frac{3}{4}$

D. none of the above

Answer: D

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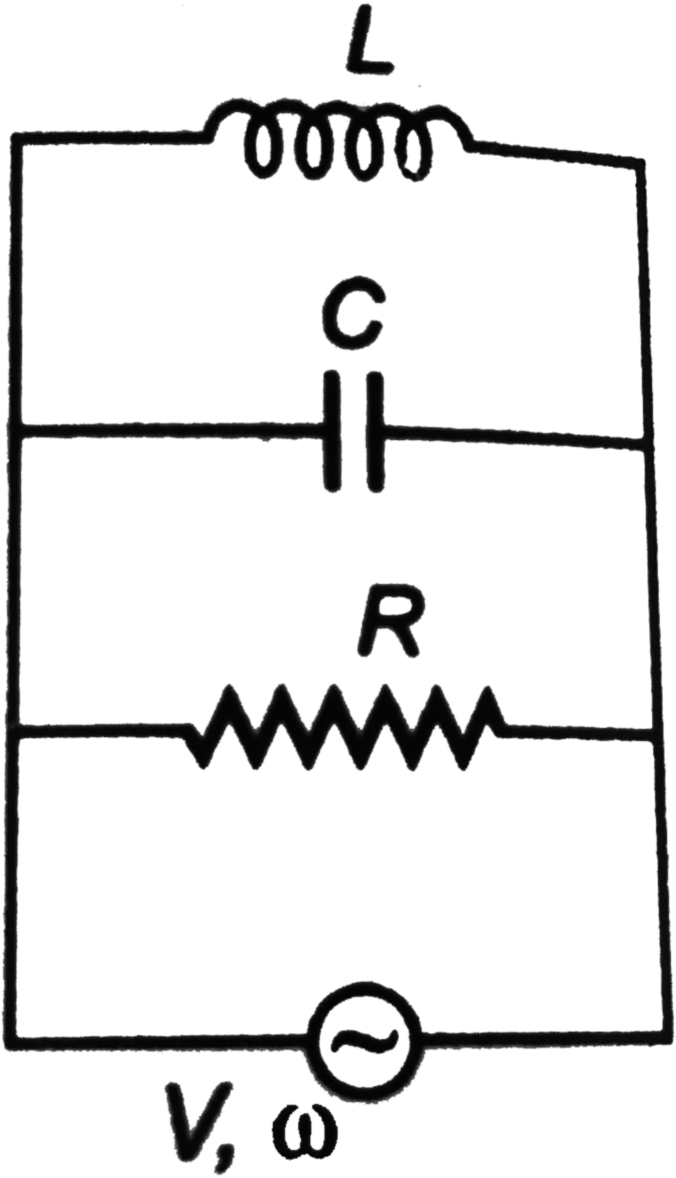
8. Consider in $L-C-R$ circuit as shown in figureure with an AC source of peak value V_0 and angular frequency ω. Then the peak value of current through the

AC



A. $\dfrac{V_0}{\sqrt{\left(\frac{1}{R^2}+\left(\omega L-\frac{1}{\omega C}\right)^2\right)}}$

B. $V_0\left[\dfrac{1}{R^2}+\left(\omega C-\dfrac{1}{\omega L}\right]^2\right.$

C. $\dfrac{V_0}{\sqrt{R^2+\left(\omega L-\frac{1}{\omega C}\right)^2}}$

D. none of these

Answer: B

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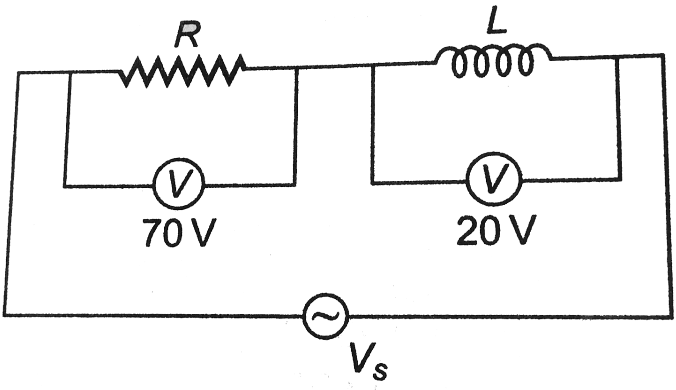
9. The adjoining figure shows an AC circuit with resistance R, inductance L and source voltage V_S. Then



A. the source voltage $V_s = 72.8V$

B. the plane angle between current and source voltage

is $\tan^{-1}\left(\frac{7}{2}\right)$

C. both a and b are correct

D. both a and b are wrong

Answer: A

Watch Video Solution

10. When an alternating voltage of $220V$ is applied across a device P, a current of $0.25A$ flows through the circuit and it leads the applied voltage by a angle $\frac{\pi}{2}$ radian. When the same voltage source is connected across another device Q, the same current is observed in the circuit but in phase with the applied voltage. What is the current when the same source is connected across a series combination of P and Q?

A. $\frac{1}{4\sqrt{2}}$ A lagging in phase by $\frac{\pi}{4}$ with voltage

B. $\frac{1}{4\sqrt{2}}$ A leading in phase by $\frac{\pi}{4}$ with voltage

C. $\frac{1}{\sqrt{2}}$ A leading in phase by $\frac{\pi}{4}$ with voltage

D. $\frac{1}{4\sqrt{2}}$ A leading in phase in $\frac{\pi}{2}$ with voltage

Answer: B

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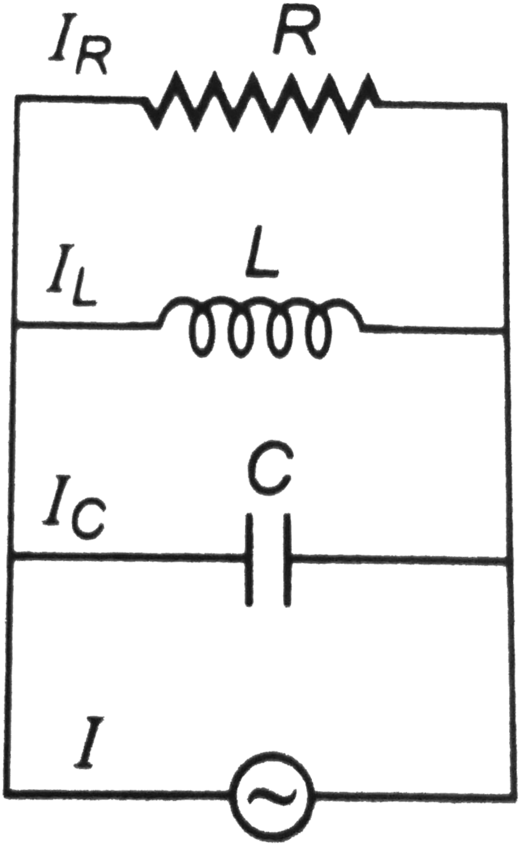
11. In a parallel $L-C-R$ circuit as shown in figureure if I_R, I_L, I_C and I represent the rms values of current flowing through resistor, capacitor and the source, then

choose the appropriate correct answer.



A. $I = I_R + I_L + I_C$

B. $I = I_R + I_L + I_C$

C. I_L or I_C may be greater than I

D. none of these

Answer: C

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12. In a series $L - C - R$ circuit, currenrt in the circuit is $11A$ when the applied voltage is $220V$. voltage across the caspcitor is $200V$. If the value of resistor is 20Ω, then the voltage across the unknown inductor is

A. zero

B. $200V$

C. $20V$

D. none of these

Answer: B

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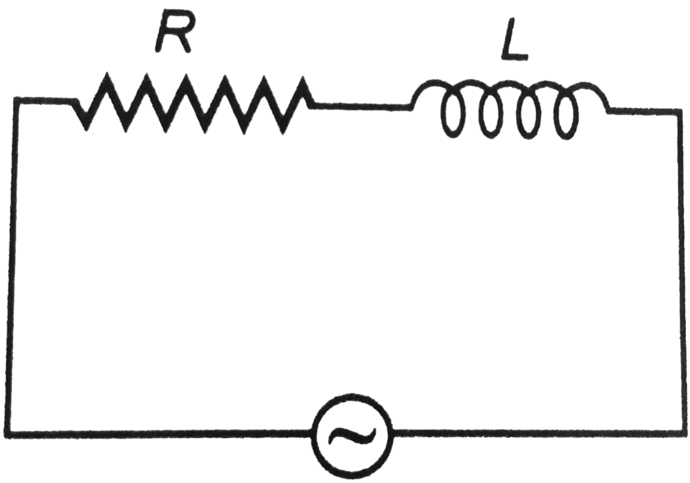
13. In the circuit shown in figureure, the power consumed is



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A. zero

B. $\frac{V_0^2}{2R}$

C. $\dfrac{V_0^{\,2} R}{2(R^2 + \omega^2 L^2)}$

D. none of these

Answer: C

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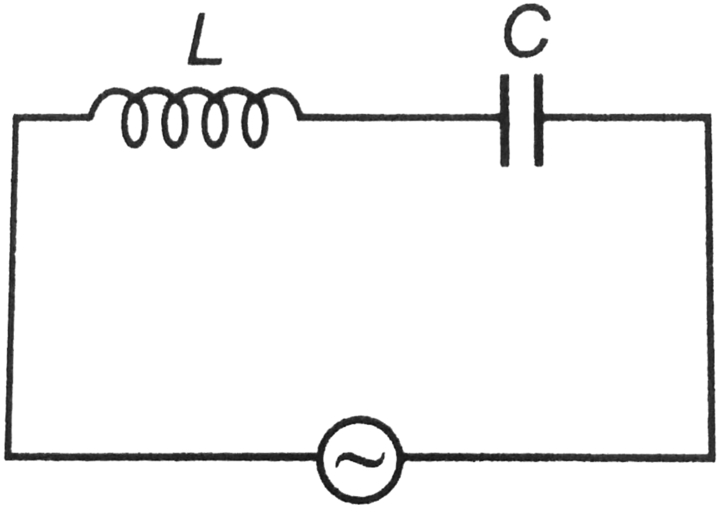
14. In a series $L - C$ circuit, the applied voltage is V_0. if omega is very low, then the voltage drop across the inductor V_L and capacitor V_C are



.

A. $V_L = \frac{V_0}{2}, V_C = \frac{V_0}{2}$

B. $V_L = 0, V_C = V_0$

C. $V_L = V_0, V_C = 0$

D. $V_L = -V_C = \frac{V_0}{2}$

Answer: B

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15. A coil a capacitor and an AC source of rms voltage $24V$ are connected in series. By varying the frequency of the source, a maximum rms current of 6 A is observed. If coil is connected is at DC batteryof emf 12 volt and internal resistance 4Ω, then current through it in steady state is

A. $2.4A$

B. $1.8A$

C. $1.5A$

D. $1.2A$

Answer: C

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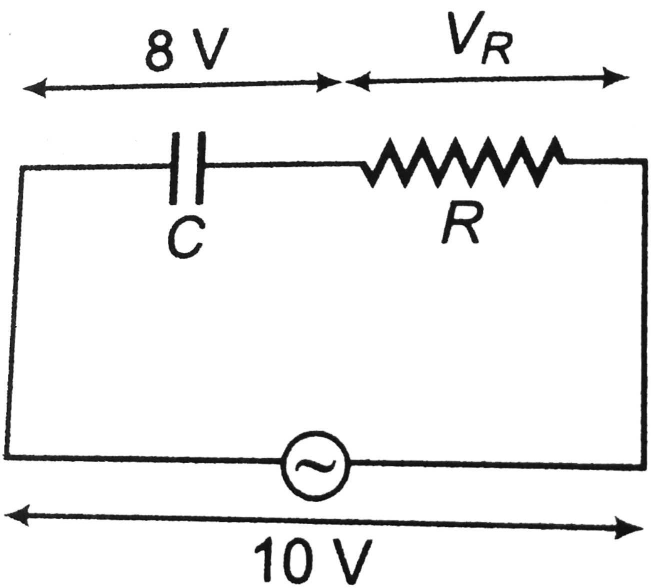
16. In a series $C - R$ circuit shown in figureure, the applied voltage is $10V$ and the voltage across capacitor is found to$8V$. The voltage across R, and the phase difference between current and the applied voltage will respectively be



A. $6V, \tan^{-1}\left(\frac{4}{3}\right)$

B. $3V, \tan^{-1}\left(\frac{3}{4}\right)$

C. $6V, \tan^{-1}\left(\frac{3}{4}\right)$

D. none of these

Answer: A

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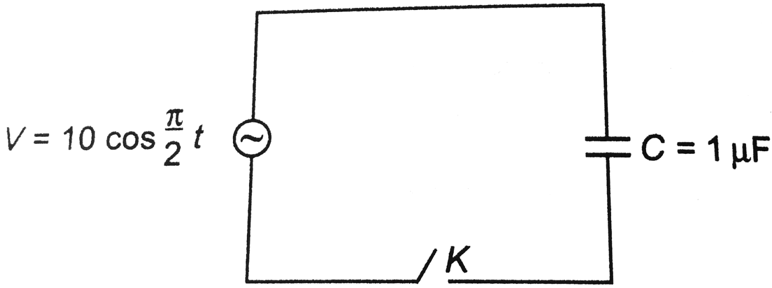
17. An AC voltage source described by $V = 10\cos\left(\frac{\pi}{2}\right)t$ is connected to a $1\mu F$ capacitor as shown in figureure. The key K is closed at $t = 0$. the time $(t > 0)$ after which the magntitude of current I reaches its maximum value for the first time is



A. $1s$

B. $2s$

C. $3s$

D. $4s$

Answer: A

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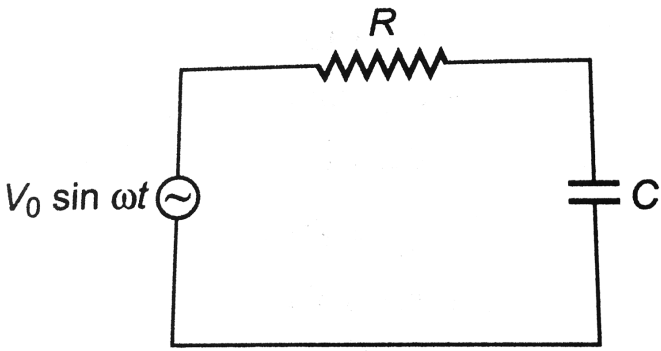
18. An AC voltage source $V = V_0 si\omega t$is connected across resistance R and capacitance C as shown in figureure. It is given that $R = \frac{1}{\omega}C$. The peak current is I_0. If the angular frequency of the voltage source is changed to $\frac{\omega}{\sqrt{3}}$, then the new peak current in the circuit is



A. $\frac{I_0}{2}$

B. $\frac{I_0}{\sqrt{2}}$

C. $\frac{I_0}{\sqrt{3}}$

D. $\frac{I_0}{3}$

Answer: B

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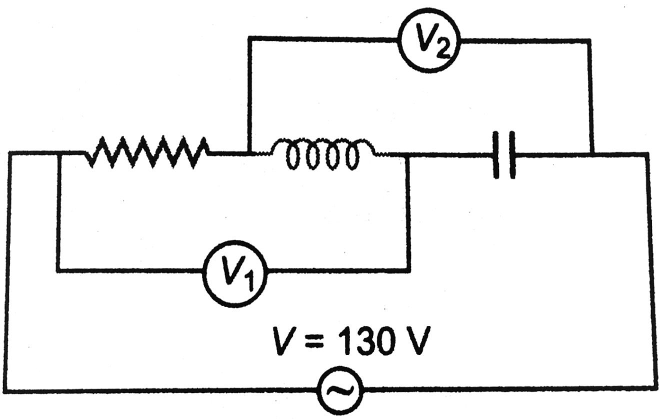
Level- 2More Than One Correct

1. In a $R-L-C$ series circuit shown in readings of voltmeters V_1 and V_2 are $100V$ and $120V$.

Choose the corredct statement(s).



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A. Voltage across resistor, inductor and capacitor are

$50V$, $86.6V$ and $206.6V$ respectively

B. Voltage across resistor, inductor and capacitor are

$10V$, $90V$ and $30V$ respectively

C. Power factor of the circuit is $\frac{5}{13}$

D. Circuit is capacitive in nature

Answer: A::C::D

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2. An alternating current is given by

$I = i_1 \cos \omega t + i_2 \sin \omega t.$

The rms current is given by

A. rms value of current is $5A$

B. mean value of this current in positive one-half period will be $\frac{6}{\pi}$

C. if voltage applied is $V = V_m \sin \omega t$, then the circuit may contain resistance and capacitance

D. if voltage applied is $V = V_m \cos \omega t$, then the circuit may contain resistance and inductance only

Answer: C::D

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3. A tube light of $60V$, $60W$ rating is connected across an AC source of $100V$ and $50Hz$ frequency. Then,

A. an inductance of $\frac{2}{5\pi}$ may be connected in series

B. a capacitor of $\frac{250}{\pi}\mu F$ may be connected in series to it

C. an inductor of $\frac{4}{5\pi}H$ may be connected in series

D. a resistance of 40 Ω may be connected in series

Answer: C::D

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4. In an AC circuit, the power factor

A. is unity when the circuit contains an ideal resistance only

B. is unity when the circuit contains an ideal inductance only

C. is zero when the circuit contains an ideal resistance only

D. is zero when the circuit contains an ideal inductance only

Answer: A::D

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5. In an AC series circuit, $R = 10\Omega, X_L = 20\Omega$ and $XC = 10\Omega$.Then, choose the correct options

A. Voltage function will lead the current function

B. Total impedance of the circuit is $10\sqrt{2}\Omega$

C. Phase angle between voltage function and current function is 45°

D. Power factor of circuit is $\frac{1}{\sqrt{2}}$

Answer: A::B::C::D

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6. In the above problem further choose the correct options.

A. The given values are at frequency less than the resonance frequency

B. The given values are at frequency more than the resonance frequency

C. If frequency is increased from the given value, impedance of the circuit will increase

D. If frequency is decreased from the given value, current in the circuit may increase or decrease

Answer: B::C::D

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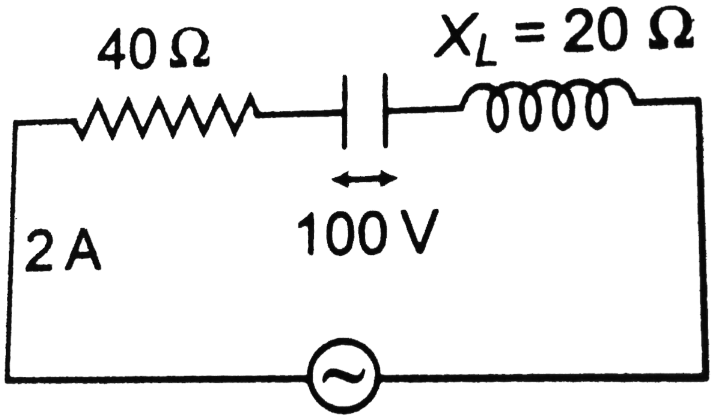
7. In the circuit shown in figureure,



A. $V_R = 80V$

B. $X_C = 50\Omega$

C. $V_L = 40V$

D. $V_0 = 100V$

Answer: A::B::C

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8. In $L-C-R$ series AC circuit,

A. If R is increased, then current will decrease

B. If L is increased, then current will decrease

C. If C is increased, then current will increase

D. If C is increased, then current will decrease

Answer: A

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Level 2 Comprehension

1. A student in a lab took a coil and connected it to a $12VDC$ source. He measures the steady state current in the circuit to be $4A$. He then replaced the $12VDC$ source by a $12V, (\omega = 50rad/s)AC$ source and observes that the reading in the AC ammeter is $2.4A$. He then decides to connect a $2500\mu F$ capacitor in series with the coil and calculate the average power developed in the circuit. Further he also decides to study the variation in current in the circuit (with the capacitor and the battery in series). The value of resistance of the coil calculated by the student is

A. 3Ω

B. 4Ω

C. 5Ω

D. 8Ω

Answer: A

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2. A student in a lab took a coil and connected it to a $12VDC$ source. He measures the steady state current in the circuit to be $4A$. He then replaced the $12VDC$ source by a $12V, (\omega = 50rad/s)AC$ source and observes that the reading in the AC ammeter is $2.4A$. He then decides to connect a $2500\mu F$ capacitor in series with the coil and calculate the average power developed in the circuit. Further he also decides to study the variation in current in the circuit (with the capacitor and the battery in series).

The power developed in te circuit when the capacitor of 2500 μF is connected in series with the coil is

A. 28.8W

B. 23.04W

C. 17.28W

D. 9.6W

Answer: C

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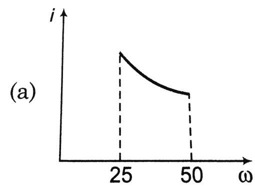
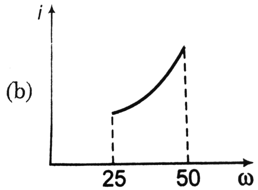
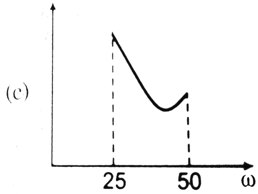
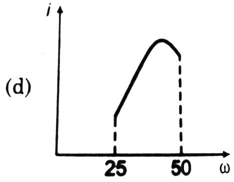
3. A student in a lab took a coil and connected it to a $12 V DC$ source. He measures the steady state current in the circuit to be $4A$. He then replaced the $12 V DC$ source by a $12V, \left(\omega = 50\frac{rad}{s}\right) AC$ source and observes that the reading in the AC ammeter is $2.4A$. He then decides to connect a $2500\mu F$ capacitor in series with the coil and calculate the average power developed in the circuit. Further he also decides to study the variation in current in the circuit (with the capacitor and the battery in series). Which of the following graph roughly matches the variation of current in the circuit (with the coil and capacitor connected in the series) when the angulr frequency is decreased from 50 rad/s to 25 rad/s?

A. 

B. 

C. 

D. 

Answer: B

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4. It is known to all of you that the impedance of a circuit is dependent on the frequency of source. In order to study the effect of frequency on the impedance, a student in a lab took 2 impedance boxes P and Q and connected them in series with an AC source of variable frequency. The emf of the source is constant at $10V$ Box P contains a capacitance of $1\mu F$ in series with a resistance of 32Ω. And the box Q has a coil of self-inductance $4.9mH$ and a resistance of 68Ωin series. He adjusted the frequency so that the maximum current flows in P and Q. Based on his experimental set up and the reading by him at various moment, answer the following questions.

The angular frequency foer which he detects maximum current in the circuit is

A. $\frac{10^5}{7} rad/s$

B. $10^4 rad/s$

C. $10^5 rad/s$

D. $\frac{10^4}{7} rad/s$

Answer: A

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5. It is known to all of you that the impedance of a circuit is dependent on the frequency of source. In order to study the effect of frequency on the impedance, a student in a lab took 2 impedance boxes P and Q and connected them in series with an AC source of variable frequency. The emf of the source is constant at $10V$ Box P contains a capacitance of $1\mu F$ in series with a resistance of 32Ω. And the box Q has a coil of self-inductance $4.9mH$ and a resistance of 68Ωin series. He adjusted the frequency so that the maximum current flows in P and Q. Based on his experimental set up and the reading by him at various moment, answer the following questions.

Impedance of box P at the above frequency is

A. 70Ω

B. 77Ω

C. 90Ω

D. 100Ω

Answer: B

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6. It is known to all of you that the impedance of a circuit is dependent on the frequency of source. In order to study the effect of frequency on the impedance, a student in a lab took 2 impedance boxes P and Q and connected them in series with an AC source of variable frequency. The emf of the source is constant at $10V$ Box P contains a capacitance of $1\mu F$ in series with a resistance of 32Ω. And the box Q has a coil of self-inductance $4.9mH$ and a resistance of 68Ωin series. He adjusted the frequency so that the maximum current flows in P and Q. Based on his experimental set up and the reading by him at various moment, answer the following questions.

Power factor of the circuit at maximum current is

A. $\frac{1}{2}$

B. 1

C. 0

D. $\frac{1}{\sqrt{2}}$

Answer: B

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Level 2 Subjective

1. A coil is series with a $20\mu F$ capacitor across a $230V, 50Hz$ supply. The current taken by the circuit is $8A$ and the power consumed is $200W$. Calculate the inductance of the coil if the current in the circuit is

(a) leading

(b) lagging

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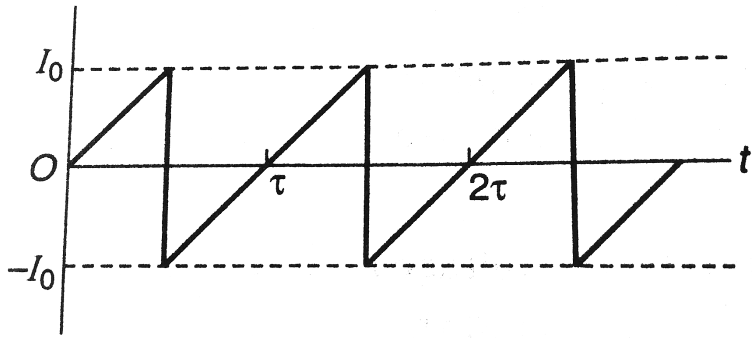
2. The current in a certain circuit varies with time as shown in figure. Find the average current and the rms current in terms of I_0



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3. Two impedances Z_1 and Z_2 when connected separately across a $230V, 50Hz$ supply consume $100W$ and $60W$ at power factor of 0.5 lagging and 0.6 leading respectively. If these impedances are now connected in series across the same supply, find

(a) total power absorbed and overall power factor

(b) the value of reactance to be added in series so as to raise the overall power factor to unity.

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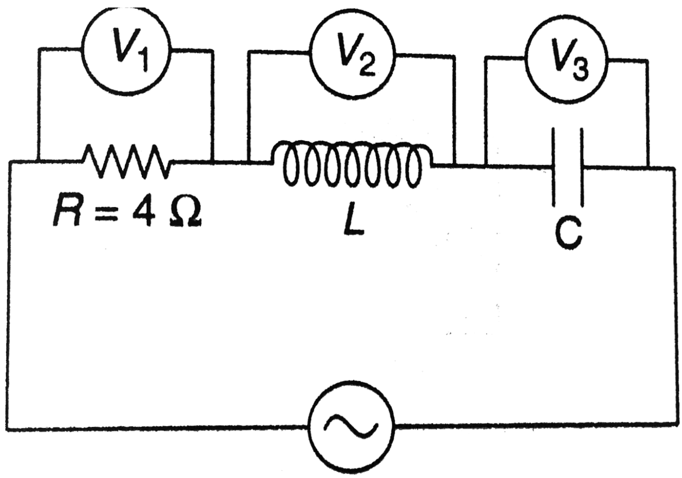
4. In the figure shown, the reading of voltmeters are $V_1 = 40V$, $V_2 = 40V$ and $V_3 = 10V$. Find



(a) the peak value of current

(b) the peak value of emf

(c) the value of L and C.

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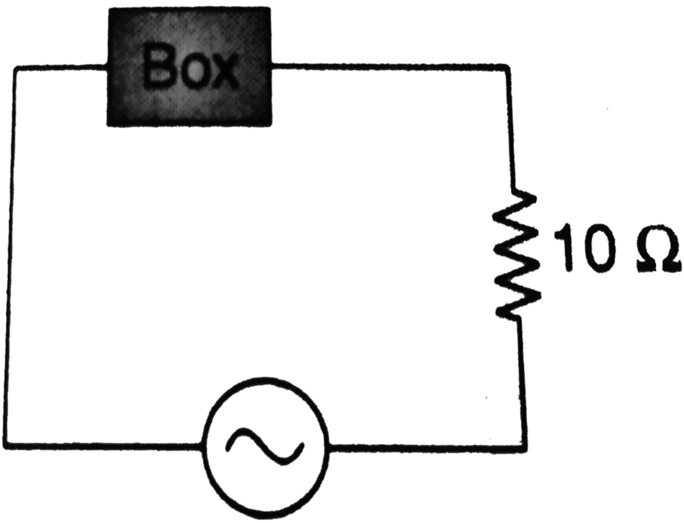
5. In the circuit shown in figure power factor of box is 0.5 and power factor of circuit is $\frac{\sqrt{3}}{2}$ .Current leading the voltage. Find the effective resistance of the box.



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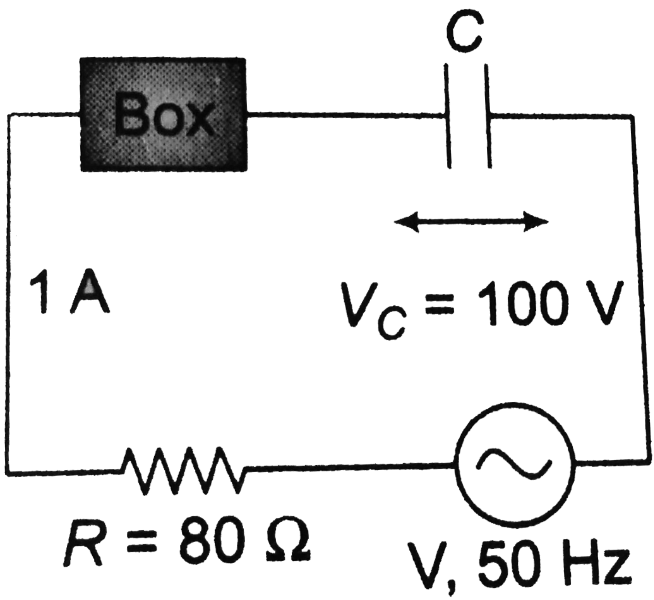
6. A circuit element shown in the figureure as a box is having either a capacitor or an inductor. The power factor of the circuit is 0.8, while current lags behind the voltage. Find



(a) the source voltage V,

(b) the nature of the element in box and find its value.

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7. The maximum values of the alternating voltages and current are $400V$ and $20A$ respectively in a circuit connected to $50Hz$ supply and these quantities are sinusoidal. The instantaneous values of the voltage and current are $200\sqrt{2}V$ and $10A$, respectively. At $t=0$, both are increasing positively.

(a) Write down the expression for voltage and current at time t.

(b) Determine the power consumed in the circuit.

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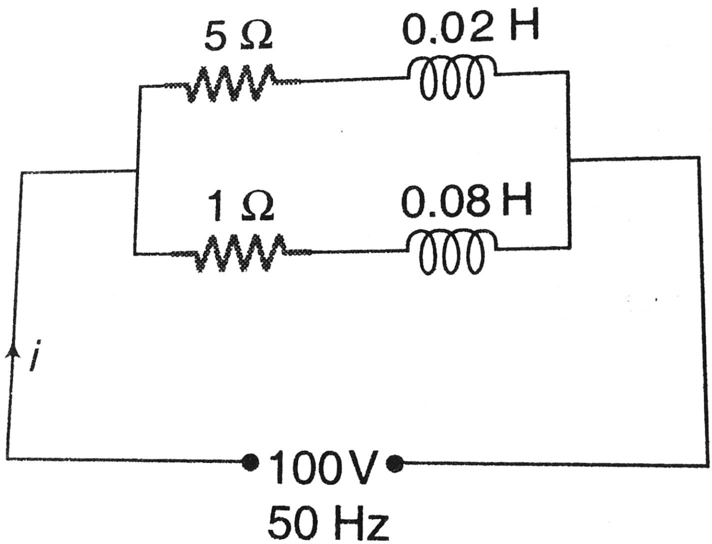
8. An $L-C$ circuit consists of an inductor coil withh $L=50.0mH$ and $20.0\mu F$ capacitor. There is negligible resistance in the circuit. The circuit is driven by a voltage source with $V=V_0\cos\omega t$. If $V_0=5.00mV$ and the frequency is twice the resonance frequency, determine.

a. the maximum charge on the capacitor.

b. the maximum current in the circuit.

c. the phase relationship between the voltages across the inductor, the capacitor and the sourse.

9. A coil having a resistance of 5 Ω and an inductance of $0.02H$ is arranged in parallel with another coil having a resistance of 1Ω and an inductance of $0.08H$. Calculate the power absorbed when a voltage of $100V$ at $50Hz$ is applied.



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10. A circuit takes a current of $3A$ at a power factor of 0.6 lagging when connected. to a $115V - 50Hz$ supply. Another circuit takes a current of $5A$ at a power factor of

0.707 leading when connected to the same supply. If the two circuits are connected in series across a $230V 50Hz$ supply, then calculate

(a) the current

(b) the power consumed and (c) the power factor

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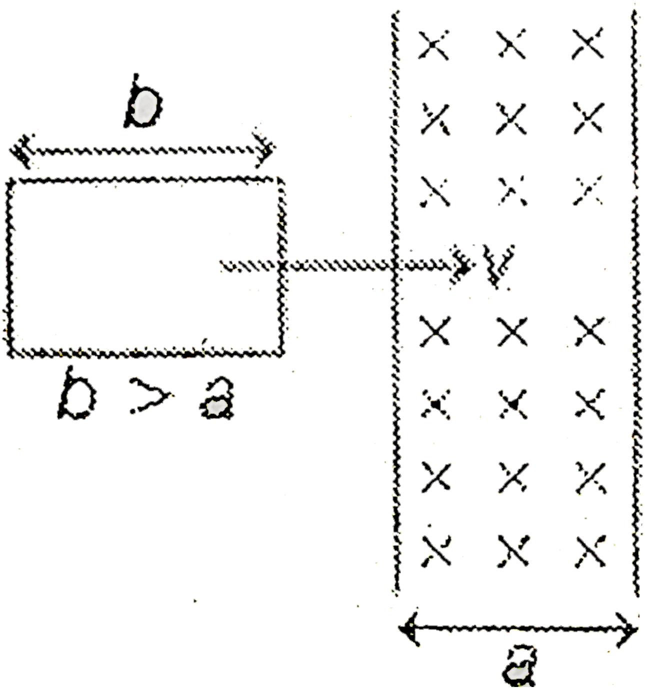
1. In the given arrangement, the loop is moved with consisant velocity in uniform magnetic field B in a restricted a region of width a. The time for which the emf is induced in the cirucit is



A. $\frac{2b}{v}$

B. $\frac{2a}{v}$

C. $\frac{a+b}{v}$

D. $\frac{2(b-a)}{v}$

Answer: B

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

A. zero

B. 25V

C. 20V

D. 15V

Answer: B

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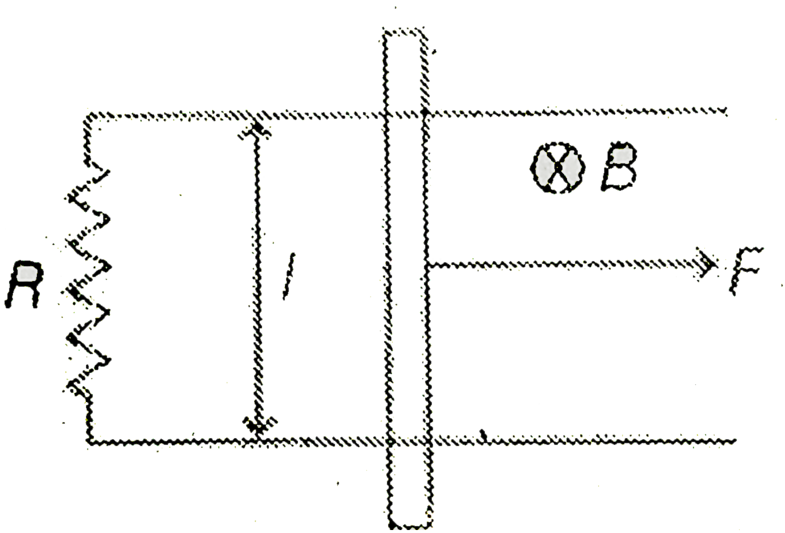
3. A constant force is being applied on a road of length 'l' kept at rest on two parallel conducting rails connected at ends by resistance R in uniform magnitic field B shown.



A. Thepower delivered by force will remain constant with time

B. The power delivered by force will be increasing first and then it will decrease

C. The power delivered by force will be increasing constinously

D. The power delivered by force will be decreasing continously

Answer: C

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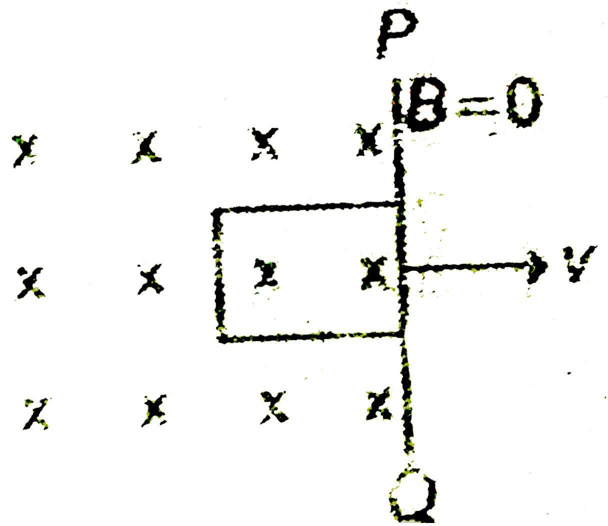
4. Figures shows a square loop of side 1m and resistance 1Ω. The magnetic field on left side of line PQ has a magnitude B=1.0T. The work done in pulling the loop out of the field uniformly in 1 s is



A. 1J

B. 10J

C. 0.1J

D. 100J

Answer: A

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5. A wire of fixed length is wound on a solenoid of length l and radius r. Its self-inductance is found to be L. Now, if the same wire is wound on a solenoid of length $l/2$ and radius $r/2$ then the self-inductance will be

A. 2L

B. L

C. 4L

D. 8L

Answer: D

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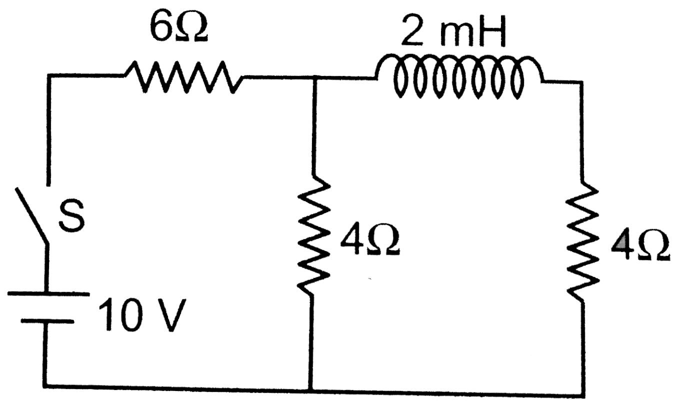
6. In the given circuit, let i_1 be the current drawn battery at time $t = 0$ and i_2 be steady current at $t = \infty$ then the ratio $\frac{i_1}{i_2}$ is



A. 0.6

B. 0.8

C. 1.2

D. 1.5

Answer: B

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7. In a series L-R growth circuit, if maximum current and maximum voltage across inductor of inductane 3mH are 2A and 6V respectively, the the time constant of the circuit is

A. 1ms

B. 2ms

C. 0.5ms

D. 0.6ms

Answer: A

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8. A resistance is connected to a capacitor in AC are the phase differece is $\frac{\pi}{4}$ between current and voltage. Whe the same resistance is connected to an inductor, phase difference becomes $\tan^{-1}(2)$. Power factor of the circuit when both capacitor and inductor are connect to the resistance will be

A. 1

B. $\frac{1}{\sqrt{2}}$

C. $\frac{1}{\sqrt{3}}$

D. $\frac{1}{2}$

Answer: B

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9. A reacangular loop if size $(2m \times 1m)$ is placed in x-y plane. A uniform but time varying magnetic field of strength T where t is the time elsapsed in second exists in sosace. The magnitude of induced emf (in V) at time t is

A. 20=20i

B. 20

C. 20i

D. zero

Answer: D

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10. State wheather the following two statement are true or false

A. TF

B. FF

C. TR

D. FT

Answer: A

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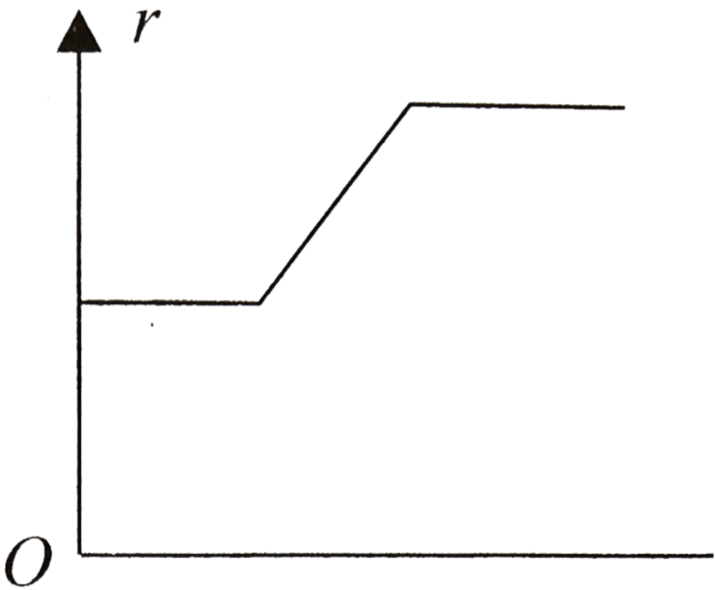
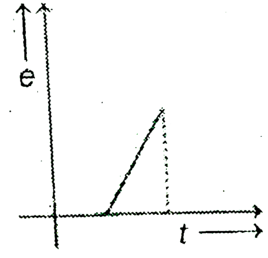
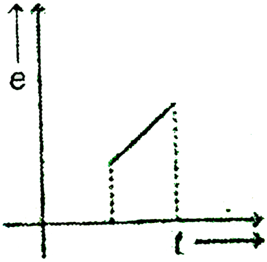
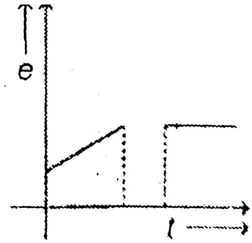
11. Radius of a circular ring is changing with time and the coil is placed in uniform magnetic field perpendicular to its plane. The variation of 'r' with time 't' is shown in Fig. Then induced emf e with time t will be best represented by

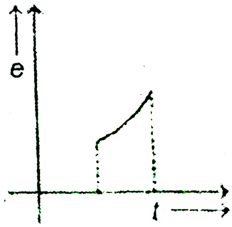


A.



B. 

C. 

D. 

Answer: B

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12. r.m.s. value of current i=3+4sin `(omegat+pi//3) is

A. 5A

B. $\sqrt{2}A$

C. $\frac{5}{\sqrt{2}A}$

D. $\frac{7}{\sqrt{2}}A$

Answer: B

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13. An AC voltage of $V = 220\sqrt{2}\sin\left(100\pi t + \frac{\pi}{2}\right)V$ is applied across a DC votlmeter, its reading will be

A. $220\sqrt{2}V$

B. 110V

C. 220V

D. zero

Answer: D

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14. A direct current of 2 A and an alternating current having a maximum value of 2 A flow through two identical resistances. The ratio of heat produced in the two resistances will be

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: C

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15. By what percentage the impedance in an AC series circuit should be increased so that the power factir changes from $(1/2)\text{to}(1/4)$ (when R is constant)?

A. 2

B. 1

C. 0.6

D. 4

Answer: B

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16. A power transformer (step up) with an $1:8$ turns ratio has $60Hz, 120V$ across the primary, the load in the secondary is $10^4\Omega$.The current in the secondary is

A. 1.2A

B. 0.96A

C. 12mA

D. 96mA

Answer: D

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17. A choke coil has.

A. high inductance and high resistance

B. low inductance and low resistance

C. high inductance and low resistance

D. low inductance and high resistance

Answer: C

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18. Comparing the L-C oscillations with the oscillations of a spring-block system (force constant of spring=k and mass of block=m), the physical quantity mk is similar to

A. CL

B. V$\frac{1}{CL}$

C. $\frac{C}{L}$

D. $\frac{L}{C}$

Answer: D

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19. A capacitor of capacity $2\mu F$ is changed to a potential different of $12V$. It is then connected across an inductor of inductance $0.6mH$ What is the current in the circuit at a time when the potential difference across the capacitor is $6.0V$?

A. 3.6A

B. 2.4A

C. 1.2A

D. 0.6A

Answer: D

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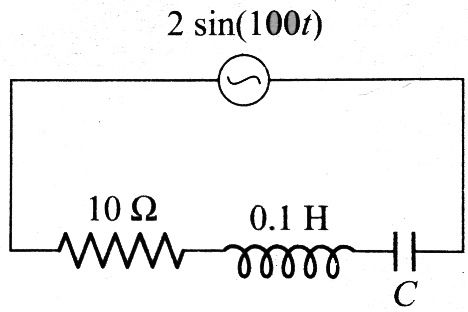
20. The power factor of the circuit in fig. is $1/\sqrt{2}$. The capacitance of the circuit is equal to



A. $400\mu F$

B. $300\mu F$

C. $500\mu F$

D. $200\mu F$

Answer: C

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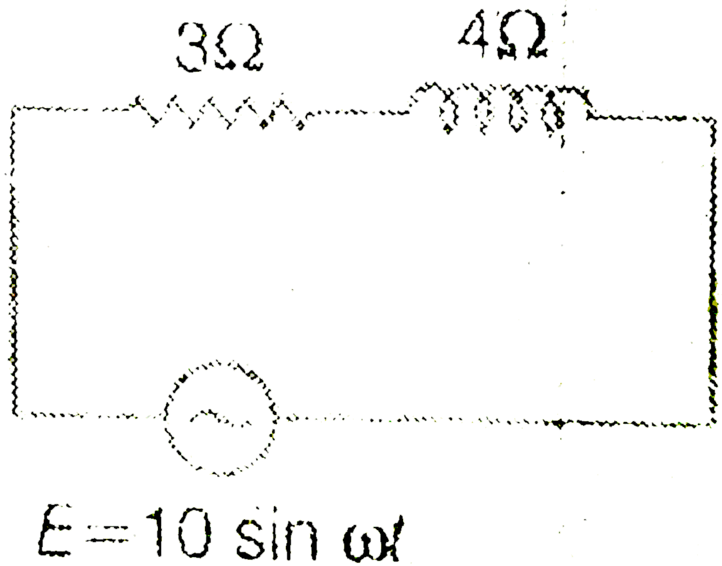
21. An ac-circuit having supply voltage E consists of a resistor of resistance 3Ω and an inductor of reactance 4Ω as shown in the figure. The voltage across the resistane at $t = \frac{\pi}{\omega}$ is



A. 6.4V

B. 10V

C. zero

D. 4.8V

Answer: D

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22. In series LR circuit, $X_L = 3R$. Now a capacitor with $X_C = R$ is added in series. The ratio of new to old power factor

A. $\sqrt{3}$

B. 2

C. $\frac{1}{\sqrt{2}}$

D. $\sqrt{2}$

Answer: C

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23. For L-R circuit, the time constant is equal to

A. twice the ratio of the energy stored in the magnetic field to the ratio of dissipation of energy in the resistance

B. the ratio of the energy stored in the magnetic field to the ratio of dissipation of energy in the resistance

C. half of the ratio of the energy stored in the magnetic field to the ratio of dissipation of energy in the resistance

D. square of the ratio of the energy stored in the magnetic field to the ratio of dissipation of energy in the resistance

Answer: A

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24. Dimensions of $\xrightarrow[\text{electric flux}]{\text{magnetic flux}}$ are

A. $(L - T^{-1})$

B. (TL^{-1})

C. $(L^3 r^2 A^{-2})$

D. $\left(M^0L^0T^0\right)$

Answer: D

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25. A current of $2A$ is increasing at a rate of $4A/s$ through a coil of inductance $2H$. The energy stored in the inductor per unit time is

A. 2J/s

B. 1J/s

C. 16J/s

D. 4J/s

Answer: C

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26. In an LR circuit, current at t=0 is 2A . After 2s it reduced to 18A. The time constant of the circuit is (in second)

A. $In\left(\frac{10}{9}\right)$

B. 2

C. $\frac{2}{In\left(\frac{10}{9}\right)}$

D. $2In\left(\frac{10}{9}\right)$

Answer: C

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27. A coil of inductance 1H and neligible resistance is connected to a source of supply, whose voltage is given by V=4VOLT. If the voltage is applied at t=0, find the energy stored in the coil in 4s

A. 512J

B. 256J

C. 1024J

D. 144J

Answer: A

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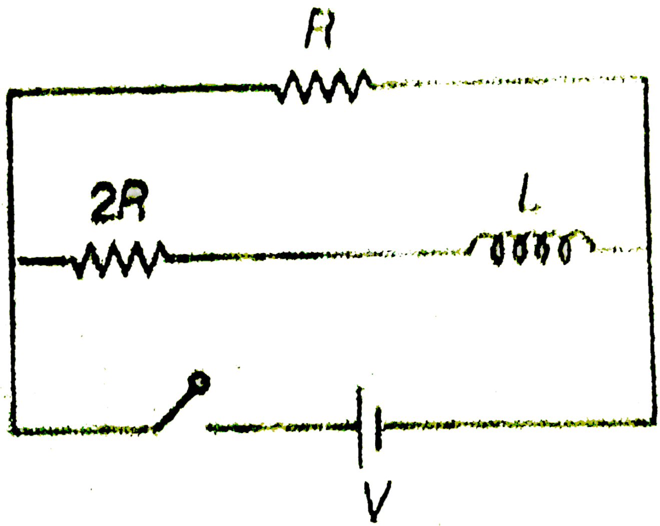
28. The ratio of time constant during current growth and current decay of the circuit shown in Figure is



A. $1:1$

B. $3:2$

C. $2:3$

D. $1:3$

Answer: B

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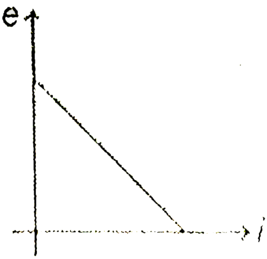
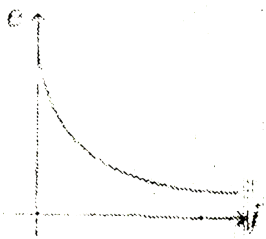
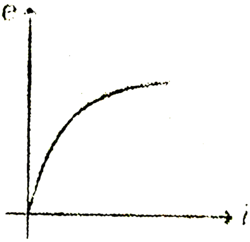
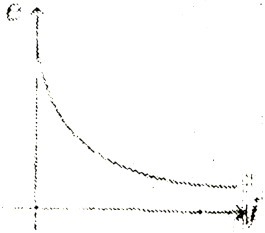
29. In an L-R circuit connected to a battery of constant emf E, switched is closed at time t=0. If denotes the induced emf across inductor and I the current in the circuit at any time t. Then which of the following graphs shown the variation of e with i?

A. 

B. 

C. 

D. 

Answer: A

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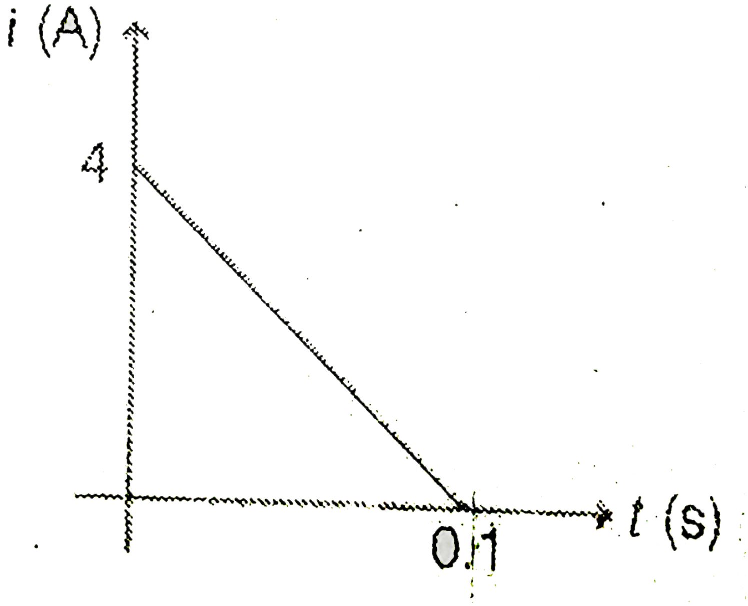
30. Some magnetic flux is changed from a coil resistance 10Ω. As a result an induced current developed in it. Which varies with time as shown figure, The magnitude of changes f in flux through the coil (in webers) is



A. 2

B. 4

C. 6

D. 8

Answer: A

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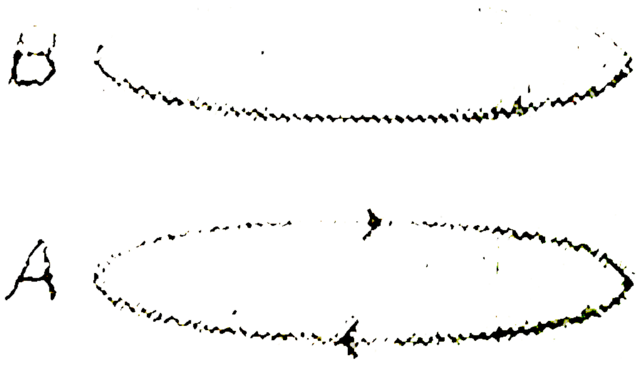
31. Two circular coils A and B are facing each other in shown figure. The current I through A can be alterned



A. there will be repuision 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 between A and B if I is increased

D. attraction of repusion between A and B depend on the direction of current, It does not depending wheather the current is increased or decreased

Answer: A

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32. Two coils are at fixed location: When coil 1 has no corrent and the current in coil 2 increase at the rate of $15.0 As^{-1}$, the emf in coil 1 is $25 mV$, when coil 2 has no current and coil 1 has a current of $3.6 A$, the flux linkange in coil 2 is

A. 16mWb

B. 10mWb

C. 4.00mWb

D. 6.00mWb

Answer: D

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33. Two identical coaxial circular loops carry a current i each circulating int the same direction. If the loops approch each other the current in

A. the current in each loop will decreases

B. the current in each loop will increases

C. the current in each loop will remain the same

D. the current in one tlop will increase and in the other loop will decrease

Answer: A

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34. Two coil A and B have coefficient of mutual inductance M=2H. The magnetic flux passing through coil A charges 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 0.5A

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 8A

D. a change in current of 1A in coil A will produces change in the flux passing through B by 4Wb

Answer: B

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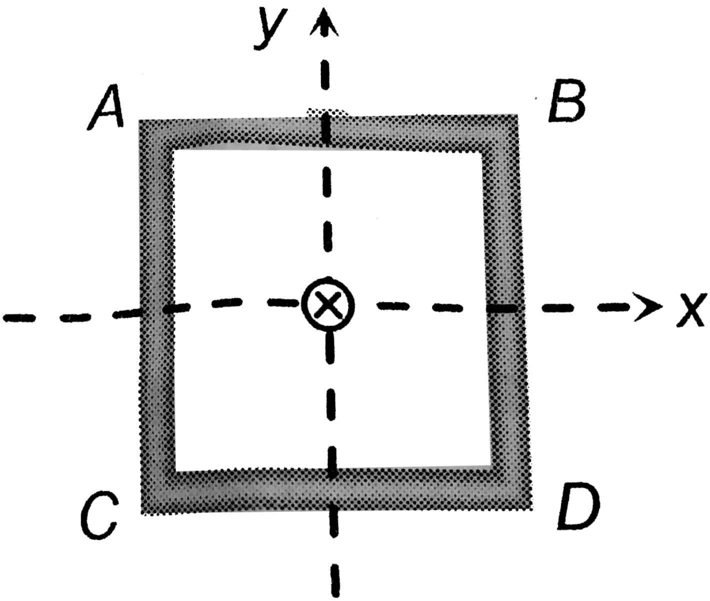
35. A square coil ABCD lying in $x-y$ plane with its centre at origin. A long straight wire passing through origin carries a current $i=2t$ in negative z-direction. The induced current in the coil is



A. clockwise

B. anticlockwise

C. altenating

D. zero

Answer: D

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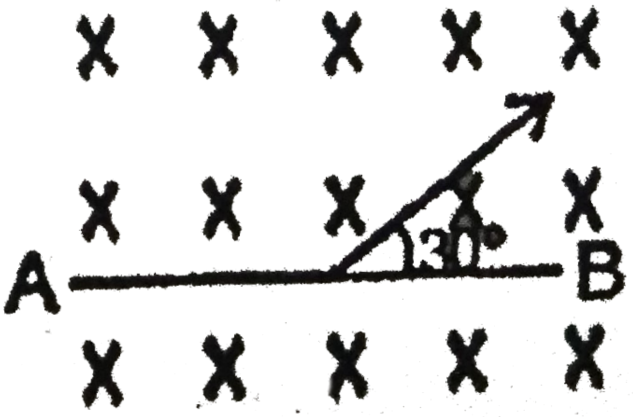
36. A conducting rod AB of length $l = 1m$ is moving at a velocity $v_A = 4m/s$ making an angle 30° with its length. A uniform magnetic field $B = 2T$ exists in a direction perpendicular to the plane of motion. Then



A. $V_A - V_B = 8V$

B. $V_A - V_B = 4V$

C. $V_B - V_A = 8V$

D. $V_B - V_A = 4V$

Answer: B

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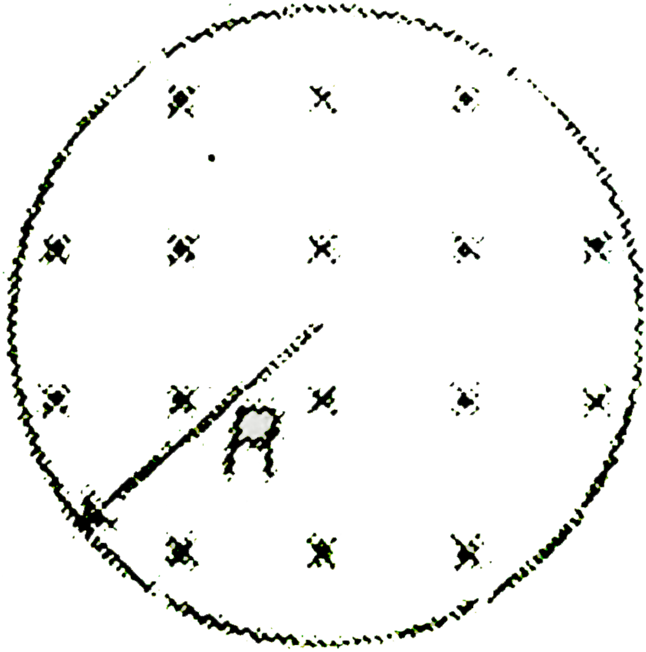
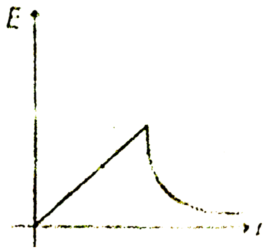
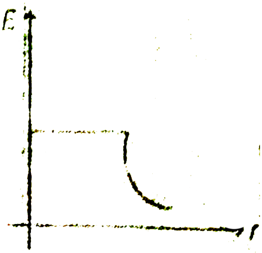
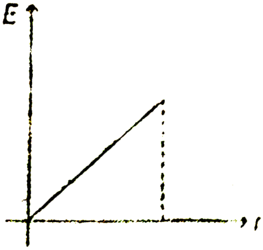
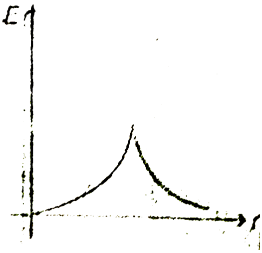
37. A cylindrical space of radius R is filled with a uniform magnetic induction parallel to the axis of the cylinder. If B charges at a constant rate, the graph showin the variation of induced electric field with distance r from the axis of cylinder is



A. 

B. 

C. 

D. 

Answer: A

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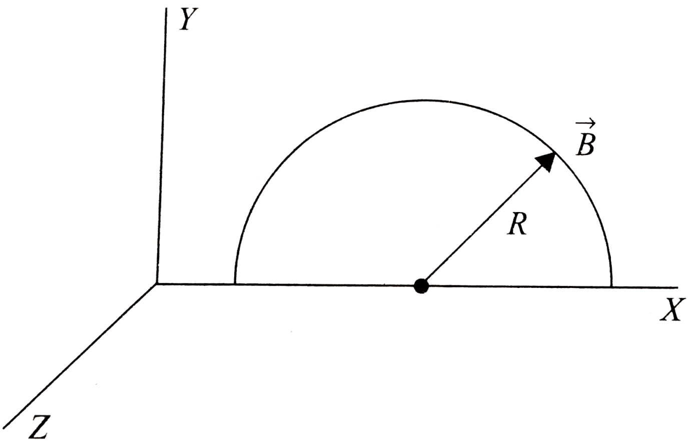
38. A semicircle conducting ring of radius R is placed in the xy plane, as shown in Fig. A uniform magnetic field is set up along the x-axis. No emf, will be induced in the ring if



A. positive x-direction

B. positive y-direction

C. positvie z-direction

D. none of the above

Answer: A

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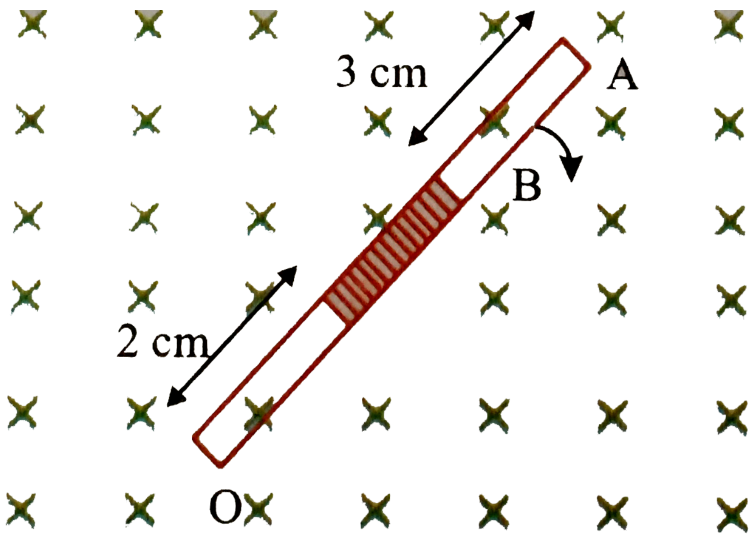
39. A rod of length $10cm$ made up of conducting and non-conducting material (shaded part is non-conducting). The rod is rotated with constant angular velocity $10rad/s$ about point O, in constant magnetic field of $2T$ as shown in the figure. The induced emf between the point A and B of rod will be:



A. 0.029V

B. 0.1V

C. 0.051V

D. 0.064V

Answer: C

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40. Power factor in series LCR circuit at reasonance is

A. 1

B. $\frac{1}{\sqrt{2}}$

C. zero

D. infinite

Answer: A

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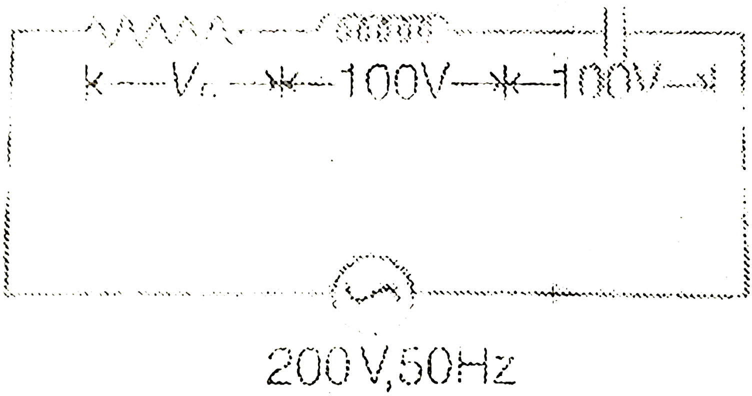
41. In the circuit shown in figure value of V_R is



A. 400V

B. 200V

C. 300V

D. zero

Answer: B

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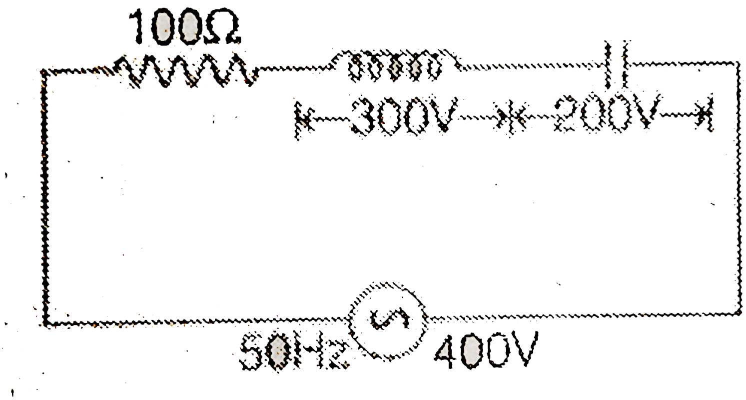
42. In the circuit shown in figure current in the circuit is



A. 1.27A

B. 2.23A

C. 4.26A

D. 4 A

Answer: D

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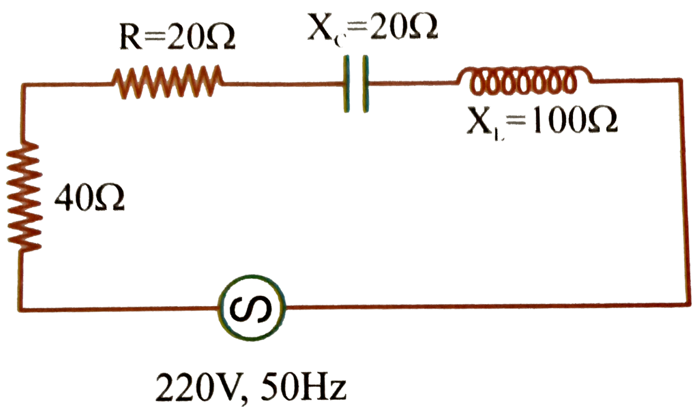
43. The power factor of the circuit shown in the figure is



A. 0.4

B. 0.2

C. 0.8

D. 0.6

Answer: D

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44. An inductor coil stores U energy when i` current is passed through it and dissipates energy at the rate of P. The time constant of the circuit, when this coil is connected across a battery of zero internal resistance is

A. $\frac{4U}{P}$

B. $\frac{U}{P}$

C. $\frac{2U}{P}$

D. $\frac{2P}{U}$

Answer: C

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45. The dimensions of magnetic flux are

A. $[MLT^{-3}A^2]$

B. $[ML^2A^{-1}]$

C. $[ML^2T^2A]$

D. $[ML^2TA^{-1}]$

Answer: B

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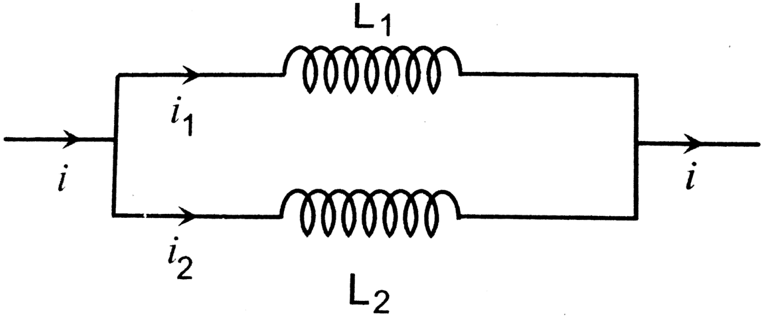
46. Two inductors L_1 and L_2 are connected in parallel and a time varying current flows as shown.

the ratio of current i_1 / i_2



A. L_1 / L_2

B. L_2 / L_1

C. $L_1^2 / (L_1 + L_2)^2$

D. $L_2^2 / (L_1 + L_2)^2$

Answer: B

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47. A resistance is connected to a n AC source. If a capacitor is induced in the series cirucit, the average power absorbed by the resistance

A. will increase

B. will decrease

C. may increase or decrease

D. will remain constant

Answer: B

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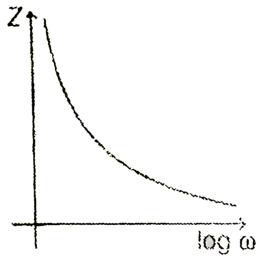
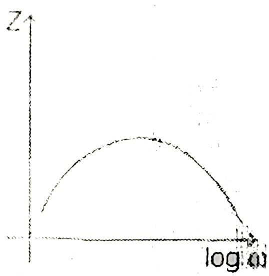
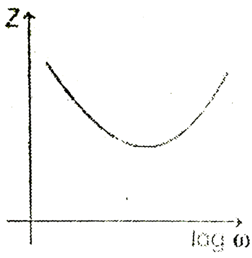
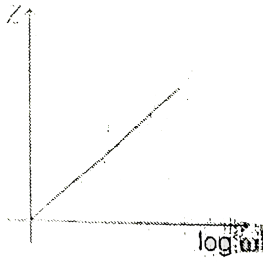
48. Which of the following plots may represent is impedence of a series LCR combination?

A. 

B. 

C. 

D. 

Answer: C

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49. An inductor-coil having some resistance is connected to an AC source. Which of the following quantities have zero average value over a cycle?

A. induced emf in the inductor

B. Current

C. Both a and b

D. Neither a nor b

Answer: C

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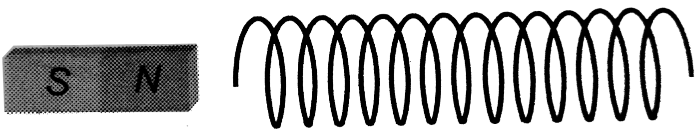
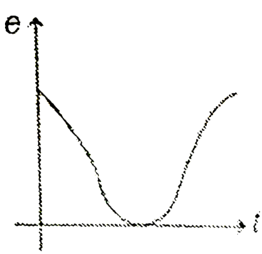
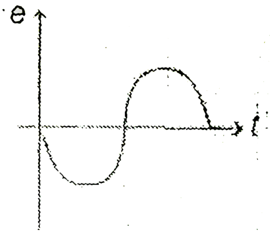
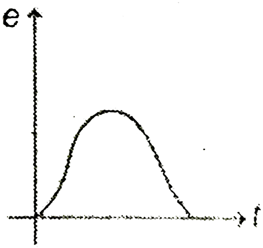
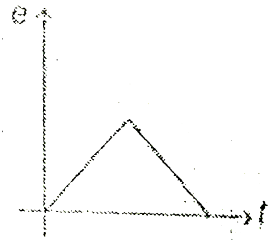
50. The variation of induced emf (E) with time (t) in a coil if a short bar magnet is moved along its axis with a constant velocity is best represent as



A. 

B. 

C. 

D. 

Answer: B

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51. An inductor L is allowed to discharge through capacitor C. The emf induced across the inductance when the capacitor is fully charged is

A. maximum

B. minimum

C. zero

D. infinite

Answer: A

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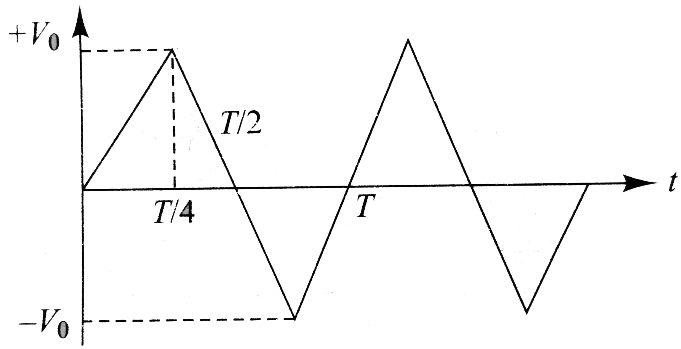
52. The voltage time (V-t) graoh for triangular wave having peak value (V_0) is as shown in fig.



A. $\frac{V_0}{3}$

B. $\frac{V_0}{2}$

C. $\frac{V_0}{\sqrt{2}}$

D. $\frac{V_0}{\sqrt{3}}$

Answer: D

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53. A rectangular loop os sides of length l an db is placed in x-y plane. A uniform but it me varying manetic field of strength exists in space. The magnitude of induced e.m.f. at time t is:

A. 20+20t

B. 20

C. 20t

D. none of the above

Answer: D

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54. In an LCR circuit $R = 100 ohm$. When capacitance C is removed, the current lags behind the voltage by $\pi / 3$. When inductance L is removed, the current leads the voltage by $\pi / 3$. The impedence of the circuit is

A. 50ohm

B. 100ohm

C. 200ohm

D. 400ohm

Answer: B

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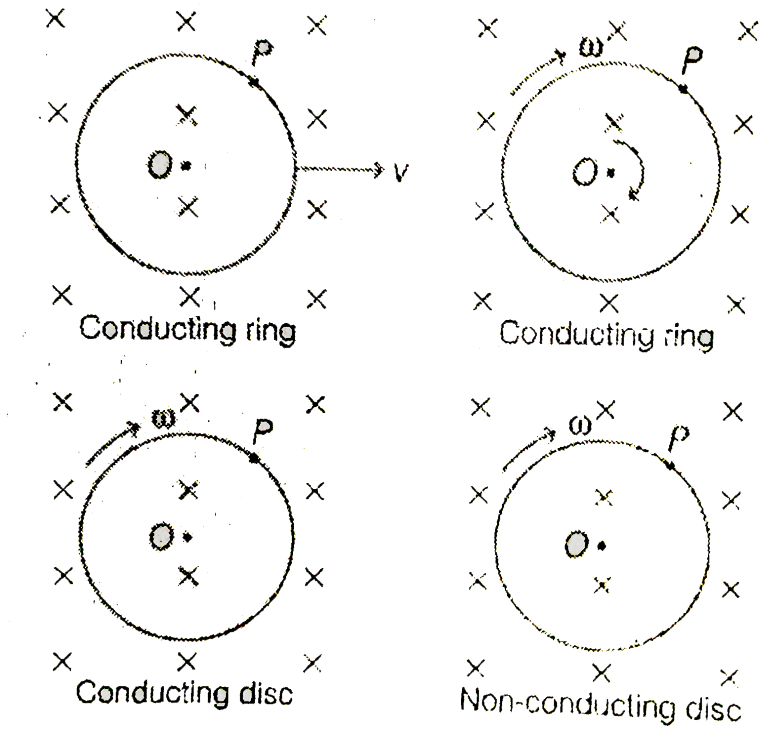
55. Some cases are given below. Identify the case in which emf is induced between O and P in uniform magnetic field



A. In I, III and IV only

B. In Ii, III and IV only

C. In III

D. In all the above

Answer: C

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56. Two coils have self-inductance $L_1 = 4mH$ and $L_2 = 1mH$ respectively. The currents in the two coils are increased at the same rate. At a certain instant of time both coils are given the same power. If I_1 and I_2 are the currents in the two coils, at that instant of time respectively, then the value of (I_1 / I_2) is :

A. $1/8$

B. $1/4$

C. $1/2$

D. 1

Answer: B

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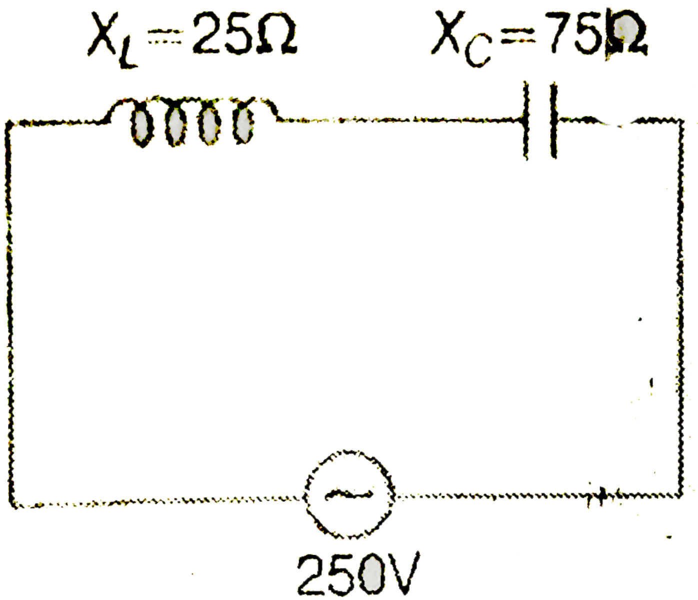
57. For the circuit shown



A. Current in circuit in 10A

B. Voltage across inductor is 100V

C. Voltage acros capacitor is less than that of supply voltage

D. Voltage across capacitor is more than that of supply voltage

Answer: D

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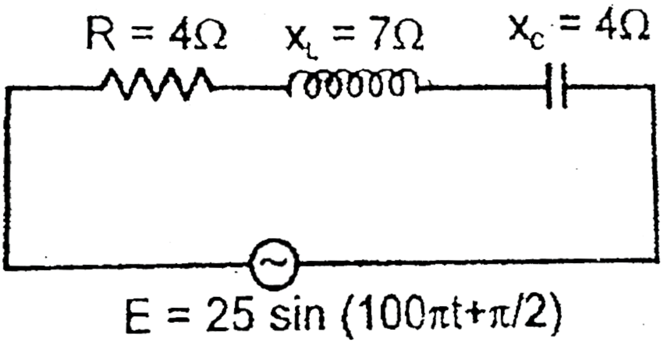
58. In the series LCR circuit as shown in figure, the heat developed in 80 seconds and amplitude of wattless current is :



A. 4000J,5A

B. 8000J, 3A

C. 4000J, 4A

D. 8000J,5A

Answer: A

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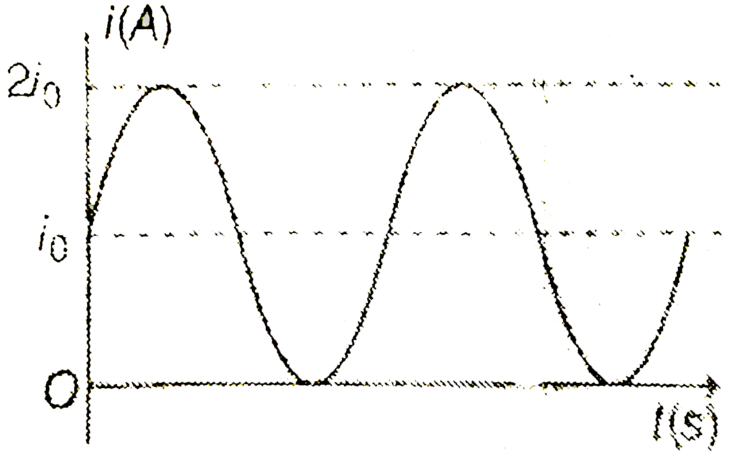
59. The current flowing in a wire fluctuates sinusoidally as shown in the diagram. The root mean square valuie of the current is



A. $i_0\left(\frac{1}{2}+1\right)^2$

B. $i_0\left(\sqrt{2}+1\right)^{t/2}$

C. $2\sqrt{2}t_0$

D. $i_0\left(\frac{2\sqrt{2}+1}{2}\right)^{t/2}$

Answer: A

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60. There is a conducting ring of radius R. Another ring having current i and radius $r(r < < R)$ is kept on the axis of bigger ring such that its center lies on the axis of bigger ring at a distance x from the center of bigger ring and its plane is perpendicular to that axis. The mutual inductance of the bigger ring due to the smaller ring is

A. $\dfrac{\mu_0 \pi R^2 r^2}{(R^2 + x^2)^{3/2}}$

B. $\dfrac{\mu_0 \pi R^2 r^2}{4(R^2 + x^2)^{3/2}}$

C. $\dfrac{\mu_0 \pi R^2 r^2}{16(R^2 + x^2)^{3/2}}$

D. $\dfrac{\mu_0 \pi R^2 r^2}{2(R^2 + x^2)^{3/2}}$

Answer: D

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61. At a perpendicular place on the earth, the horizontal component of earth's magnetic field of B, and the angle of dip is θ. A striaght meridian and is moved horizontally perpendicular to its length with a velocity v. The emf induced across the rod is

A. $Bvi\sin\theta$

B. $Bvi\cos\theta$

C. Bvl tan theta\`

D. Bvi

Answer: C

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62. An LC circuit contains a 20mH inductor and a $50\mu F$ capacitor with an initial charge of 10mC. The resistance of the circuit be closed at t=0. The time when the total energy shared equally between the inductor and the capacitor is, approximately.

A. $16 \times 10^{-3} s$

B. $8 \times 10^{-4} s$

C. $3.2 \times 10^{-3} s$

D. $1.25 \times 10 - (4) s$

Answer: B

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63. A magnet is taken towards a conducting ring in such a way that a constant current of $10mA$ is induced in it. The total resistance of the ring is 0.5Ω. In $5s$, the magnetic flux through the ring changes by

A. 0.25mWb

B. 25mWb

C. 50mWb

D. 15mWb

Answer: B

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Examples

1. If the peak value of a current in 50Hz AC. Cirucit is 7.07 A. What is the mean value of current over half a cycle and the value of current $1/300$s after it was zero?

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2. Find the average value in the following cases

(i) $i = 4 + 3\cos\omega t$

(ii) $5\sin\omega t + 2\sin 2\omega t + 3\sin 3\omega t$

(iv) $V = \cos\omega t + 3\cos 2\omega t + 3\cos 3\omega t + 2$

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3. a) The peak voltage of an AC supply is 300 V. What is the rms voltage?

b) The rms value of current in an AC circuit is 10A. What is the peak current?

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4. If $V = 220\sqrt{2}\sin(314t - \phi)$ calculat peak and rms value of the voltage (b) average voltage for half time - period (c) frequency of ac

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5. If the current in an AC circuit is represented by the equation, $i = 5\sin\left(300t - \frac{\pi}{4}\right)$

Here t is in second and in an ampere, calculate

(a) peak and rms value of current

(b) frequecne of AC

(c) average current.

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6. The voltage supplied to a circuit is given by $V = V_0 t^{\frac{3}{2}}$, where t is time in second. Find the rms value of voltage for the period, t=0 to t=1s.

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7. Calcualte rms value of current and voltages for the giving cases

i) I = $4 + 3\sin\omega t$

ii) V = 5+2$\cos\omega t$

(iii) i=$2 + 3\sin\omega t = 2\cos\omega t$

iv) V $= \cos\omega t + 2\cos 2\omega t$

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8. A 200Ω resistor is connected to a 220 V, 50 Hz AC supply. Calculate rms value of current in the circuit. Also find phase difference between voltage and the current.

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9. A $60\mu F$ capacitor is connected to a 110V, 60 Hz AC supply determine the rms value of the curent in the circuit.

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10. An alternating voltage $E = 200\sqrt{2}\sin(100t)$ is connected to a 1 microfarad capacitor through an AC ammeter. The reading of the ammeter shall be

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11. An ideal inductor of inductance $50\mu H$ is connected to an AC source of 220V, 50 Hz. Find the inductive reactance.

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12. A 44 mH inductor is connected to 220 V, 50 Hz ac supply. The rms value of the current in the circuit is

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13. A sinusoidal voltage of frequency 60 Hz and peak value 150 V is applied to a series L-R circuit, where $R = 20\Omega$ and L=40 mH.

a) Compute T, `omega, X

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14. A 100Ω resistasnce is connected in series with a $4H$ inductor. The voltage across the resistor is $V_R = (2.0V)\sin(10^3 rad/s)t$:

(a) Find the expession of circuit current

(b) Find the inductive reactance

(c) derive an expression for the voltage across the inductor,

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15. An alternating emf 200 virtual volts at $50Hz$ is connected to a circuit resistance 1ω and inductance $0.01H$. What is the phase difference between the current and the emf in the circuit? Also, find the virtual current in the circuit.

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16. A resistance and inductance are connected in series across a voltage,

$V = 283 \sin 314t$

The current is found to be $4 \sin(314t - \pi / 4)$. Find the value of the inductance and resistance.

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17. A long solenoid connected to a 12V DC source passes a steady current of 2 A. When the solenoid is connected to an AC source of 12V at 50 Hz, the current flowing is 1A. Calculate inductance of the solenoid.

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18. A $100\mu F$ capacitor in series with a 40Ω resistance is connected to 110 V, 60 Hz supply.

(a) what is the maximum current in the circuit ?

(b) what is the time lag between the current maximum and the voltage maximum ?

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19. A circuit conatining of a capacitor and an active resistance R=110Ω connected in series is fed and alternating voltage with amplitude$V_0 = 110V$. In this case, the amplitude of current is equal to $I_0 = 0.50A$. Find the phase difference between the current and the voltage fed .

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20. An AV voltage source is applied across an R-C circuit. Angular frequency of the source is ω, resistance is R and capacitance is C. The current registered is I. If now the frequency of source is changed to $\frac{\omega}{2}$ (but maintaining the same voltage), the current in the circuit is found to be two third. calculate the ratio of reactance to resistance at the original frequency ω .

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21. A coil of inductance 0.01 H is connected in series with a capacitor of capacitance $25\mu F$ with an AC source whose emf is given by E = 310 sin 314t (volt). What is the reactance of the circuit ?

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22. A series LCR circuit is connected across a source of emf E $= 20\sin\left(100\pi t - \frac{\pi}{6}\right)$. The current from the supply is I $= 4\sin\left(100\pi t + \frac{\pi}{12}\right)$. Draw the impedance triangle for the circuit.

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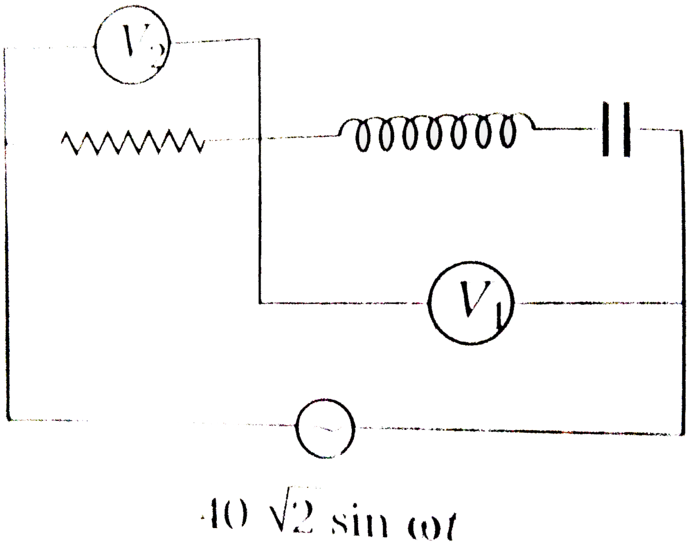
23. If the reading of volmeter V_1 is 30 V, what is the reading of voltmeter V_2 ?



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24. A coil a capacitor and an AC source of rms voltage $24V$ are connected in series. By varying the frequency of the source, a maximum rms current of 6 A is observed. If coil is connected is at DC batteryof emf 12 volt and internal resistance 4Ω, then current through it in steady state is

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25. A coil of inductance 0.4 mH is connected to a capacitor of capacitance 400 pF. To what wavelength is this circuit tuned ?

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26. A 200 km telephone wire has capacity of $0.014\mu F km^{-1}$. If it carries an alternating current oif frequency 50kHz, what should be the value of an inductance required to be connected in series so that impedance is minimumn ?

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27. Find the voltage across the various elements, i.e., resistance, capacitance and inductance which are in series and having values $1000\Omega, 1\mu F$ and 2.0 H respectively . Given emf as,

V = 100sqrt2 sin 1000 t V`

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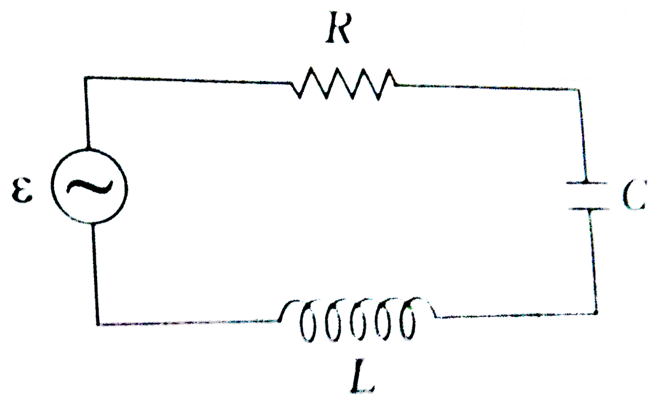
28. Figure here, shows a series L-C-R circuit connected to a variable frequency 230 V source. L = 5.0H, C = $80\mu F$ and r =

40Ω

(a) Determine the source frequency which drives the circuit in resonance.

(b) Obtain the impedance of the circuit and the amplitude of current at the resonating frequency.

(c) Determine the rms potential drops across the three elements of the circuit. show that the potential drop across the L-C combination is zero at the resonating frequency.



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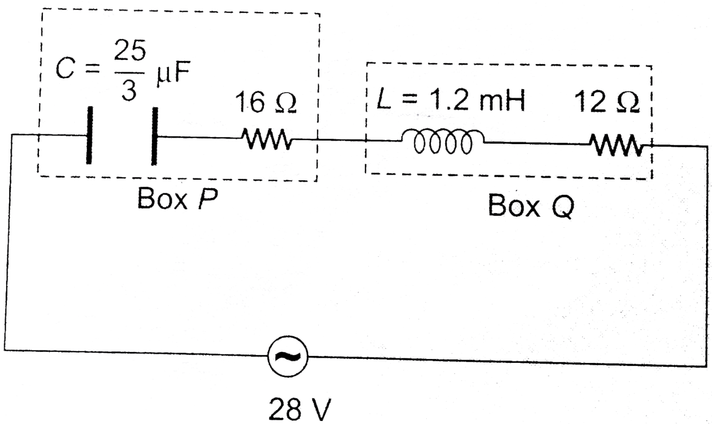
29. A box P and a coil Q are connected in series with an ac source of variable freguency The emf of the source is constant at $28V$ The frequency is so adjusted that the maximum current flows in P and Q Find

(a) impedance of P and Q at this frequency

(b) voltage across P and Q



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30. (a) In a series L-C-R circuit with an AC source, R =300Ω, C = $20\mu F$, $L = 1.0H$, $V_0 = 50\sqrt{2}V$ and $f = \frac{50}{\pi}Hz$. Find (i) the rms current in the circuit and (ii) the rms voltage across each element.

(b) Consider the situatiuon of the previous part. find the average electric field energy stored in the capacitor and the average magnetic field energy stored iun the coil .

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31. A series $L-C-R$ circuit containing a resistance of 120Ω has resonance frequency $4 \times 10^5 rad/s$. At resonance the voltages across resistance and inductance are $60V$ and $40V$, respectively. Find the values of L and C

.At what angular frequency the current in the circuit lags the voltage by $\pi / 4$?

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32. A capacitor of capacitance 250 pF is connected in parallel with a choke coil having inductance of $1.6 \times 10^{-2} H$ and resistance 20Ω. Calculate

(a) the resonance frequency and

(b) the circuit impedance at resonance.

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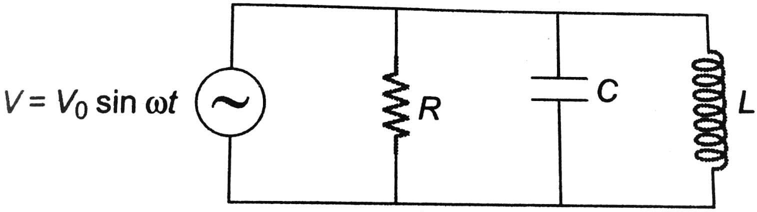
33. For the circuit shown in figureure, find the instaneous current through each element.



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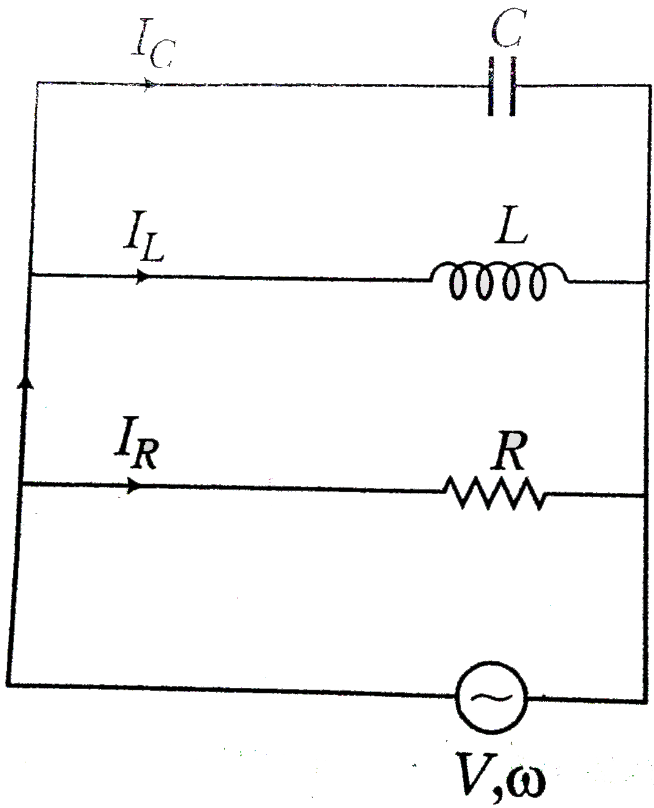
34. AC voltage source (V, ω) is applied across a parallel LC circuit as shown in figure. Find the impedance of the circuit and phase of current.



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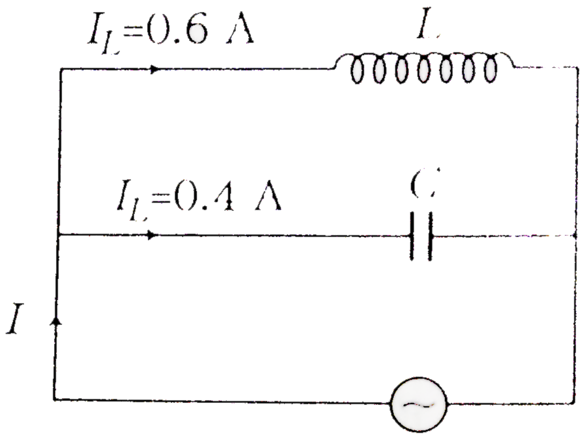
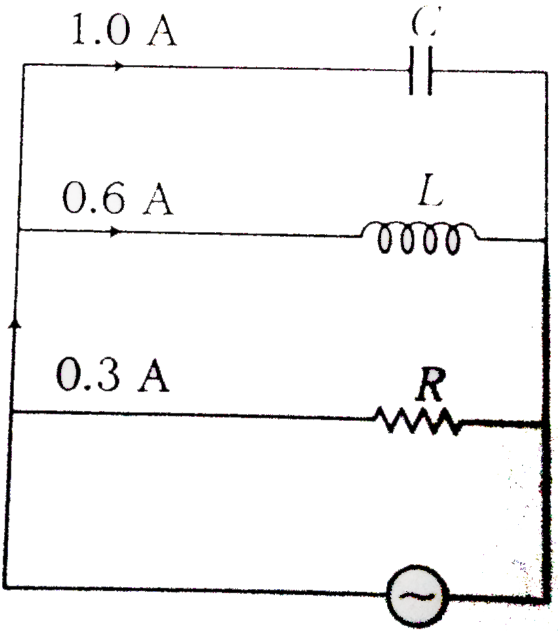
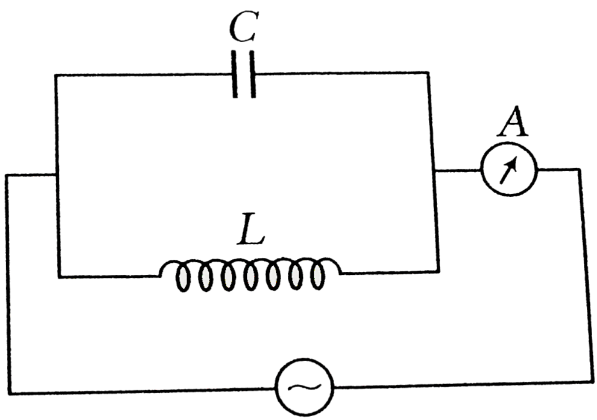
35. Find the current drawn from source in each of the circuits as given below


$I_L = 0.6$ A
L
$I_L = 0.4$ A
C
I


1.0 A
C
0.6 A
L
0.3 A
R

36. An LC circuit $(L = 0.01H, C = 1\mu F)$ is connected to an AC source of variable frequency. If the frequency is varied from 1 kHz, then show the consequent variation of impedance by a rough sketch.



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37. Inductance (L), capacitance (C) and resistance (R) are constained in a box. When 250 V DC is applied to the

terminals of the box, a current of 1.0A floes in the circuit. When an AC source of $250V_{rms}$ at $2250 rad \sec^{-1}$ is connected, a current of $1.25A_{rms}$ flows. It is observed that the current rises with frequency and becomes maximum at $4500 rad \sec^{-1}$. find the values of L,C and R. draw the circuit diagram.

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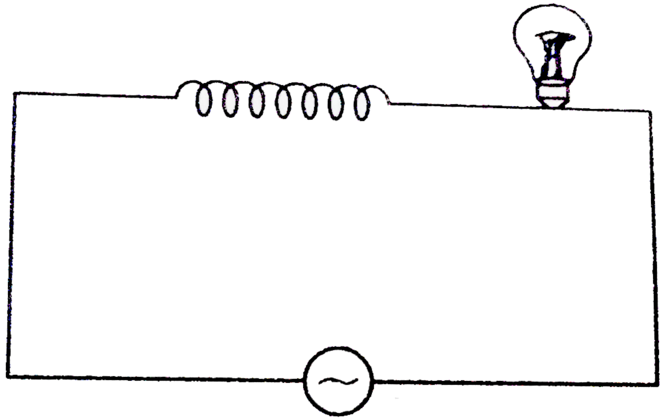
38. An iron cored coil is connected in series with an electric bulb, with an AC source, as shoen in figure. As the iron piece is taken out of the coil, how will tthe brightness of bulb challenge ?



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39. A light bulb has the rating 200W 220V. Find (i) resistance of the bulb filament (ii) rms value of current flowing through the filament.

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40. A series L-C-R circuit with R = 20Ω, L = 1.5 H and C = $35\mu F$ is connected to a variable frequency 200 V, AC supply. When the frequency of the supply equals the natural frequency of the circuit, what is the average power transfered to the circuit, what is the average power transfered to the circuit in one complete cycle ?

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41. A 100Ω resistor is connected to a 220 V, 50 Hz ac supply.

(a) What is the rms value of current in the circuit?

(b) What is the net power consumed over a full cycle?

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42. A series L-C-R circuit is connected across an AC source E = $10\sin\left[100\pi t - \frac{\pi}{6}\right]$. Current from the supply is I = $2\sin\left[100\pi t + \frac{\pi}{12}\right]$, What is the average power dissipated?

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43. An AC circuit containing 800mH inductor and a $60\mu F$ capacitor is in series with 15Ω resistance. They are connected to 230 V ,50 Hz AC supply. Obtain average power transferred to each element and total power absorbed.

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44. A 60 cycle AC, circuit has a resistance of 200Ω and inductor of 100 mH. What is the power factor? What capacitance placed in the circuit will make the power factor unity?

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45. An $L-C-R$ series circuit with 100Ω resistance is connected to an AC source of $200V$ and angular frequency $300 rad/s$. When only the capacitance is removed, the current lags behind the voltage by 60°. When only the inductance is removed the current leads the voltage by 60°. Calculate the current and the power dissipated in the $L-C-R$ circuit

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46. A solenoid with inductance $L = 7mH$ and active resistance $R = 44\Omega$ is first connected to a source of direct voltage V_0 and then to a source of sinusoidal voltage with effective value $V = V_0$. At what frequency of the oscillator will be power consumed by the solenoid be $\eta = 5.0$ times less than in the former case ?

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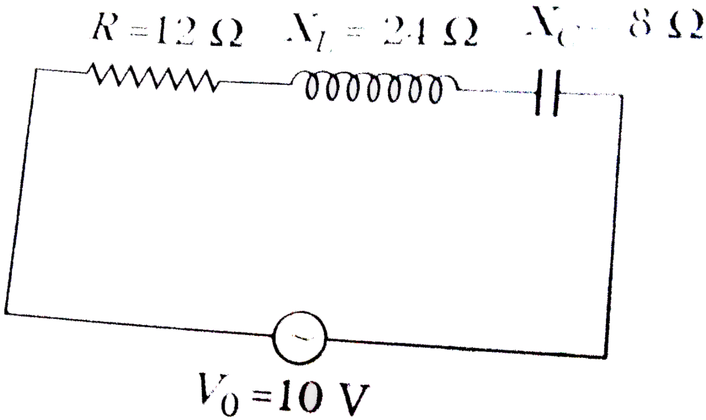
47. Consider the following R-L-C circuit in which R=12Ω. $X_L = 24\Omega$, $X_C = 8\Omega$. The emf of source is given by V = $10\sin(100\pi t)V$.

Find the energy dissipated in 10 min.

If resistance is removed from the circuit and value of inductance is doubled, express variation of current with time t in the new circuit.



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48. A series circuit consisting of an inductance $-$ free resistance $R = 0.16k\Omega$ and coil with active resistance is connected to the mains with effective voltabe $V = 220V$. Find the heat power generated in the coil if the effective voltage values across the resistance R and the coil are equal to $V_1 = 80V$ and $V_2 = 180V$ respectively.

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49. A current of $4A$ flows in a coil when connected to a $12VDC$ source. If the same coil is connected to a $12V, 50rad/sAC$ source, a current of $2.4A$ flows in the circuit. Determine the inductance of the coil. Also, find the power developed in the circuit if a$2500\mu F$ capacitor is connected in series with the coil.

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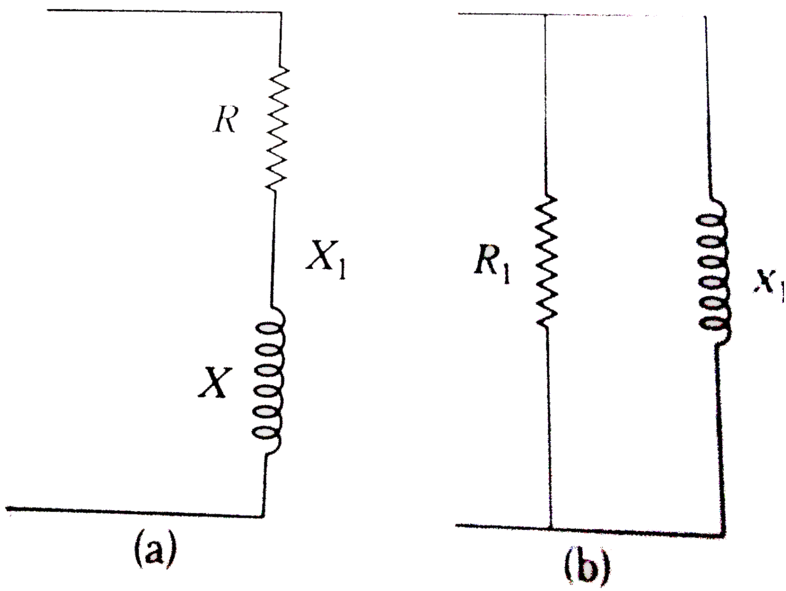
50. The series and parallel circuits shown in figure have the same impedance and the same power factor. If $R = 3\Omega$ and $X = 4\Omega$, find the values of R_1 and X_1. Also, find the impedance and power factor.



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51. A charged 30 μF capacitor is connected to a 27 mH inductor. What is the angular frequency of free oscillations of the circuit ?

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52. A radio can tune over the frequency range of a portion of MW broadcast band (800 kHz to 1200 kHz). If its LC circuit has an effective inductance of $200 \mu H$, what must be the range of its varialbe capacitor ?

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53. In an $L-C$ circuit, $L=3.3H$ and $C=840pF$. At $t=0$ charge on the capacitor is $105\mu C$ and maximum. Compute the following quantities at $t=2.0ms$.

a. The energy stored in the capacitor.

b. The total energy in the circuit,

c. The energy stored in the inductor.

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54. An L-C circuit contains 20 mH inductor and a $50\mu F$ capacitor with an initial charge of 10 mC. The resistance of the circuit is negligible. Let the instant the circuit is closed be t = 0. what is the total energy stored initially ? At what times is the total energy shared equally between the inductor and the capacitor ?

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55. An AC circuit consists of a 220Ω resistance andn a $0.7H$ choke. Find the power obsorbed from $220V$ and $50Hz$ source connected in this circuti if the resistance and choke are joined

(a) In series

(b) in parallel.

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56. A Choke coil is needed to operate an arc lamp at $160V$ (rms) and $50Hz$. The lamp has an effective resistnce of 5Ω when running at $10A(\text{rms})$. Calculate the inductance of the choke coil. If the same arc lamp is to be operated on $160V(DC)$, what additional resistance is required ? Compare the power loses in both cases.

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57. In a step-down transformer having primary to secondary turn ratio 10:1, the input voltage applied is 250V and outout current is 10 A. Assuming 100% efficiency, calculate the

(i) voltage across secondary coil

(ii) current in primary coil

(iii) power output

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58. A 10 kW transformer has 20 turns in primary and 100 turns in secondary circuit. A.C. voltage $E_1 = 600 \sin 314t$ is applied to the primary. Find max. value of flux and max. value of secondary voltage.

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59. (i) The primary of a transformer has 400 turns while the secondary has 2000 turns. If the power output from the secondary at 1100 V is 12.1 kW, calculate the primary voltage. (ii) If the resistance of the primary is 0.2Ω and that of the secondary is 2.0Ω and the efficiency of the transformer is $90\,\%$, calculate the heat losses in the primary and the secondary coils.

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60. An a.c generator consists of a coil of 1000 turns each of area $100cm^2$ and rotating at an angular speed of 100 rpm in a uniform magnetic field fo $3.6 \times 10^2 T$. Find the peak and r.m.s value of e.m.f induced in the coil.

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Check point 7.1

1. The frequency of the sinusoidal wave

$y = 0.40 \cos[2000t + 0.80x]$ would be

A. 1000 Hz

B. 2000 Hz

C. 20 Hz

D. 1000 / π Hz

Answer: D

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2. The frequency of ac mains in India is

A. 30 cps

B. 50 cps

C. 60 cps

D. 120 cps

Answer: B

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3. 220 volt a.c. is more dangerous than 220 volt d.c why?

A. the AC attracts

B. the DC repels

C. the body offers less resistance to AC

D. peak voltage for AC is much larger than 220 V

Answer: D

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4. Alternating current is transmitted to distant places at

A. at high voltage and low current

B. at high voltage and high current

C. at low voltage and low current

D. at low voltage and high current

Answer: A

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5. An AC voltage is given by E = E_o sin 2πt / T

Then , the mean value of volatage calculated over any time interval of T / 2

A. is always zero

B. is never zero

C. is always $(2E_o / \pi)$

D. may be zero

Answer: C

View Text Solution

6. 220 V, 50 Hz , AC is applied to a resistor . The instantaneous value of voltage is

A. $220\sqrt{2}\sin 100\pi t$

B. $220\sin 100\pi t$

C. $220\sqrt{2}\sin 50\pi t$

D. $220\sin 50\pi t$

Answer: A

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7. The instantaneous current in an AC circuit is $I = \sqrt{2}\sin(50t + \pi/4)$. The rms value of current is

A. $\sqrt{2}$A

B. 50 A

C. 90 A

D. 1A

Answer: D

Watch Video Solution

8. The peak value of an alternating current is $5A$ and its frequency is $60Hz$. Find its rms value. How long will the current take to reach the peak value starting from zero?

A. 3.536 A, 4.167 ms

B. 3.536 A, 15 ms

C. 6.07 A, 10 ms

D. 2.536 A, 4.167 ms

Answer: A

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9. If an alternating voltage is represented as $E = 141 \sin(628t)$, then the rms value of the voltage and the frequency are respectively

A. 141 Hz, 628 Hz

B. 100 V, 50 Hz

C. 100 V, 100 Hz

D. 141 V, 100 Hz

Answer: C

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10. An alternating current in a circuit is given by I = 20 sin (100πt + 0.05π) A. The rms value and the frequency of current respectively are

A. 10 A and 100 Hz

B. 10 A and 50 Hz

C. $10\sqrt{2}$A and 50 Hz

D. $10\sqrt{2}$A and 100 Hz

Answer: C

Watch Video Solution

Check point 7.2

1. Ohm's law expressed as E = IR

A. can never be applied to AC

B. applies to AC in the same manner as to DC

C. always applies to AC circuits when Z is substituted for R

D. tells us that $E_{eff} = 0.707\,(E_{\max})$ for AC

Answer: C

Watch Video Solution

2. An alternating current of rms value 10 A is passed through a 12Ω resistor. The maximum potential difference across the resistor is

A. 20 V

B. 90 V

C. 169.68 V

D. None of these

Answer: C

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3. The reactance of a $25\mu F$ capacitor at the AC frequency of $4000Hz$ is

A. $\frac{5}{\pi}\Omega$

B. $\frac{\sqrt{5}}{}$pi Ω

C. 10Ω

D. $\sqrt{10}\Omega$

Answer: A

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4. The capacitance of a pure capacitance is 1 farad. In DC circuits, its effective resistance will be

A. zero

B. infinte

C. 1Ω

D. $\frac{1}{2}\Omega$

Answer: B

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5. In an AC circuit containing only capacitance the current

A. leads the voltafe by 180°

B. remians in phase with the volatage

C. leads the voltage by 90°

D. lags the voltage by 90°

Answer: C

Watch Video Solution

6. A capacitor becomes a perfect insulator for

A. direct current

B. alternating current

C. direct as well as direct current

D. None of these

Answer: A

Watch Video Solution

7. In an AC circuit , an alternating voltage e = 200sin 100t V is connected to a capacitor of capacity $1\mu F$. The rms value of the current in the circuit is

A. 100 mA

B. 200 mA

C. 20 mA

D. 10 mA

Answer: C

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8. The reactance of a coil when used in the domestic AC power supply $(220V, 50cycles)$ is $50ohm$. The inductance of the coil is nearly

A. 2.2 H

B. 1.6 H

C. 0.22 H

D. 0.16 H

Answer: D

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9. The unit of inductance is

A. $A(V - s)^{-1}$

B. JA^{-1}

C. $V - sA^{-1}$

D. $V - As^{-1}$

Answer: C

Watch Video Solution

10. In the case of an inductor

A. voltage lags the current by $\pi/2$

B. voltage leads the currrent by $\pi/2$

C. voltage leads the current by $\pi/3$

D. voltage leads the current by π / 4

Answer: B

Watch Video Solution

11. An ideal inductive coil has a resistance of 100Ω When an ac signal of frequency $100Hz$ is applied to the coil the voltage leads the current by 45° The inductance of the coil is .

A. $\frac{1}{10}\pi$

B. $\frac{1}{20}\pi$

C. $\frac{1}{40}\pi$

D. $\frac{1}{60}\pi$

Answer: B

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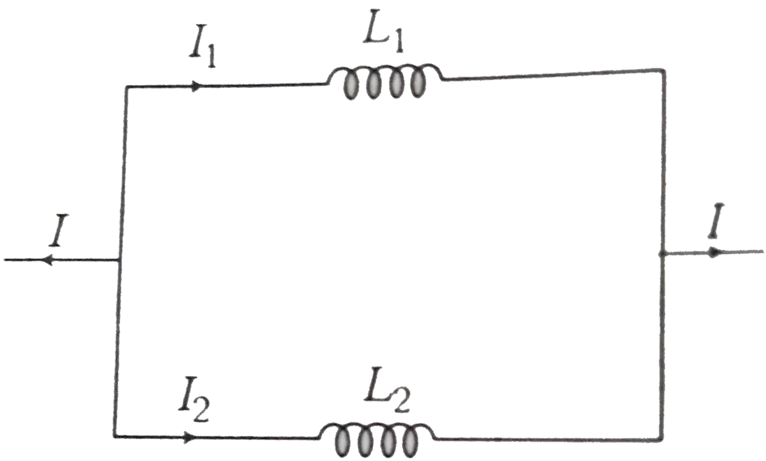
12. Two inductors L_1 and L_2 are connected in parallel and a time varying current flows as shown in figure. Then the ratio currents I_1 / I_2 at any time t is



A. $\frac{L_1}{L_2}$

B. $\frac{L_2}{L_1}$

C. $\frac{L_1}{\left(l_1 + l_2\right)^2}$

D. $\frac{L_2}{l_1 + l_2}$

Answer: B

Watch Video Solution

13. An inductance and a resistance are connected in series with an AC potential . In this circuit

A. the current and the potential difference across the resistance lead the PD across the inductive by phase angle $\pi/2$

B. the current and the potential difference across the resistance lag behind PD across the inductance by an angle $\pi/2$

C. the current and the potential difference across the resistance lag behind in PD across the inductance by an anle π

D. the PD across the resistance lags behind the PD across the inductance by an angle $\pi/2$ but the current in the resistance leads the PD across inductance by $\pi/2$

Answer: B

Watch Video Solution

14. If an 8Ω resistance and 6Ω reactance are present in an AC series circuit then the impedence of the circuit will be

A. 2Ω

B. 14Ω

C. 4Ω

D. 10Ω

Answer: D

Watch Video Solution

15. In an ac circuit, the current lags behind the voltage by $\pi/3$. The components in the circuit are

A. R and L

B. L and C

C. R and C

D. only R

Answer: A

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16. In an AC circuit, a resistance of $R ohm$ is connected is series with an inductance L. If phase angle between volage and current be 45°, the value of inductive reactance will be

A. R / 4

B. R / 2

C. R

D. cannot be found with the given data

Answer: C

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17. In a circuit containing R and L , as the frequency of the impressed AC increase, the impedance of the circuit

A. decreases

B. increases

C. remains unchanged

D. first increases and then decreases

Answer: B

Watch Video Solution

18. An AC voltage is applied to a resistance R and an inductance L in series. If R and the inductive reactance are both equal to 3Ω, the phase difference between the applied voltage and the current in the circuit is

A. $\pi/4$

B. π / 2

C. zero

D. π/ 6

Answer: A

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19. In an ac circuit , $L = \dfrac{0.4}{\pi} H$ and $R = 30\Omega$. If the circuit has an alternating emf of 220 V, 50 cps, the impedance and the current in the circuit will be :

A. 11.4Ω,17.5 A

B. `30.7 Omega, 6.5 A

C. 40.4Ω, 5 A

D. 50Ω, 4 A

Answer: D

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20. The instantaneous values of current and voltage in an AC circuit are given by

I = 6sin (100πt + π / 4)

V = 5sin (100 πt - π / 4), then

A. current leads the voltage by 45°

B. voltage leads the current by 90°

C. current leads the voltage by 90°

D. voltage leads the current by 45°

Answer: C

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21. In an L-C-R circuit the AC voltage across R, L and C comes out as 10 V , 10 V and 20 V respectively . The voltage across the enter combination will be

A. 30 V

B. $10\sqrt{3}$V

C. 20 V

D. $10\sqrt{2}$A

Answer: D

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Watch Video Solution

22. Which increase in frequency of an AC supply , the impedance of an L-C-R series circuit

A. remians constant

B. increases

C. decreases

D. decreases at first, becomes minimum and then increases

Answer: D

Watch Video Solution

23. An sinusoidal voltage of peak value 300 V and an argular frequency ω = 400 $rads^{-1}$ is applied to series L-C-R circuit , in which R = 3Ω , L = 20 mH and C = 625 μF .The peak current in the circuit is

A. $30\sqrt{2}$A

B. 60 A

C. 100 A

D. $60\sqrt{2}$A

Answer: B

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24. The value of current at resonance in a series L-C-R circuit is affected by the value of

A. R only

B. C only

C. L only

D. L, C and R

Answer: A

Watch Video Solution

25. An LCR circuit is connected to a source of alternating current. At resonance, the applied voltage and the current flowing through the circuit will have a phase difference of

A. zero

B. $\pi / 4$

C. $\pi / 2$

D. π

Answer: A

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26. A series L-C-R circuit is operated at resonance . Then

A. voltage across R is minimum

B. impedance is minimum

C. impedance is maximum

D. current amplitude is minimum

Answer: B

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27. An L-C-R series is under resonance . If l_m is current amplitude V_m is voltage amplitude, R is the resonance , Z is the impedance , X_L is the inducitve reactance and X_C is the capacitive reactance , then

A. $l_m = underser(m)(V)/$ Z

B. V_m / X_L

C. $l_m = V_m / X_C$

D. $I_m = V_m / R$

Answer: D

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28. In an L-C-R series, AC circuit at resonance

A. the capacitive reactance is more than the inductive

B. the capacitive reactance equals the inductive reactance

C. the capactive reactance is less than the inductive reactance

D. the power dissipated is minimum

Answer: B

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29. An L-C-R series circuit , connected to a source E, is at resonance. Then,

A. the voltage across R is zero

B. the voltage across R equals applied voltage

C. the volatage across C is zero

D. the voltage across C equals applied voltage

Answer: B

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30. The reciprocal of impedance is called

A. reactance

B. admittance

C. inductance

D. conductance

Answer: B

Watch Video Solution

Check point 7.3

1. An electric heater rated 220 V and 550 V is connected to AC mains. The current drawn by it is

A. 0.8 A

B. 2.5 A

C. 0.4 A

D. 1.25 A

Answer: B

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2. In an AC circuit , V_o , I_o and $\cos\theta$ are voltage amplitude , current amplitude and power factor respectively, the power consumption is

A. 1/2$V_o I_o$ cosθ

B. $\left(\frac{1}{\sqrt{2}}\right)V_0 I_0 \cos\theta$

C. $V_0 I_0 \cos\theta$

D. $\left(\frac{1}{\sqrt{2}}\right)V_0 I_0 \sin\theta$

Answer: A

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3. The power factor of a circuit is

A. Z/R

B. R/Z

C. R/X

D. X/R

Answer: B

Watch Video Solution

4. In an AC circuit, V and I are given by $V = 100\sin(100t)vo < s, I = 100\sin\left(100t + \frac{\pi}{3}\right)mA.$

The power dissipated in circuit is

A. 10^4W

B. 10 W

C. 2.5 W

D. 5 W

Answer: C

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5. Power factor is one for

A. pure inductor

B. pure capacitor

C. pure resistor

D. Either an inductor or a capacitor

Answer: C

Watch Video Solution

6. The average power dissipated in a pure inductor `L carrying an alternating current of rms value I is .

A. 1/2Li^2

B. 1/4Li^2

C. 2Li^2

D. zero

Answer: D

Watch Video Solution

7. The average power dissipation in a pure capacitance in AC circuit is

A. CV

B. zero

C. 1/CV^2

D. 1/4 CV^2

Answer: B

Watch Video Solution

8. In an AC circuit, the power factor

A. is zero when the circuit contain an ideal resistance only

B. is unity when the circuit contains an ideal resistance only

C. is zero when the circuit contains an ideal inductance only

D. is unity when the circuit contains an ideal inductance only

Answer: B::C

Watch Video Solution

9. The impedance of a circuit consister of 3Ωresistance and 4Ω reactance. The power factor of the circuit is

A. 0.4

B. 0.6

C. 0.8

D. 1

Answer: B

Watch Video Solution

10. Power dissipated in an $L-C-R$ series circuit connected to an AC source of emf ε is

A. $\dfrac{\varepsilon R}{R^2+\left(L\omega-\frac{1}{C\omega}\right)^2}$

B. $\sqrt{R^2+\dfrac{L\omega-\frac{1}{(C\omega)^2}}{R}}$

C. $\dfrac{R^2 + \left(L\omega - \frac{1}{C\omega}\right)^2}{R}$

D. $\dfrac{\omega^2 R}{\sqrt{R^2 + \left(L\omega + \frac{1}{C\omega}\right)^2}}$

Answer: A

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11. The SI unit of inductance, the henry can be written as :

A. weber/ampere

B. volt-second/ampere

C. joule/$(ampere)^2$

D. ohm-second

Answer: B

Watch Video Solution

12. The energy stored in an inductor of self-inductance L henry carrying a current of I ampere is

A. 1/2L^2I

B. 1/2LI^2

C. LI^2

D. L^2I

Answer: B

Watch Video Solution

13. In an inductor of inductance $L = 100mH$, a current of $I = 10A$ is flowing. The energy stored in the inductor is

A. 5 J

B. 10 J

C. 100 J

D. 1000 J

Answer: A

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14. In an L-C circuit

A. the energy stored in L as well as in C is magnetic energy

B. the energy stored in L is magnetic but in C it is electrical

C. the energy stored in L is electrical but in C it is magnetic

D. the energy stores in L as well as C is electrical energy

Answer: B

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15. The equivalent quantity of mass in an inductor circuit is

A. charge

B. potential

C. inductance

D. current

Answer: C

Watch Video Solution

Check point 7.4

1. A choke coil has.

A. low inductance and low resistance

B. high inductance and high resistance

C. low inductance and high resistance

D. high inductance and low resistance

Answer: D

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2. What is increase in step-down transformer?

A. Voltage

B. Current

C. Power

D. Current density

Answer: B

Watch Video Solution

3. A transformer works on the principle of

A. self-induction

B. electrical inertia

C. mutual induction

D. magnetic effect of the electrical current

Answer: C

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4. Quantity that remains unchanged in a transformer is

A. voltage

B. Current

C. frequency

D. None of these

Answer: C

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5. The ratio of secondary to the primary turns in a transformer is $3:2$. If the power output be P, then the input power neglecting all loses must be equal to

A. 0.708333333333

B. 1.5 P

C. P

D. (2/5)P

Answer: C

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6. The transformation ratio in the step -up transformer is

A. 1

B. greater than one

C. less than one

D. the ratio greater or less than one depends on the other factors

Answer: B

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7. In a transformer, the number of turns in primary and secondary are 500 and 2000 respectively. If current in primary is $48A$, the current in the secondary is

A. 12A

B. 24 A

C. 48 A

D. 144 A

Answer: A

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8. The core used in a transformer and other electromagnetic devices is laminated so that

A. ratio of voltage in the primary and secondary may be increased

B. energy loss due to eddy currents may be minimised

C. the weight of the transformer may be reduced

D. residual magnetism in the core may be reduced

Answer: B

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9. which of ther following is constructed on the principle of electromagnetic induction?

A. Galvanometer

B. Electric motor

C. Generator

D. Voltmeter

Answer: C

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10. when the speed of a dc motor increase the armature current

A. increases

B. decreases does not change

C. increases and decreases continuosly

D. increases and decreases continuously

Answer: B

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Taking it together

1. The resistance of a coil for DC is 5Ω . In case of AC, the resistance will

A. remain 5Ω

B. decrease

C. increase

D. be zero

Answer: C

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2. In the non-resonant circuit, what will be the nature of the circuit for frequencies heigher than the resonant frequency?

A. Resistive

B. Capacitive

C. inductance

D. None of these

Answer: C

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3. A choke coil has.

A. high inductance and low resistance

B. low inductance and high resistance

C. high inductance and high resistance

D. low inductance and low resistance

Answer: A

Watch Video Solution

4. A circuits contains a capacitor and inductance each with negligible resistance. The capacitor is initially charged and the charging battery is disconnected. At subsequent time , the charge on the capacitor will

A. increase exponentially

B. decrease exponentially

C. decrease linearly

D. remain constant

Answer: C

View Text Solution

5. A choke coil is preferred to a resistance for reducing current in an ac circuit because .

A. choke coil is cheap

B. there is no wastage of power

C. choke is compact in size

D. choke is a good absorber of heat

Answer: B

Watch Video Solution

6. The frequency for which a 5μF capacitor has a reactance of $\frac{1}{1000}\Omega$is given by

A. $\frac{100}{\pi}$ MHz

B. $\frac{1000}{\pi}$ MHz

C. $\frac{1}{1000}Hz$

D. 1000 Hz

Answer: A

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7. What will be the approximate resistance offered by a capacitor of 10μF and frequency 100Hz?

A. 160Ω

B. 1600Ω

C. 16Ω

D. None of these

Answer: A

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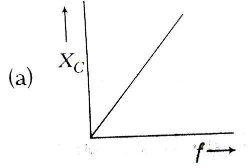
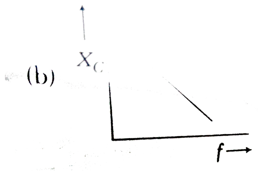
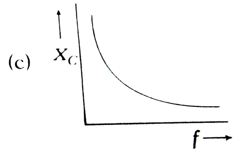
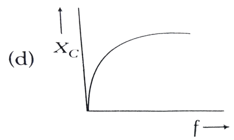
8. Which of the following curves correctly represent the variation of capacitve reactance $\left(X_C\right)$ with frequency (f) ?

A. 

B. 

C. 

D. 

Answer: C

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9. L, C and R represent the physical quantities, inductance, capacitance and resistance respectively. The combinations which does not have the dimensions of frequency are

A. 1/RC

B. R/L

C. $1/\sqrt{LC}$

D. C/L

Answer: D

Watch Video Solution

10. An AC source is connected to a capacitor. The current in the current is I. Now a dielectric slab is inserted into the capacitor , then the new current is

A. equal I

B. more than I

C. less than I

D. may be more than or less than I

Answer: B

Watch Video Solution

11. An alternating voltage is connected in series with a resistance R and inductance L if the potential drop across the resistance is $200V$ and across the inductance is $150V$, then the applied voltage is

A. 350 V

B. 250 V

C. 500 V

D. 300 V

Answer: B

Watch Video Solution

12. An L-R circuit has $R = 10\ \Omega$ and $L = 2H$. If $120\ V$, $60\ Hz$ AC voltage is applied, then current in the circuit will be

A. 0.32 A

B. 0.16 A

C. 0.45 A

D. 0.80 A

Answer: B

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13. A complex current wave is given by $i = 95 + 5\sin 100\omega t A$. Its given value over one time period is given as

A. 10A

B. 5A

C. $\sqrt{50}$ A

D. 0

Answer: B

Watch Video Solution

14. If the rms current in a 50 Hz ac circuit is 5 A, the value of the current $1/300$ second after its value becomes zero is

A. $5\sqrt{2}$A

B. $5\sqrt{\frac{3}{2}}$A

C. $\frac{5}{6}$A

D. $\frac{5}{\sqrt{2}}$ A

Answer: B

Watch Video Solution

Watch Video Solution

15. The peak value of an alternating emf E given by

E = E_o cos ωt

is 10 V and frequency is 50 Hz . At time t = (1/600) s, the instantaneous value of emf is

A. 10 V

B. $5\sqrt{3}$ V

C. 5 V

D. 1 V

Answer: B

Watch Video Solution

16. Current and voltage in AC are I = I_o sin (ωt + π/4), Then

A. X_L gt X_C

B. R = 0

C. Both are correct

D. Both are wrong

Answer: C

View Text Solution

17. A 10 ohm resistance, $5mH$ coil and $10\mu F$ capacitor are joined in series. When a suitable frequency alternating current source is joined to this combination, the circuit resonates. If the resistance is halved, the resonance frequency

A. is halved

B. is doubled

C. remains unchanged

D. in quadrupled

Answer: C

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18. The resonant frequency of a circuit is f. If the capacitance is made 4 times the initial values, then the resonant frequecy will become

A. f/2

B. 2f

C. f

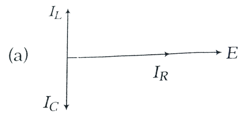
D. f/4

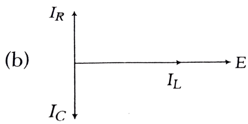
Answer: A

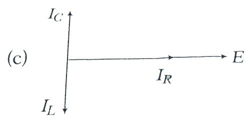
Watch Video Solution

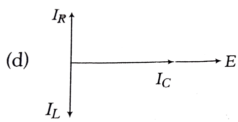
19. An alternating emf is applied across a parallel combination of a resistance R, capacitance C and an inductance L. If I_R, I_L and I_C are the currents through R,L and C respectively, the phase relationship among I_R, underset(L)(I) and underset(C)(I)` and source emf E, is

given by

A. 

B. 

C. 

D. 

Answer: C

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20. An AC supply gives 30 $\underset{rms}{V}$ which passes 10Ω resistance. The power dissipated in it is

A. $90\sqrt{2}$ W

B. 90 W

C. $45\sqrt{2}$ W

D. 45 W

Answer: B

Watch Video Solution

21. An alternating potential V = $\underset{o}{V} \sin \omega$t is applied across a circuit. As a result the current.

I = $I_o \sin\left(\omega t - \frac{\pi}{2}\right)$ flows in it. The power consecutive in the circuit per cycle is

A. zero

B. 0.5V_0 and I_0

C. 0.707V_0 and I_0

D. 1.414V_0 and I_0

Answer: A

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22. A direct current of 2 A and an alternating current having a maximum value of 2 A flow through two identical resistances. The ratio of heat produced in the two resistances will be

A. 0.0423611111111

B. 0.0430555555556

C. 0.0840277777778

D. 0.1673611111111

Answer: C

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23. In a heating arrangement , an alternating current having a peak value of 28 A is used . To produce the same heat energy , If the constant current is used, its magnitude must be

A. about 1A

B. about 28 A

C. about 20 A

D. Cannot say

Answer: C

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24. A lamp consumes only 50% of peak power in an $a.c.$ circuit. What is the phase difference between the applied voltage and the circuit current

A. $\pi/6$

B. $\pi/3$

C. $\pi/4$

D. $\pi/2$

Answer: B

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25. 110 $\underset{rms}{V}$ is applied across a series circuit having resistance 11Ω and independence 22Ω . The power consumed is

A. 275 W

B. 366 W

C. 550 W

D. 1100 W

Answer: A

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26. A 20volts AC is applied to a circuit consisting of a resistance and a coil with negligible resistance. If the voltage across the resistance is $12V$, the voltage across the coil is

A. 16 V

B. 10 V

C. 8 V

D. 6 V

Answer: A

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27. To reduce the resonant frequency in an LCR series circuit with a generator

A. the generator frequency should be reduced

B. another capacitor should be added in parallel to the first

C. the iron core of the inductor should be removed

D. dielectric in the capacitor should be removed

Answer: B

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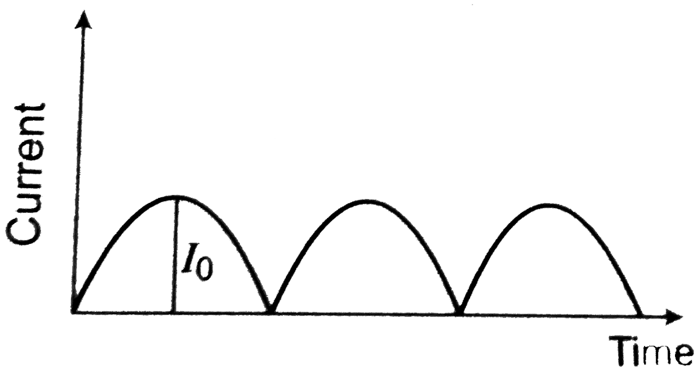
28. The output current versus time curve of a rectifire is shown in the figure. The voltage value of output current in this case is



A. 0

B. $\frac{I_O}{2}$

C. $\frac{2I_0}{\pi}$

D. I_0

Answer: C

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29. An alternating voltage is given by: $e = e_1 \sin \omega t + e_2 \cos \omega t$. Then the root mean square value of voltage is given by:

A. $\sqrt{e_1^2 + e_2^2}$

B. $\sqrt{e_2 e_2}$

C. $\frac{\sqrt{e_1 e_2}}{2}$

D. $\frac{\sqrt{e_1^2 + e_2^2}}{2}$

Answer: D

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30. Voltage and current in an ac circuit are given by

$V = 5\sin\left(100\pi t - \frac{\pi}{6}\right)$ and $I = 4\sin\left(100\pi t + \frac{\pi}{6}\right)$

A. voltage leads the current by 30°

B. current leads the voltage by 30°

C. current leads the voltage by 60°

D. voltage leads the current by 60°

Answer: C

31. An alternating voltage $E = 200\sqrt{2}\sin(100t)$ is connected to a 1 microfarad capacitor through an AC ammeter. The reading of the ammeter shall be

A. 10 mA

B. 20 mA

C. 40 mA

D. 80 mA

Answer: B

32. A coil having an inductance of $1/\pi$ henry is connected in series with a resistance of 300Ω. If 20 volt from a 200 cycle source are impressed across the combination, the value of the phase angle between the voltage and the current is :

A. 5/4.

B. 4/5.

C. 3/4.

D. 4/3.

Answer: D

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33. A condenser of capacity 20μF is first charged and then discharged through a 10mH inductance. Neglecting the resistance of the coil, the frequency of the resulting vibrations will be

A. 364 cycles/s

B. 35.6 cycles/s

C. 365×10^{3} cycles/s

D. 3.56 cycles/s

Answer: A

Watch Video Solution

34. An dielectric current has both DC and AC components . DC component of BA and AC component is given as I = $6\,\mathrm{sinomega}a t.\ S o$underset(rms)(I)` value of resulatant current is

A. 8.05 A

B. 9.05 A

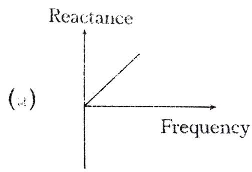
C. 11.58 A

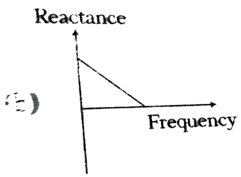
D. 13.58 A

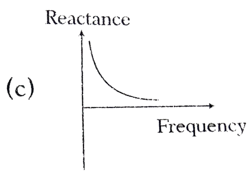
Answer: B

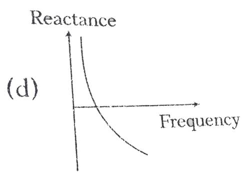
Watch Video Solution

35. Which of the shown graphs may represent the reactance of a series L-C combination?

A. 

B. 

C. 

D. 

Answer: D

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36. Two coils have a mutual inductance 0.005 H. The alternating current charges in the first coil according to equation I = $I_o$sinωt, where I_o = 10 A amd ω = 100π $rads^{-1}$. The maximum value of emf in the second coil

is (in volt)

A. 2π

B. 5π

C. π

D. 4π

Answer: B

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37. Two identical heaters rated $220V$, $1000W$ are paced in series with each other across $220V$ line , then the combined power is

A. 2000 W

B. 1000 W

C. 500 W

D. 250 W

Answer: C

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38. In an LR-circuit, the inductive reactance is equal to the resistance R of the circuit. An e.m.f $E = E_0 \cos(\omega t)$ applied to the circuit. The power consumed in the circuit is

A. $\dfrac{E_0^2}{\sqrt{2R}}$

B. $\dfrac{E_0^2}{4R}$

C. $\dfrac{E_0^2}{2R}$

D. $\dfrac{E_0^2}{8R}$

Answer: B

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39. A choke coil and capacitor are connected in series and the current through the combination is maximum for AC of frequency n. If they are connected in parallel, at what frequency is the current through the combination minimum?

A. n

B. n/2

C. 2n

D. None of these

Answer: A

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40. In a transformer, the coefficient of mutual inductance between the primary and the secondary coil is 0.2 henry. When the current changes by 5 ampere//second in the primary, the induced e.m.f. in the secondary will be

A. 5V

B. 1 V

C. 25 V

D. 10 V

Answer: B

Watch Video Solution

41. In a transformer, number of turns in the primary coil are 140 and that in the secondry coil are 280. If current i primary ciol is 4A, then that in the secondary coil is

A. 4A

B. 2A

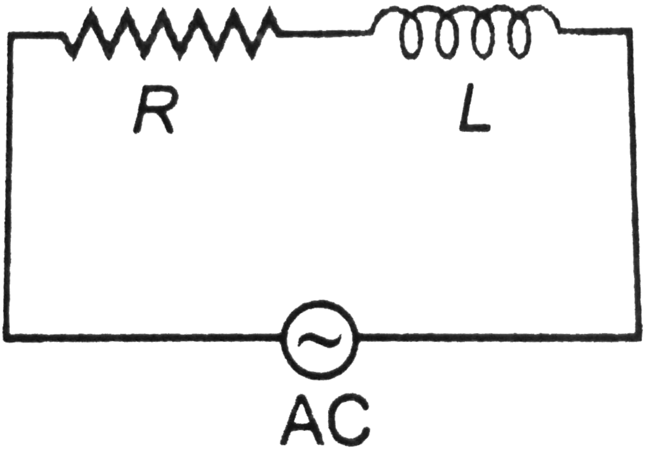
C. 6A

D. 10A

Answer: B

Watch Video Solution

42. A circuit contains resistance R and an inductance L in series. An alternating voltage $V = V_0 \sin \omega t$ is applied across it. The currents in R and L respectively will be



A. $I_R = I_O \cos \omega t, I_L = I_0 \cos \omega t$

B. $I_R = - I_0 \sin \omega t, I_L \cos \omega t$

C. $I_R = I_0 \sin \omega t, I_L = - I_0 \cos \omega t$

D. none of the above

Answer: D

Watch Video Solution

43. A transfomer has 500 primary tunrs and 10 secondary turns. If the secondary has a resistive load respectively, are

A. $0.16A, 3.2 \times 10^{-3}A$

B. 3.2×10^{-3} A, 0.16 A

C. $0.16A, 0.16A$

D. $3.2 \times 10^{-3}A, 3.2 \times 10^{-3}$A

Answer: B

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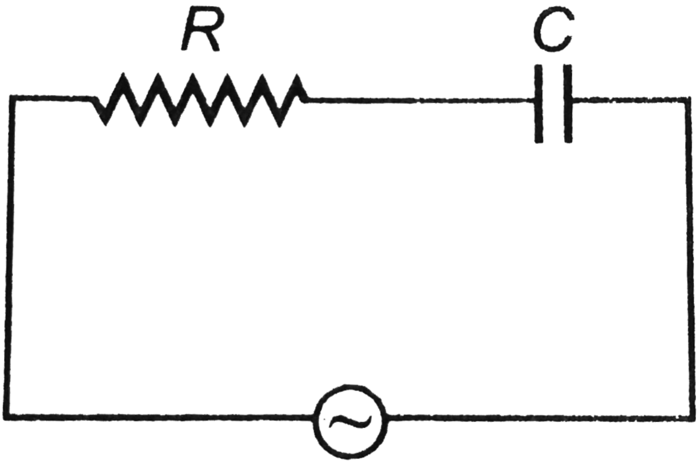
44. A $50 Hz AC$ source of $20 V$ is connected across R and C as shown in figureure.



The voltage across R is $12 V$. The voltage across C is

A. 8 V

B. 16 V

C. 10 V

D. not possible to determine unless value of R and C are given

Answer: B

Watch Video Solution

45. In an circuit, V and I are given by $V = 150 \sin(150t) V$ and $I = 150 \sin\left(150t + \frac{\pi}{3}\right) A$. The power dissipated in the circuit is

A. 106 W

B. 150W

C. 5625 W

D. zero

Answer: C

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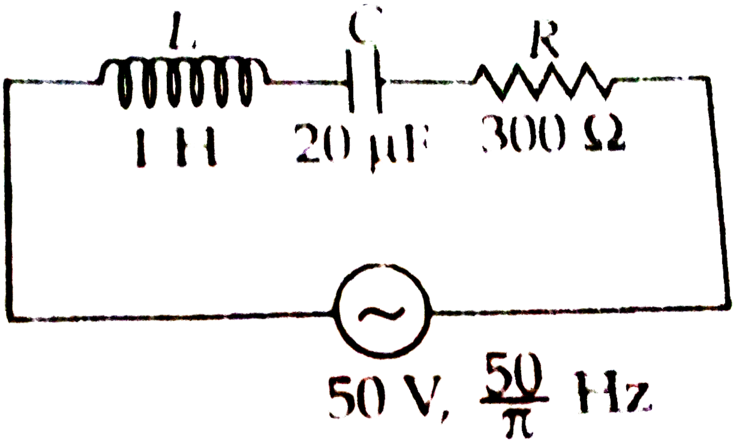
46. In the series LCR circuit shown the impedance is



A. 200Ω

B. 100Ω

C. 300Ω

D. 500Ω

Answer: D

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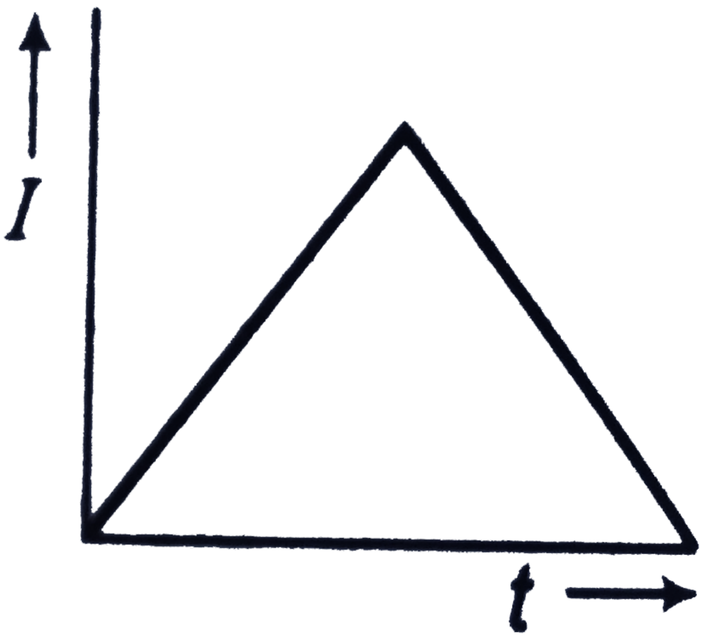
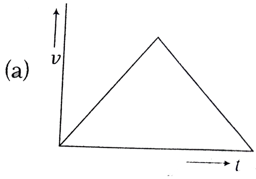
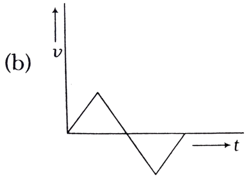
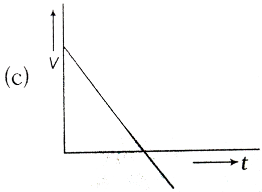
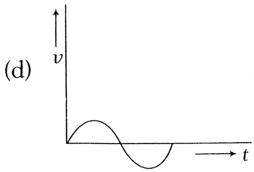
47. An alternating current I in an inductance coil varies with time t according to the graph as shown: Which one of the following graph gives the variation of voltage with time?



A. 

B. 

C. 

D. 

Answer: B

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48. A resistor and a capacitor are connected in series with an a.c. source. If the potential drop across the capacitor is 5 V and that across resistor is 12 V, applied voltage is

A. 13V

B. 17 V

C. 5 V

D. 12 V

Answer: A

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49. When a voltage measuring device is connected to a.c. mains the meter shows the steady input voltage of $220 V$. This means

A. input voltage cannot be AC voltage, but a DC voltage

B. maximum input voltage is 220 V

C. the meter reads not v but $< v^2 >$ and is calibrated to read $\sqrt{< v^2 >}$

D. the pointer of the meter is stuck by some mechanical defect.

Answer: C

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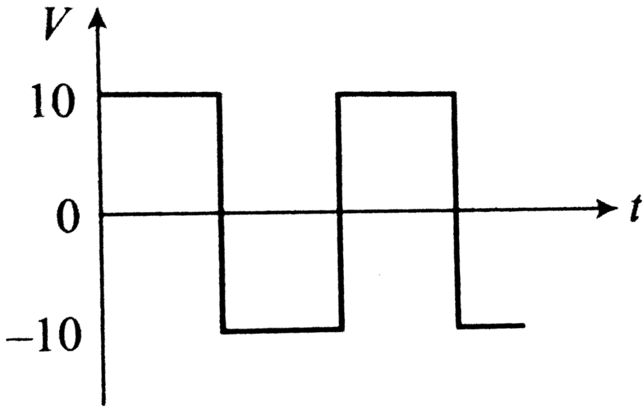
50. The r.m.s. voltage of the wave form shown is



A. 10 V

B. 7 V

C. 6.37 V

D. none of the above

Answer: A

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51. Using an ac voltmeter, the potential difference in the electrical line in a house is read to be 234 V. If the line freqency is known to be 50 cycles per second, the equation for the line voltage is

A. 165 sin $(200\pi t)$

B. 234 sin $(100\pi t)$

C. 331 sin $(100\pi t)$

D. 440 sin $(200\pi t)$

Answer: C

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52. The output of a step-down transformer is measured to be $24V$ when connected to a 12 watt light bulb. The value of the peak current is

A. $\frac{1}{\sqrt{2}}A$

B. $\sqrt{2}A$

C. 2A

D. $2\sqrt{2}A$

Answer: A

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53. The rms value of an ac of 50Hz is 10A. The time taken by an alternating current in reaching from zero to maximum value and the peak value will be

A. $2 \times 10^{-2} s$ and 14.14A

B. $1 \times 10^{-2} s$ and $7.07A$

C. $5 \times 10^{-3} s$ and $7.07A$

D. $5 \times 10^{-3} s$ and 14.14 A

Answer: D

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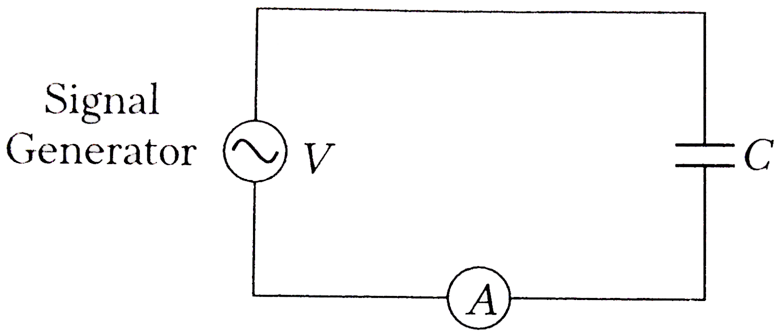
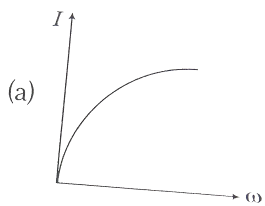
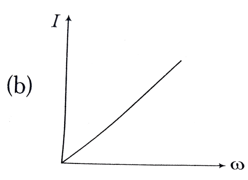
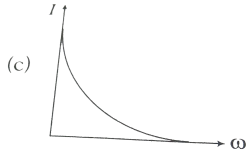
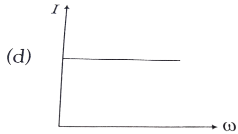
54. A constant voltage at different frequencies is applied across a capacitance. C as shown in the figure. Which of the following graphs correctly depicts the varitaion of current with frequency?



A. 

B. 

C. 

D. 

Answer: B

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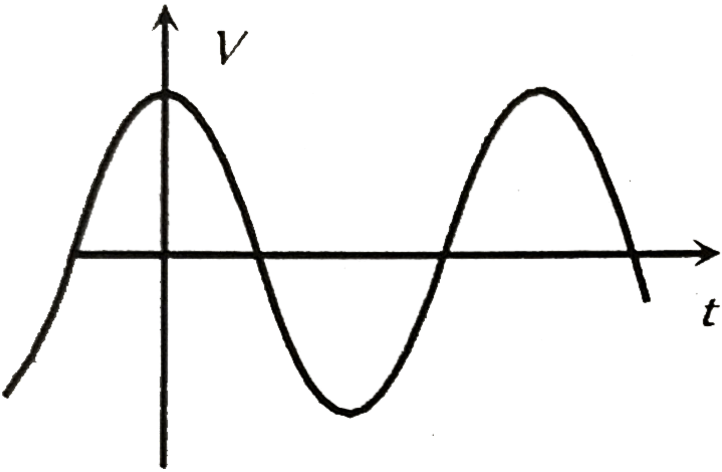
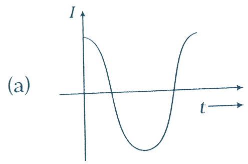
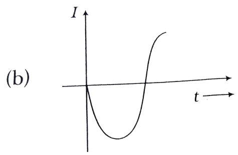
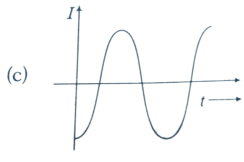
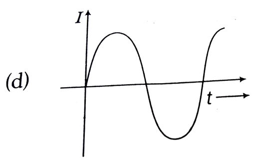
55. The voltage across a pure inductor is represented by the following diagram. Which one of the following diagrams will represent the current



A. 

B. 

C. 

D. 

Answer: D

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56. An inductance of 1 mH a condenser of $10\mu F$ and a resistance of 50Ω are connected in series. The reactances of inductor and condensers are same. The reactance of either of them will be

A. 100Ω

B. 30Ω

C. 3.2Ω

D. 10Ω

Answer: D

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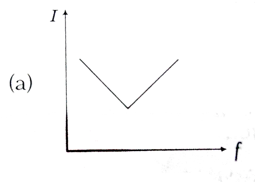
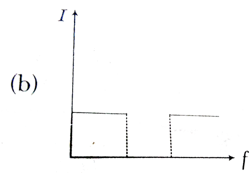
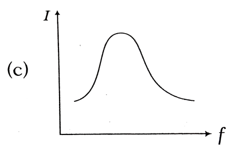
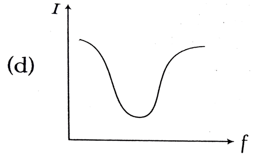
57. An AC source of variable frequency f is connected to an LCR series circuit. Which one of the graphs in figure represents the variation of current of current I in the circuit with frequecy f?

A. 

B. 

C. 

D. 

Answer: C

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58. The armature of a DC motor has 20Ω resistance. It draws a current of $1.5A$ when run by $200V\,DC$ supply The value of back emf induced in it will be

A. 150 V

B. 170 V

C. 180 V

D. 190V

Answer: D

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59. A group of electric lamps having a total power rating of 1000 watt is supplied by an AC voltage $E = 200 \sin(310t + 60^\circ)$. Then the r.m.s value of the circuit current is

A. 0.41666666666667

B. $5\sqrt{2}$A

C. 20 A

D. $10\sqrt{2}$A

Answer: B

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60. An alternating voltage V=140 sin 50 t is applied to a resistor of resistance 10 Ω. This voltage produces $\triangle H$ heat in the resistor in time $\triangle t$. To produce the same heat in the same time, rquired DC current is

A. $\frac{5}{\sqrt{2}}$

B. $\frac{10}{\sqrt{2}}$A

C. 0.208333333333333

D. None of these

Answer: A

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61. An alternating voltage V=140 sin 50 t is applied to a resistor of resistance 10 Ω. This voltage produces $\triangle H$ heat in the resistor in time $\triangle t$. To produce the same heat in the same time, rquired DC current is

A. 14 A

B. About 20 A

C. about 10 A

D. None of these

Answer: C

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62. In a certain circuit current changes with time according to $i = 2\sqrt{t}$ RMS value of current between t=2s to t=4s will be

A. 3A

B. $3\sqrt{3}$A

C. $2\sqrt{3}$

D. $\sqrt{3}$A

Answer: C

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63. The power factor of an R-L circuit is $1/\sqrt{2}$ if the frequency of AC is doubled , what will be the power

A. $\dfrac{1}{\sqrt{3}}$

B. $\dfrac{1}{\sqrt{7}}$

C. $\dfrac{1}{\sqrt{7}}$

D. $\dfrac{1}{\sqrt{11}}$

Answer: B

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64. When a DC voltage of 200 V is applied to a coil of self inductance $(2/\sqrt{3}/\pi)$H a current of 1A flows through it .

But by replacing DC source with AC source of 200 V , the current in the coil is reduced to 0.5A . Then the frequency of AC supply is

A. 30 Hz

B. 60 Hz

C. 75 Hz

D. 50 Hz

Answer: D

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65. One $10V, 60W$ bulb is to be connected to $100V$ line. The required inductance coil has self-inductance of value

$(f = 50Hz)$

A. 0.052 H

B. 2.42 H

C. 16.2 H

D. 16.2 mH

Answer: A

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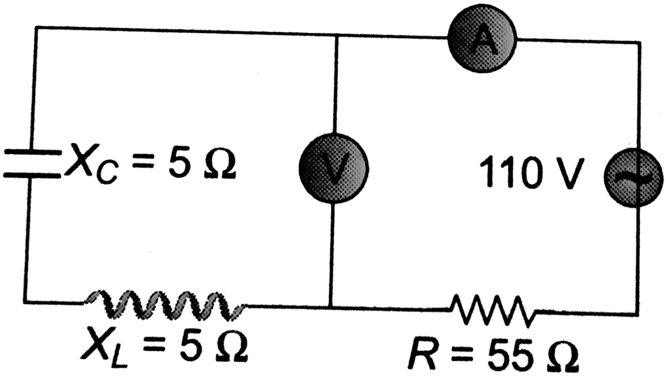
66. The reading of ammeter in the circuit shown will be



A. 2A

B. 2.4A

C. Zero

D. 1.7A

Answer: C

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67. In series LCR circuit voltage drop across resistance is 8V, across inductor is 6V and across capacitor is 12V. Then

A. voltage of the source will be leading in the circuit

B. voltage drop across each element will be less than the applied voltage

C. Power factor of the circuit will be $3/4$

D. None of the above

Answer: D

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68. In a series L-C-R circuit shown in the figure , what is the resonance frequency and the current at the resonating frequency?

A. 0°

B. 30°

C. 45°

D. 60°

Answer: A

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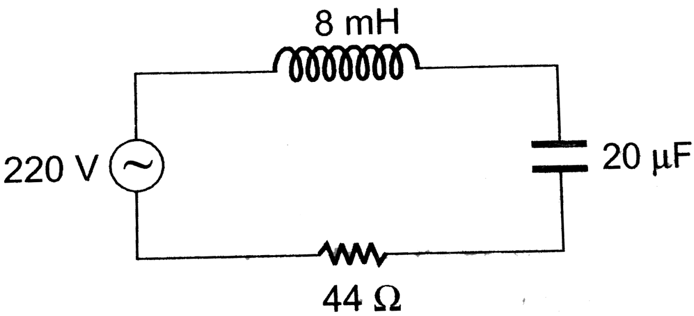
69. For the series LCR circuit shown in the figure, what is the resonance frequency and the amplitude of the current at the resonating frequency



A. 2500 $rads^{-1}$ and 5sqrt 2A

B. 2500 $rads^{-1}$ and 5 A

C. 2500 $rads^{-1}$ and $\frac{5}{\sqrt{2}}$A

D. 25 $rads^{-1}$ and $5\sqrt{2}$A

Answer: B

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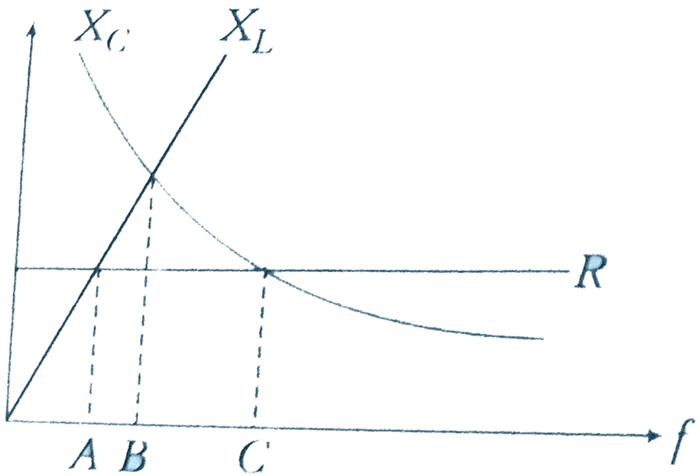
70. The figure shows variation of R, X_L and X_C with frequency f in a series L, C , R circuit . Then , for what frequency point, the circuit is inductive?



A. A

B. B

C. C

D. All points

Answer: C

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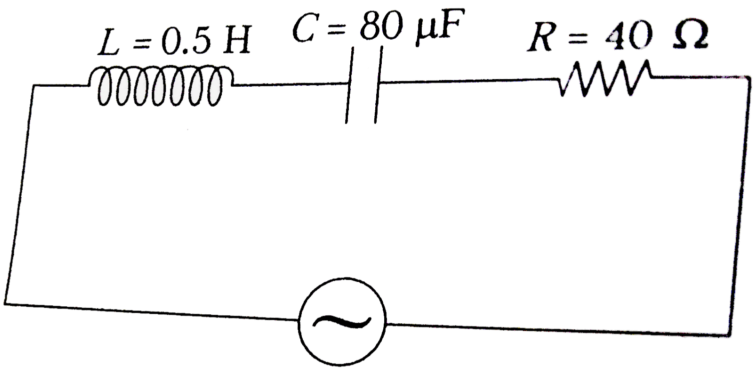
71. In the given figure , a series L-C-R circuit is connected to a variable frequency source of 230 V . The impedance and amplitude of the current at the resonating frequency will be



A. 20Ω and 4.2 A

B. 30Ω and 6.9 A

C. 25Ω and 5.8 A

D. 40Ω and 5.75 A

Answer: D

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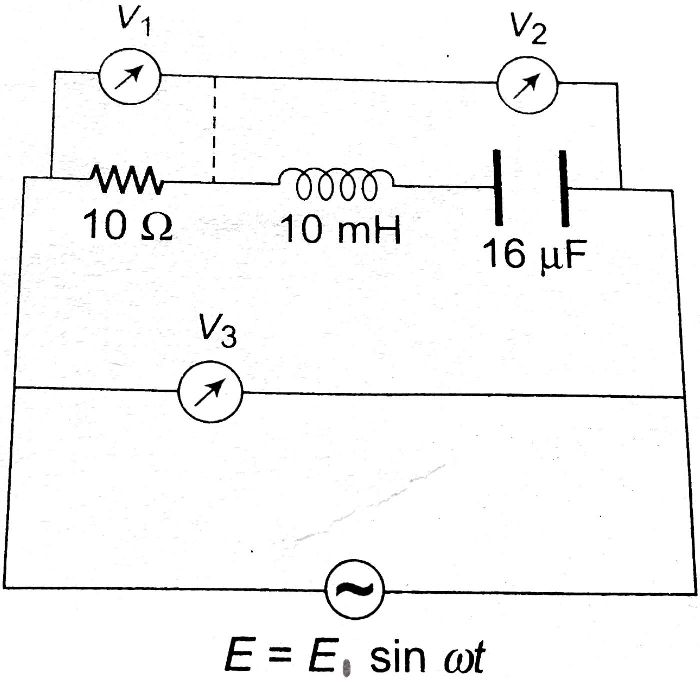
72. In figure which voltmeter reads zero when ω is equal to the resonant frequency of series LCR circuit



A. V_1

B. V_2

C. V_3

D. None of these

Answer: B

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73. An R-L-C circuit containing a 52Ω resistor , a 230 mH inductor, and a 8.8μF capacitor is driven by an AC voltage source that has an amplitude of 150 V and frequency f = 80 Hz . How much average power is dissipated by this circuit?

A. 78.6 W

B. Zero

C. 19.6 W

D. 24.8 W

Answer: A

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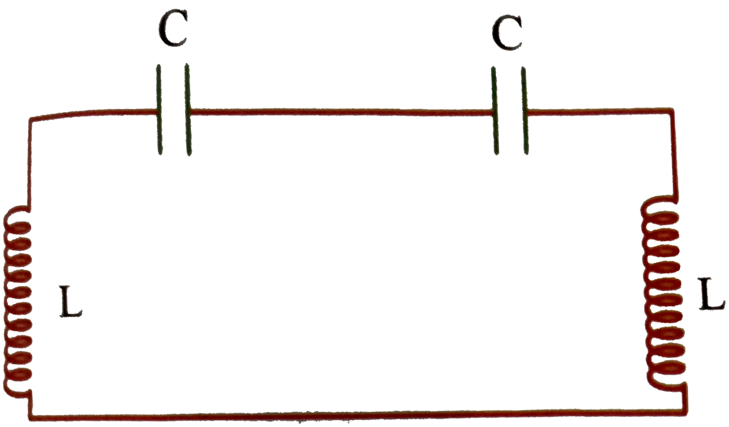
74. The natural frequency of the circuit shown in the figure is



A. $\frac{1}{2}\pi\sqrt{LC}$

B. $\frac{1}{2}\pi\sqrt{2LC}$

C. $\frac{2}{2}\pi\sqrt{LC}$

D. None of these

Answer: A

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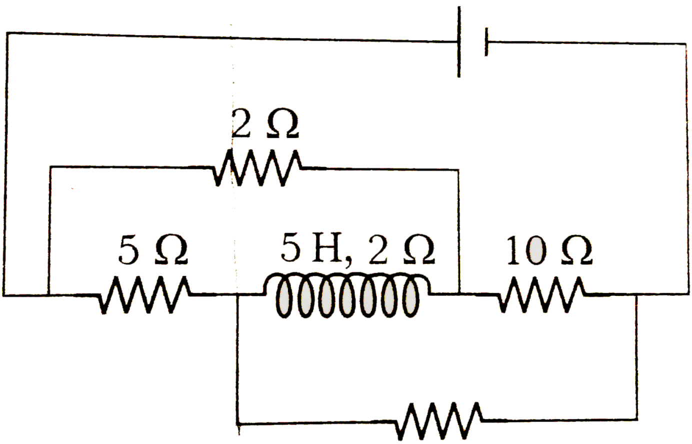
75. In the circuit shown , what is the energy stored in the coil at steady state?



A. 21.3 J

B. 42.6 J

C. Zero

D. 213 J

Answer: C

Watch Video Solution

76. A loss-free transformer having 100 turns in primary is used to transmit 10 KW of power . The input voltage is 200 V and power is transmitted at 5 KV. The current in the primary and secondary of the transformer are

A. 2 A and 50 A

B. 50 A and 2 A

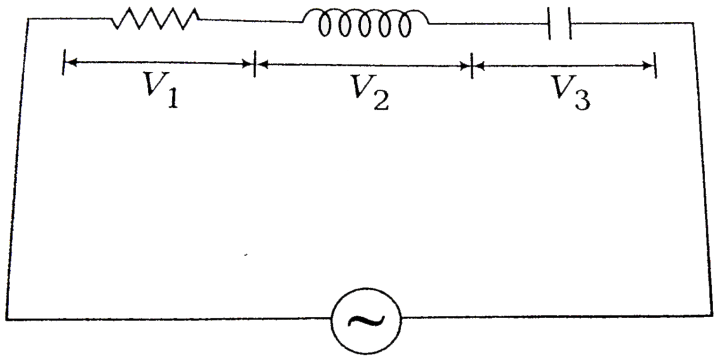
C. 25 A and 4 A

D. 12.5 A and 8 A

Answer: B

Watch Video Solution

77. For series L-C-R circuit shown in the figure, the readings of V_1 and V_3 are same and each equal to 100 V .Then



A. the reading V_2 is 200 V

B. the reading of V_2 is 0

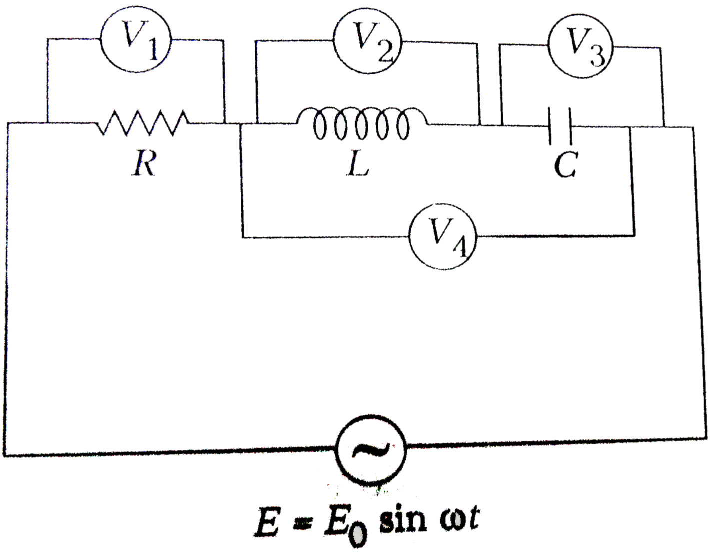
C. the circuit is in resonant mode and resonant frequency is 50 Hz

D. the inductive and capacitive reactance are equal

Answer: A::C::D

Watch Video Solution

78. In the given figure, which voltmeter will read zero voltage at resonant frequency?



A. V_1

B. V_2

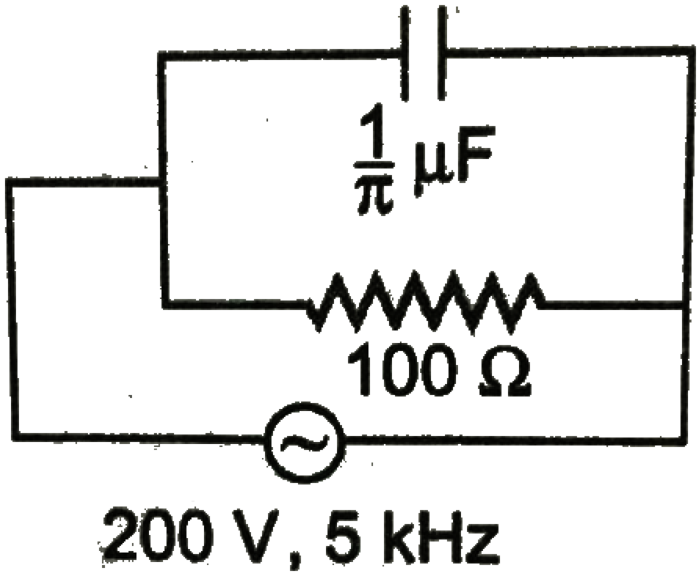
C. V_3

D. V_4

Answer: D

Watch Video Solution

79. A signal generator supplies a sine wave of $200V, 5kHz$ to the circuit shown in the figureure. Then, choose the wrong statement.



A. The current in the resistive branch is 0.2 A

B. The current in the capacitive branch is 0.126 A

C. Total line current is $\approx$ 0.283 A

D. Current in both the branches is same

Answer: A::C::D

Watch Video Solution

80. An AC source is 120 V-60 Hz. The value of voltage after 1/720 s from start will be

A. 20.2 V

B. 42.4 V

C. 84.8 V

D. 106.8 V

Answer: C

Watch Video Solution

81. A pure resistive circuit element X when connected to an ac supply of peak voltage 400 V gives a peak current of 5 A which is in phase with the voltage. A second circuit element Y, when connected to the same ac supply also gives the same value of peak current but the current lags behind by 90°. If the series combination of X and Y is connected to the same supply, what will be the rms value of current?

A. $\frac{10}{\sqrt{2}}$ A

B. $\frac{5}{\sqrt{2}}$ A

C. 5/2 A

D. 5A

Answer: C

Watch Video Solution

82. A coil a capacitor and an AC source of rms voltage $24V$ are connected in series. By varying the frequency of the source, a maximum rms current of 6 A is observed. If coil is connected is at DC batteryof emf 12 volt and internal resistance 4Ω, then current through it in steady state is

A. 2.4 A

B. 1.8 A

C. 1.5 A

D. 1.2 A

Answer: C

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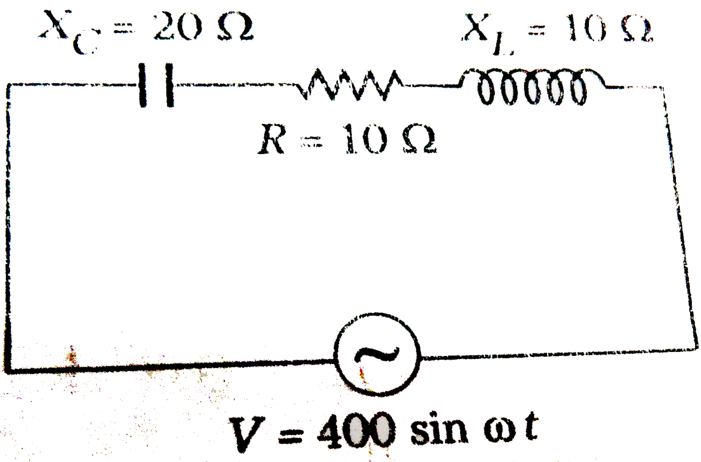
83. In the L-C-R circuit as shown in figure,



A. Current will lead the voltage

B. Runs value of current is 20 A

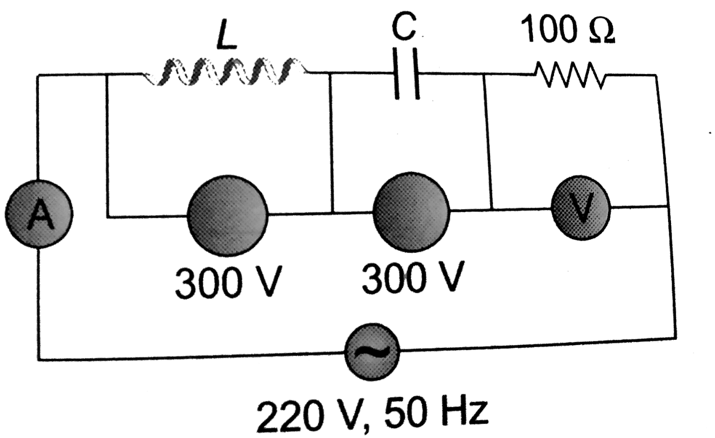
C. Power factor of the circuit is $\frac{1}{\sqrt{2}}$

D. Voltage drop across resistance is 200 V

Answer: A::B::C::D

Watch Video Solution

84. In the circuit shown below, what will be the reading of the voltmeter and ammeter?



A. 200 V , 1 A

B. 800 V and 2 A

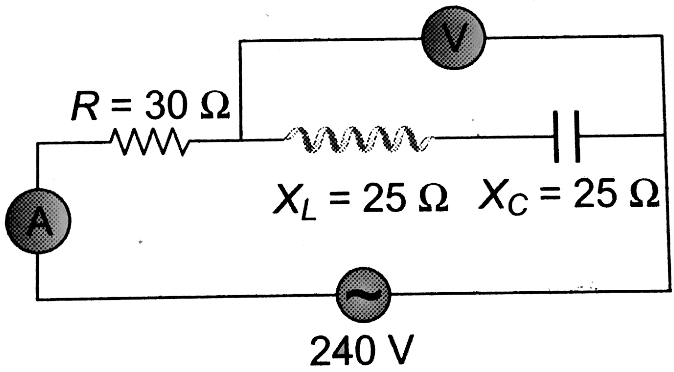
C. 220 V , 2 A

D. 220 V , 2.2 A

Answer: D

Watch Video Solution

85. In the circuit shown in figure neglecting source resistance the voltmeter and ammeter reading will respectively, will be



A. 0 V , 3 A

B. 150 V , 3 A

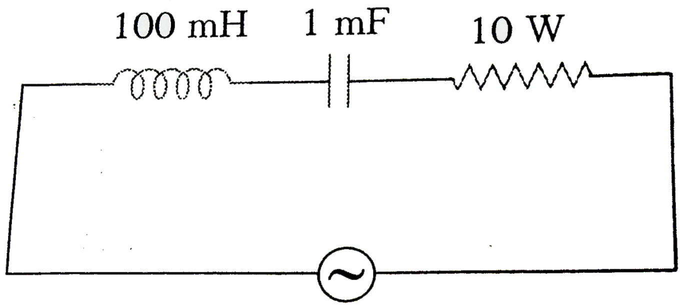
C. 150 V, 6 A

D. 0 V, 8 A

Answer: D

Watch Video Solution

86. The following series L-C-R circuit, when driven by an emf source of angular frequency 70 kilo-radians per second, the circuit effectively behaves like



A. purely resistive circuit

B. series R-L circuit

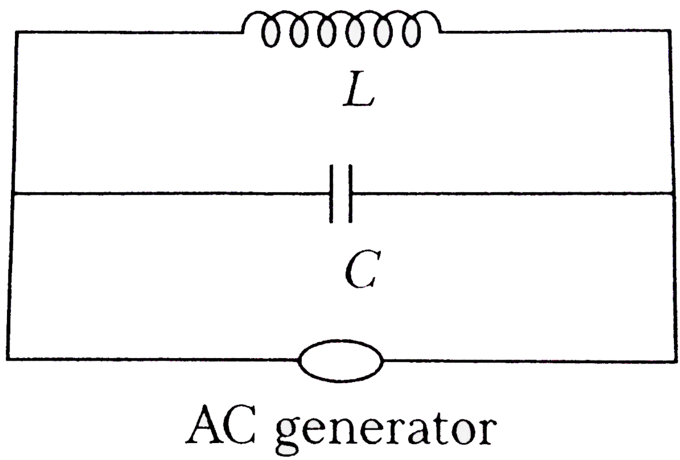
C. series R-C circuit

D. series L-C circuit with R = 0

Answer: B

Watch Video Solution

87. In the circuit shown in the figure , the alternating currents through inductor and capacitor are 1.2 and 1.0 A respectively . The current drawn from the generator is



A. 0.4 A

B. 0.2 A

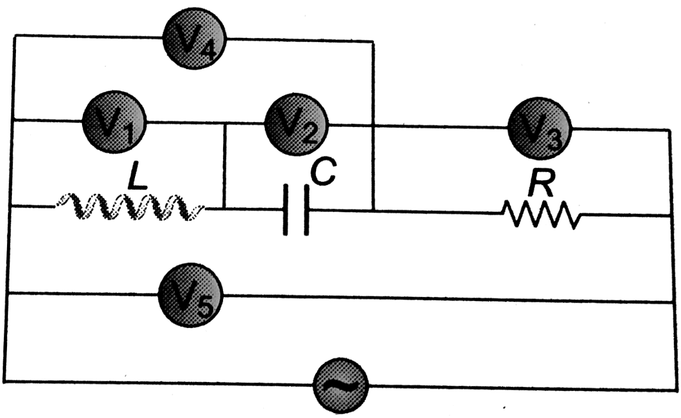
C. 1.0 A

D. 1.2 A

Answer: B

Watch Video Solution

88. In the adjoining AC circuit the voltmeter whose reading will be zero at resonance is



A. V_1

B. V_2

C. V_3

D. $\frac{V}{4}$

Answer: D

Watch Video Solution

89. An alternating current generator has an internal resistance R_g and an internal reactance X_g. It is used to supply power to a passive load consisting of a resistance R_g and a reactance X_L. For maximum power to be delivered from the generator to the load, the value of X_L is equal to

A. zero

B. X_g

C.

D. $\frac{R}{g}$

Answer: C

Watch Video Solution

90. Which of the following combinations should be selected for better turning of an LCR circuit used for communication ?

A. R = 20 Ω , L = 1.5h, C = 35μF

B. R = 25Ω , L = 2.5 H , C = 45μF

C. R = 15Ω , L = 3.5 H , C = 30μF

D. R = 25Ω, L = 3.5 H, C = 45μF

Answer: C

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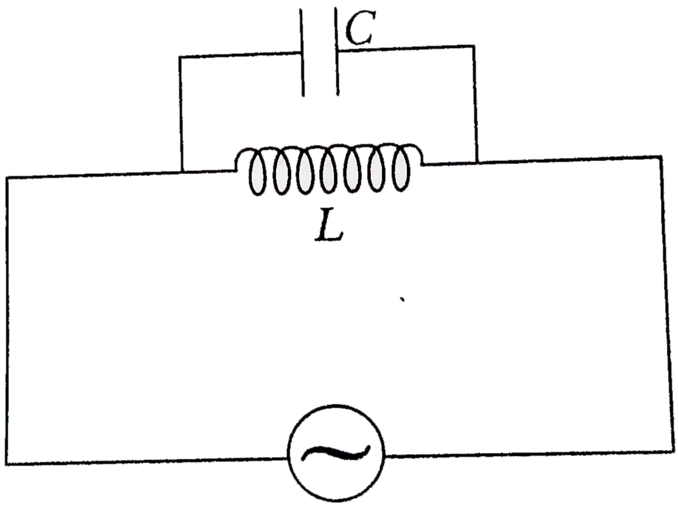
91. For the circuit as shown in the figure the current through the inductor is 1.6 A, while the current through the condenser is 0.4 A . Then, the current drawn from the source is



A. $I = 2\sqrt{2}A$

B. I = 1.65 A

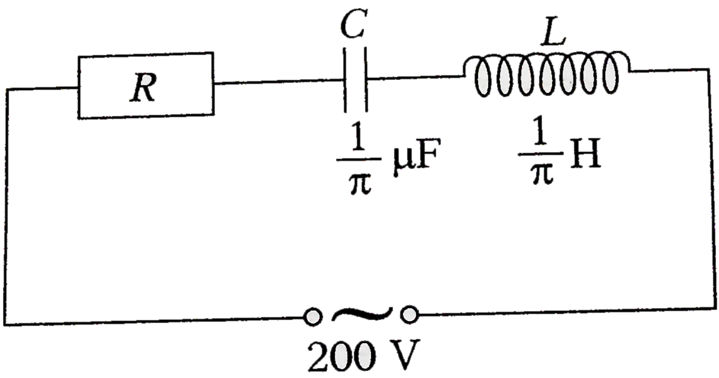
C. I = 1.2 A

D. I = 2.0 A

Answer: C

Watch Video Solution

92. In the circuit shown in figure , the supply has a constant rms value V but variable frequency f. The frequency at which the voltage drop across R is maximum is



A. 100 Hz

B. 500 Hz

C. 300 Hz

D. None of these

Answer: B

Watch Video Solution

93. When an AC voltage, of variable frequency is applied to series L-C-R circuit , the current in the circuit is the same at 4 kHz and 9 kHz. The current in the circuit is maximum at

A. 5 kHz

B. 6.5 kHz

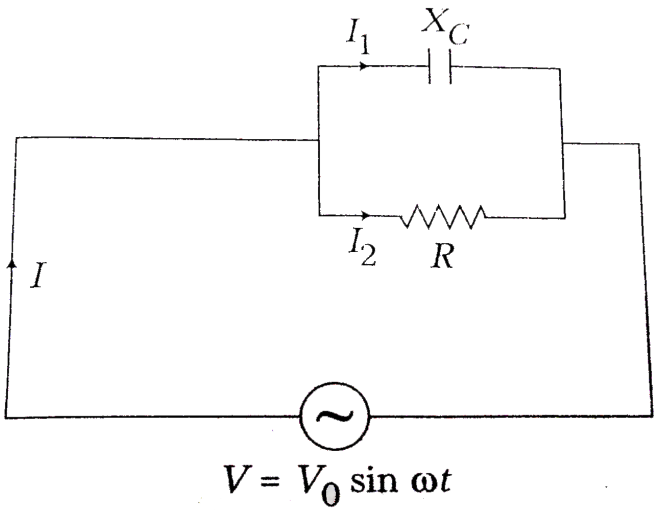
C. 4.2 kHz

D. 6 kHz

Answer: D

Watch Video Solution

94. In the given AC circuit



A. current I_2 and V are is same value

B. current I_2 leads I_1 by 90°

C. current I leads I_2 by θ lt 90°

D. current I leads I_1 by θ lt 90°

Answer: A

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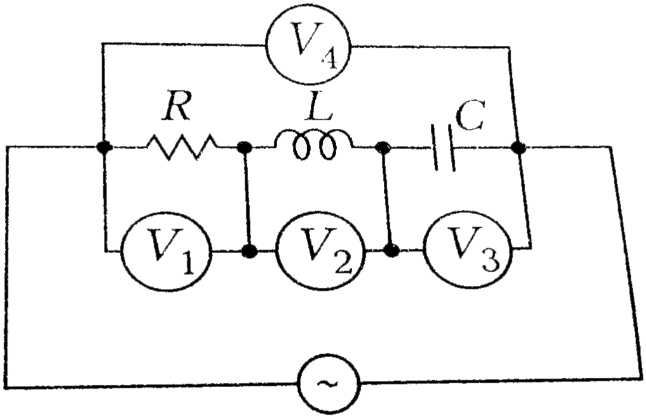
95. An ideal resistance R, ideal inductance L , ideal capacitance C and AC voltmeters V_1 , V_2 , V_3 and V_4 are connected to an AC source as shown . At resonance



A. Reading in V_3 = reading in V_1

B. Reading in V_1 = reading in V_2

C. Reading in V_2 = reading in V_4

D. Reading in V_2 = reading in V_3

Answer: D

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96. An AC voltage source of variable angular frequency (ω) and fixed amplitude V_0 is connected in series with a capacitance C and an electric bulb of resistance R (inductance zero). When (ω) is increased

A. The bulb glows dimmer

B. The bulb glows brighter

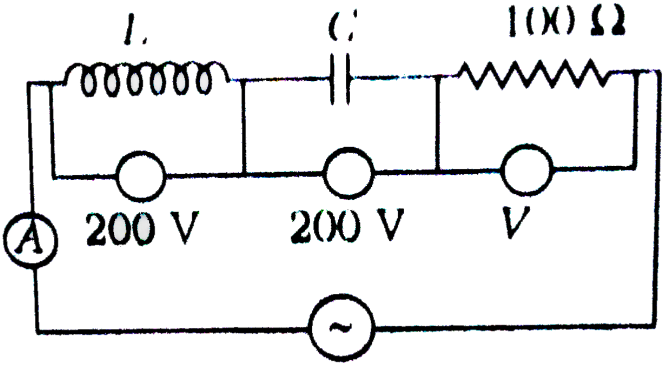
C. Total impedance of the circuit is unchanged

D. Total impedance of the circuit increases

Answer: B

Watch Video Solution

97. The reading of ammeter and voltmeter in the following circuit are respectively



A. 2 A , 200 V

B. 1.5 A , 100 V

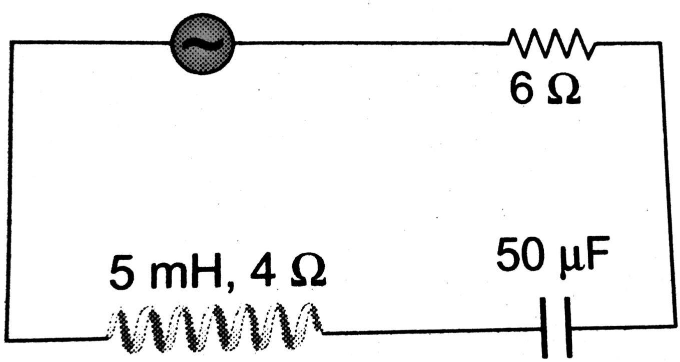
C. 2.7 A, 220 V

D. 22 A, 220 V

Answer: D

Watch Video Solution

98. In the circuit below, the AC source the voltage $V = 20\cos(\omega t)$ volts with $\omega = 2000 rad/\text{sec.}$ The amplitude of the current will be nearest to



A. $2:0$

B. 3.3 A

C. $2\sqrt{5}$ A

D. $\sqrt{5}$ A

Answer: A

Watch Video Solution

99. In a series L-C-R circuit the voltage across resistance , capacitance and inductance is 10 V each. If the capacitance is short circuited, the voltage across the inductance will be

A. $10/\sqrt{2}$ V

B. 10 V

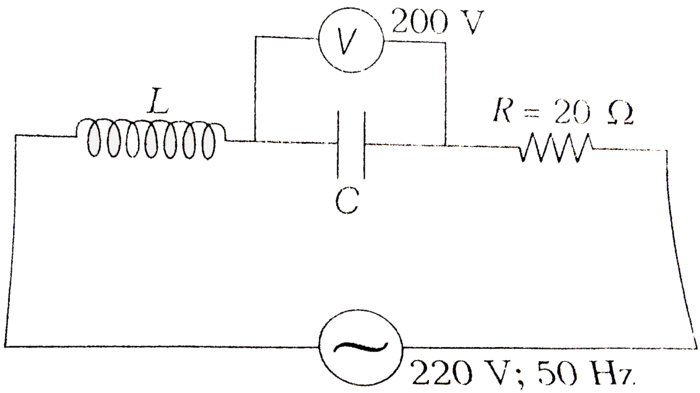
C. $10\sqrt{2}$ V

D. 20 V

Answer: A

Watch Video Solution

100. In the circuit shown, rms circuit is 11 A . The potential difference across the inductor is



A. 220 V

B. 0 V

C. 300 V

D. 200 V

Answer: D

Watch Video Solution

101. A inductor of reactance 1Ω and a resistor of 2Ω are connected in series to the terminals of a 6 V (rms) a.c. source. The power dissipated in the circuit is

A. 8 W

B. 12 W

C. 14.4 W

D. 18 W

Answer: C

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102. An AC circuit consists of a resistance and a choke coil in series . The resistance is of 220 Ω and choke coils is of 0.7 H . The power abosorbed from 220 V and 50 Hz , source connected with the circuit , is

A. 55 W

B. 110 W

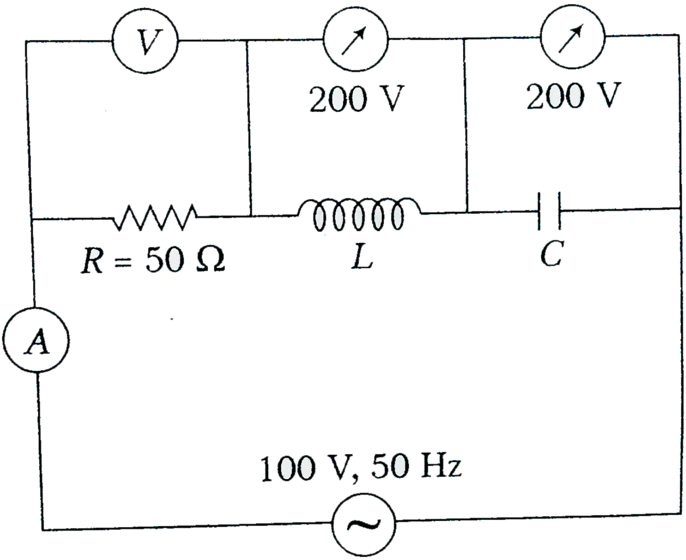
C. 220 W

D. 440 W

Answer: B

Watch Video Solution

103. In the series L-C-R circuit , the voltmeter and ammeter readings are respectively



A. V = 200 V , I = 4 A

B. V = 150 , I = 2 A

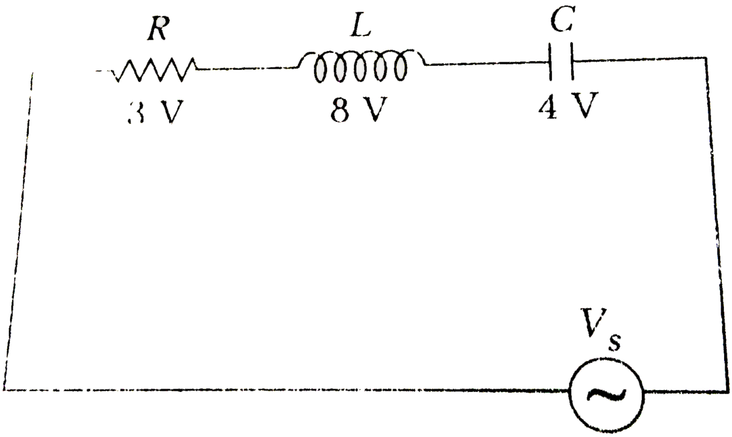
C. V = 100 , I = 5 A

D. V = 100 V, I = 2 A

Answer: D

Watch Video Solution

104. Current in resistance is 1 A , then



A. V_s = 5 V

B. impedance of network is 5Ω

C. power factor of given circuit is (0.6) lagging (current is lagging)

D. All the above

Answer: D

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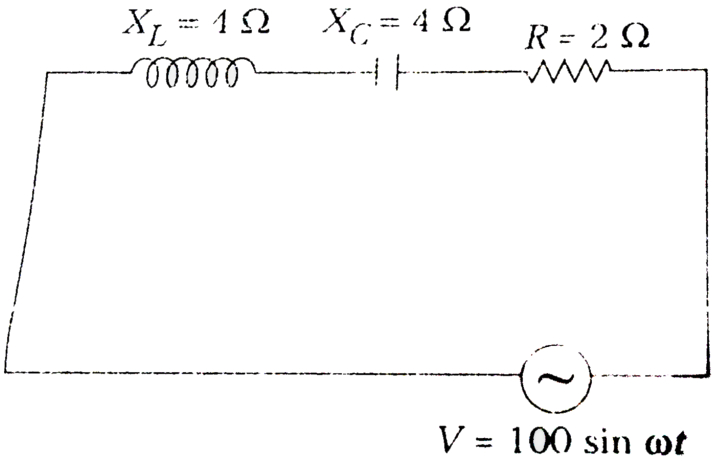
105. Which of the following statements is correct regarding the AC circuit shown in the adjacent figure?



A. The rms value of current through the circuit is i_{rms} = $5\sqrt{2}$ A

B. The phase difference between source emf and current is $= \cos^{-1}$ (1/3)

C. Avereage power dissipated in the circuit is 500 W

D. None of the above

Answer: D

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106. An $L-C-R$ series circuit with 100Ω resistance is connected to an AC source of $200V$ and angular frequency $300 rad / s$. When only the capacitance is removed, the current lags behind the voltage by 60°. When only the inductance is removed the current leads the voltage by 60°. Calculate the current and the power dissipated in the $L-C-R$ circuit

A. 50 W

B. 100 W

C. 200 W

D. 400 W

Answer: D

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107. A virtual current of $4A$ and $50Hz$ flows in an AC circuit contaning a coil. The power consumed in the coil is $240W$.If the virtual voltage across the coil is 100v then its inductance will be

A. $1/3\pi$

B. $1/5\pi$ H

C. $1/7\pi$ H

D. $1/9\pi$ H

Answer: B

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108. An inductance L, a capacitor of 20μF and a resistor of 10Ω are connected in series with an AC source of frequency 50 Hz. If the current is in phase with the voltage, then the inductance of the inductor is

A. 2.00 H

B. 0.51 H

C. 1.5 H

D. 0.99 H

Answer: B

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109. An LCR series circuit consists of a resistance of a 10Ω a capacitance of reactance 60Ω and an inductor coil The circuit is found to resonate when put across a $300V$, 100 Hz supply The inductance of the coil is $(take n\pi = 3)$.

A. 0.1 H

B. 0.01 H

C. 0.2 H

D. 0.02 H

Answer: A

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110. A capacitor of capacitance $1\mu F$ is charged to a potential of $1V$, it is connected in parallel to an inductor of inductance $10^{-3}H$. The maximum current that will flow in the circuit has the value

A. $\sqrt{1000}$ mA

B. 1A.

C. 1 mA

D. 1000 mA

Answer: A

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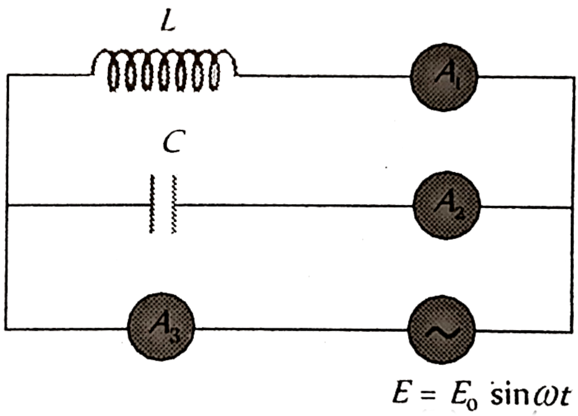
111. An inductor L and a capacitor C are connected in the circuit as shown in the figure. The frequency of the power supply is equal to the resonant frequency of the circuit. Which ammeter will read zero ampere



A. A_1

B. A_2

C. A_3

D. None of these

Answer: C

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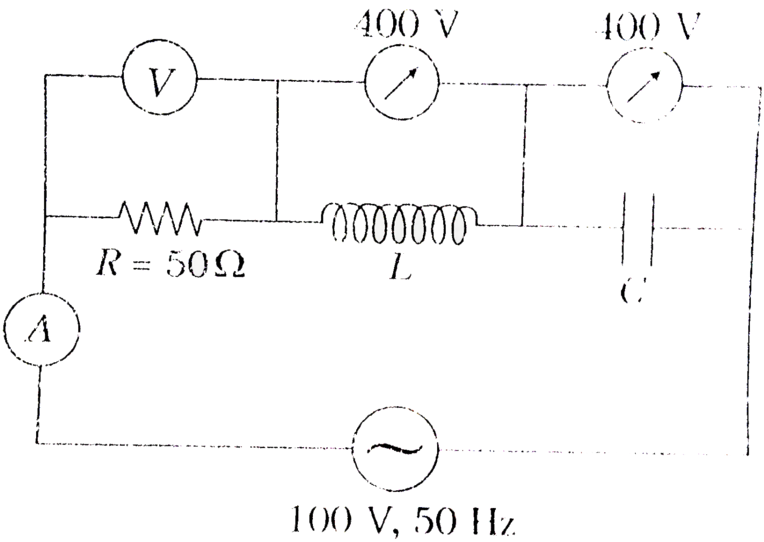
112. In the series L-C-R circuit , the voltmeter and ammeter readings are



A. V = 100 V, I = 2 A

B. V = 100 V , I = 5 A

C. V = 1000 V, I = 2 A

D. V = 300 V , I = 1 A

Answer: A

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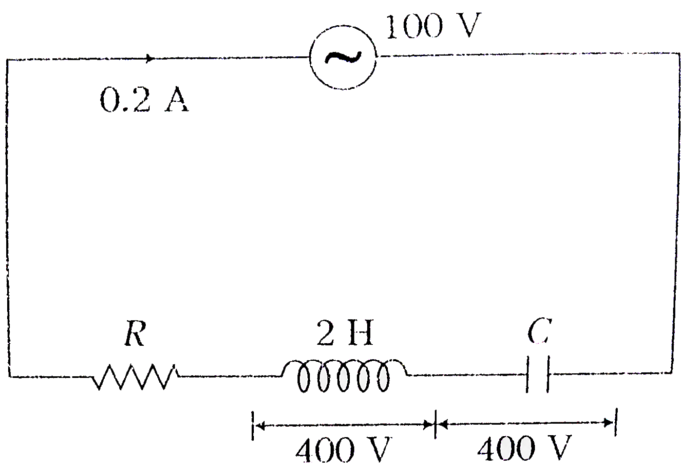
113. Which of the following options is correct with respect to the circuit diagram given below?



A. R = 400Ω , C = 0.5 μF

B. R = 500 Ω , C = 1μF

C. R = 500 Ω , C = 1 μF

D. R = 400 Ω , C = 0.1 μF

Answer: B

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114. When $100V$ DC is applied across a solenoid, a current of $1.0A$ flows in it. When $100V$ AC is applied across the same coil. The current drops to $0.5A$. If the frequency of the ac source is $50Hz$, the impedance and inductance of the solenoid are

A. 200Ω and 0.55 H

B. 100Ω and 0.86 H

C. 200Ω and 1.0 H

D. 1100Ω and 0.93 H

Answer: A

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115. An ideal choke takes a current of 10 A when connected to an ac supply of 125 V and 50 Hz. A pure resistor under the same conditions takes a current of 12.5 A. If the two are connected to an ac supply of 100 V and 40 Hz, then the current in series combination of above resistor and inductor is

A. 10A.

B. 5A.

C. $5\sqrt{2}$ A

D. $10\sqrt{2}$ A

Answer: C

Watch Video Solution

116. An AC source is connected with a resistance (R) and an unchanged capacitance C, in series. The potential difference across the resistor is in phase with the initial potential difference across the capacitor for the first time at the instant (assume that at t =0 , emf is zero)

A. $\frac{\pi}{\Omega}$

B. $2\frac{\pi}{\Omega}$

C. $\frac{\pi}{2}\Omega$

D. $3\frac{\pi}{2}\Omega$

Answer: D

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117. Current through an AC series L-C-R circuit is 2 A if operated at resonance frequency , and 1 A if operated at 50% less than resonant frequency . The current (in A) if the frequency is 100% more than the resonant frequency , is

A. $\sqrt{2}$

B. 1

C. $\sqrt{3}$

D. Data insufficient

Answer: B

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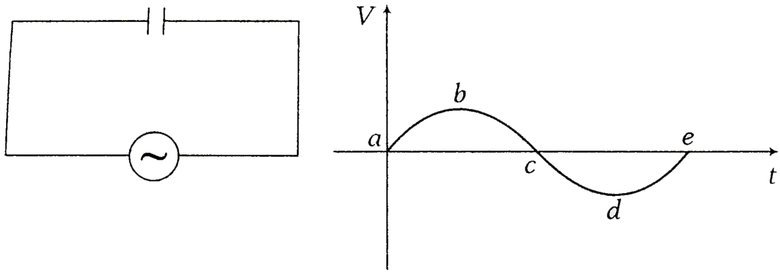
118. For an AC circuit containing only, the applied AC voltage waveform is shown in figure.

For this situation , mark the correct stament(s).



A. As V increases from a to b, the charging of capacitor rakes place

B. As V increases from a to b ,the current is circuit decreases from maximum to zero value

C. As V decreases from b to c, the capacitor discharges

D. As V decreases from b to c charging of capacitor takes plaece

Answer: A::B::C::D

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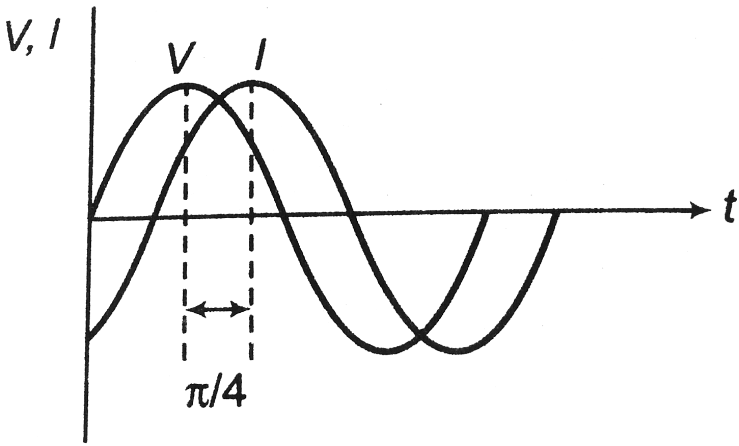
119. An Ac voltage $V = V_0 \sin 100t$ is applied to the circuit, the phase difference between current and voltage is found to be $\frac{\pi}{4}$, then



A. R = 100 Ω, C= μF

B. R = 1kΩ , C = 1μF

C. R = 10kΩ , L = `H

D. R = 1 $k\Omega$, L = 10H.

Answer: B

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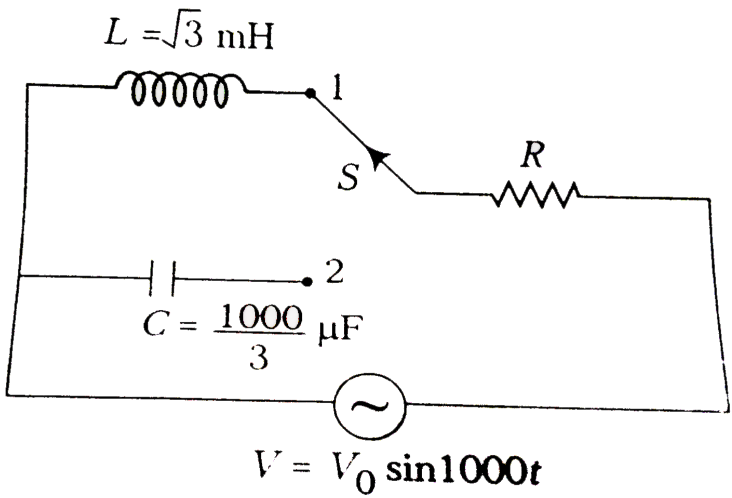
120. In the given AC circuit, when switch S is at position 1, the source emf leads current by $\frac{\pi}{6}$. Now, if the switch is at position 2, then



A. current leads the source emf by $\frac{\pi}{4}$

B. current leads source emf by $\frac{\pi}{3}$

C. source emf leads current by $\frac{\pi}{4}$

D. source emf leads current by $\frac{\pi}{3}$

Answer: A

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121. An ac ammeter is used to measure currnet in a circuit. When a given direct current passes through the circuit. The ac ammeter reads 3 A. When another alternating current passes through the circuit, the ac ammeter reads

4A. Then find the reading of this ammeter (inA), if dc and ac flow through the circuit simultaneously.

A. 3A

B. 4A.

C. 7 A

D. 5A

Answer: D

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122. An LC circuit contains a 20 mH inductor and a $50\mu F$ capacitor with an initial charge of 10 mC. The resistance of the circuit is negligible. Let the instant at which the circuit which is closed be t=0. At what time the energy stored is completely magnetic ?

A. 3A

B. t=0

C. $t = 1.54ms$

D. $t = 3.14ms$

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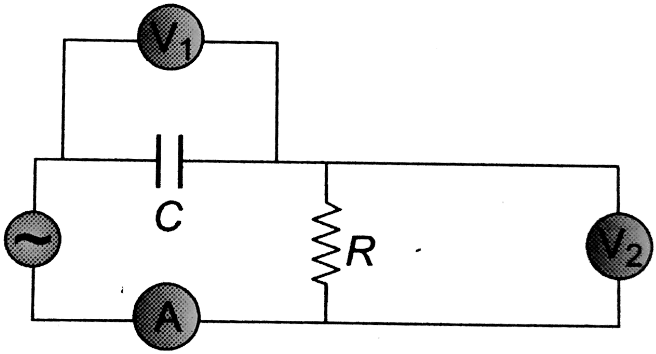
123. The diagram shows a capacitor C and a resistor R connected in series to an AC source. V_1 and V_2 are voltmeters and A is ammeter



Now, consider the following statemensts :

(I) Reading in A and V_2 are always in phase.

(II) Reading in V_1 is ahead in phase with reading in V_2,

(III) Reading in A and V_1 are always in phase. Which of these statements are/is correct

A. I only

B. II only

C. I and II only

D. II and III only

Answer: B

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124. When an alternating voltage of $220V$ is applied across a device P, a current of $0.25A$ flows through the circuit and it leads the applied voltage by a angle $\frac{\pi}{2}$ radian. When the same voltage source is connected across another device Q, the same current is observed in the circuit but in phase with the applied voltage. What is the current when the same source is connected across a series combination of P and Q?

A. $\frac{1}{4\sqrt{2}}$ A lagging in phase by $\frac{\pi}{4}$ with voltage

B. $\frac{1}{4\sqrt{2}}$ A leading in phase by $\frac{\pi}{4}$ with voltage

C. $\frac{1}{\sqrt{2}}$A leading in phase by $\frac{\pi}{4}$ with voltage

D. $\frac{1}{\sqrt{2}}$ A leading in phase by $\pi/6$ with voltage

Answer: B

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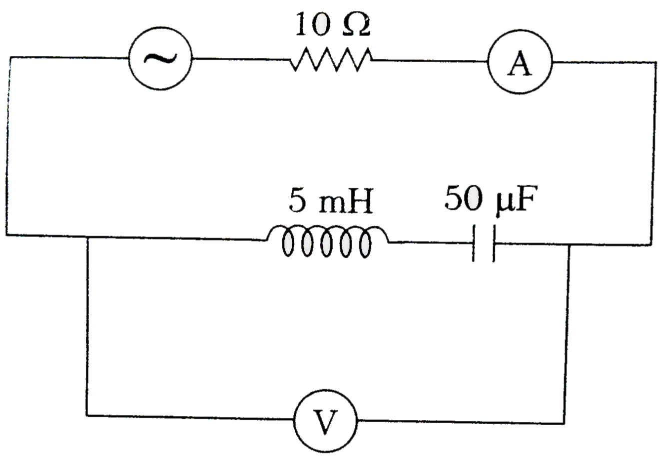
125. In the circuit shown in figure, the AC source gives a voltage V = 20 cos(2000 t) . Neglecting source resistance, the voltmeter and ammeter readings will be

(approximately)



A. 4 V, 2.0 A

B. 0 V, 2 A

C. 0 V, 1.4 A

D. 8 V, 2.0 A

Answer: C

Watch Video Solution

126. A fully charged capacitor C with initial charge q_o 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

A. $\pi\sqrt{LC}$

B. $\pi/4\sqrt{LC}$

C. $2\pi\sqrt{LC}$

D. $\sqrt{LC}$

Answer: B

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127. A circuit draws 330 W from a 110 V , 60 Hz AC line. The power factor is 0.6 and the current lags the voltage. The capacitance of a series capacitor that will result in a power factor of unity is equal to

A. 31 μF

B. 54 μF

C. 151 μF

D. 201 μF

Answer: B

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128. An are lamp requires a direct current of 10A at 80V to function. If it is connected to a 220V(rms), 50 Hz AC supply, the series inductor needed for it to work is close to:

A. 0.08 H

B. 0.044 H

C. 0.065 H

D. 80 H

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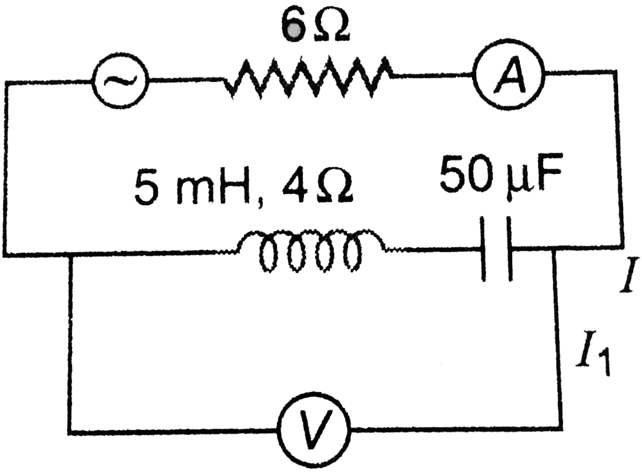
129. In the circuit shown in figureure the AC source gives a voltage $V = 20\cos(2000t)$. Neglecting source resistance, the voltmeter and and ammeter readings will be



.

A. 0 V, 0.47 A

B. 1.68 V, 0.47 A

C. 0 V, 1.4 A

D. 5.6 V, 1.4 A

Answer: C::D

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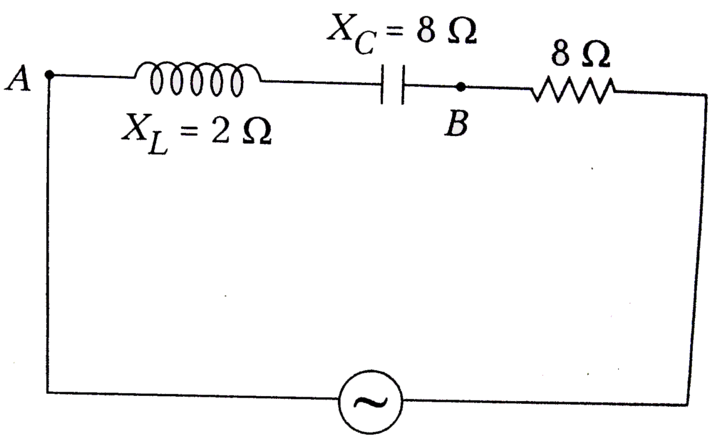
130. An inductor X_L = 2Ω) , a capacitor (X_C = 8Ω) and a resistance (R = 8 Ω) are connected in series with an AC source . The voltage output of AC source is given by V = 10 cos(100πt)

The instantaneous potential difference between points A and B, when the applied voltage is 3/5th of the maximum value of applied voltage is



A. 0 V

B. 6 V

C. 8 V

D. None of these

Answer: B

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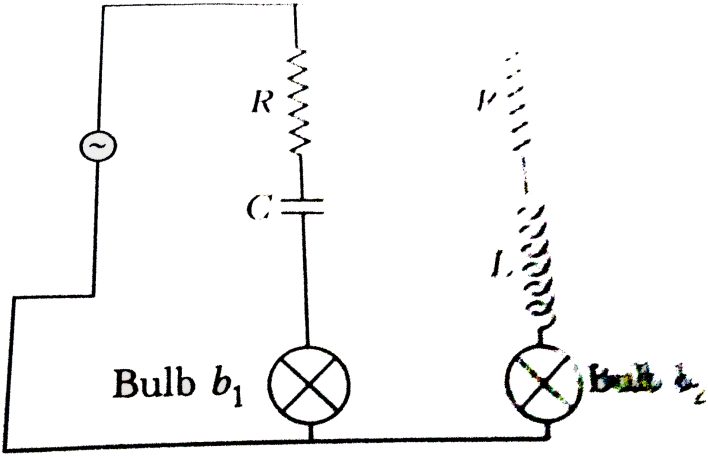
131. Two identical incandescent light bulbs are connected as shown in figure. When the circuit is an AC voltage source of frequency f, which of the following observations will be correct.



A. Both bulbs will glow alternatively

B. Both bulbs will glow with same brightness provided

$$f = 1/2\pi \frac{\sqrt{1}}{L} C$$

C. Bulb b_1 will light up initially and goes OFF, bulb b_2 will be ON constantly

D. Bulb b_1 will blink and bulb b_2 will be ON constantly

Answer: A

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132. A series R-C circuit is connected to AC voltage source . Consider two cases , (A) when C is without a dielectric medium and (B) when C is filled with dielectric of constant 4. The current I_R through the resistor and voltage V_C across the capacitor are compared in the two cases. Which of the following is/are true

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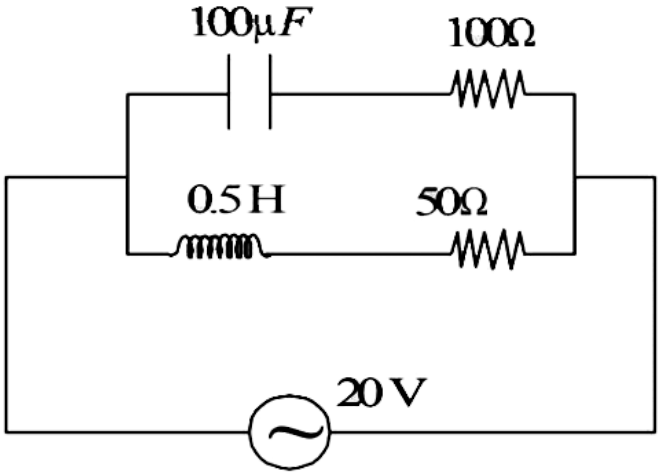
133. In the given circuit, the AC source has $(\omega) = 100 rad/s$. Considering the inductor and capacitor to be ideal, the correct choice(s) is (are)



A. The current through the circuit , I is 0.3 A

B. The current through the circuit , I is $0.3\sqrt{2}$ A

C. The voltage across 100Ω resistor = $10\sqrt{2}$V

D. The voltage across 50Ω resistor = 10 V

Answer: A::C::D

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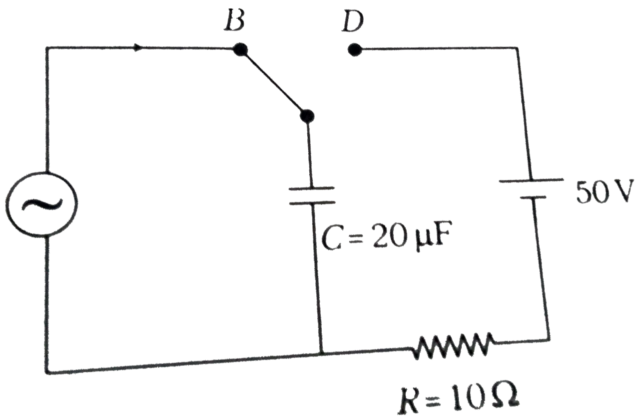
134. At time t = 0 , terminal A in the circuit shown in the figure is connected to B by a key and alternating current I(t) = $I_o \cos(\omega t)$, with I_o = 1 A and ω = 500 $rads^{-1}$ starts flowing in it with the initial direction shown in the figure . At t = $7\pi/6\omega$, the keys is switched from B to D . Now onwards only A and D are connected . A total charge Q flows from the battery to charge the capacitor fully. If C = 20 μ , R = 10 Ω and the battery is deal with emf of 50 V , identify the correct statement(s).



A. Magnitude of the maximum charge on the capacitor

before t = $7\pi/6\omega$ is 1×10^{-3}C

B. The current in the left part of the circuit just before

t = $7\pi/6\omega$ is clockwise

C. Immediately after A is connected to D . The current

in R is 10 A

D. Q = 2×10^{-3} C

Answer: C::D

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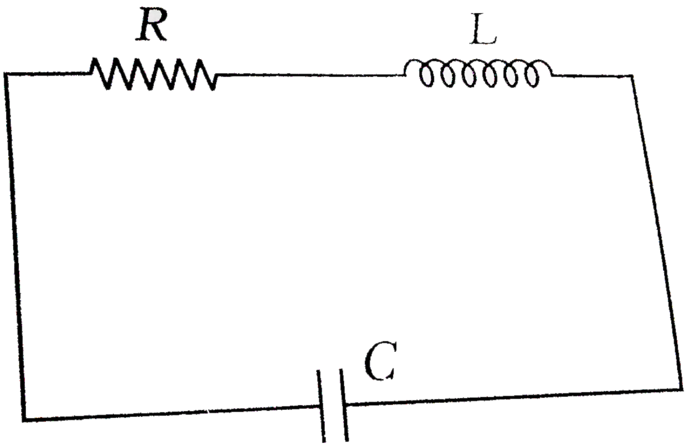
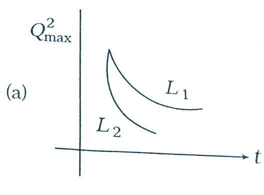
135. A L-C-R circuit is equivalent to a damped pendulum . In

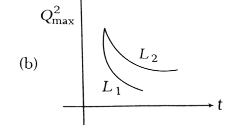
an L-C-R circuit the capacitor is charged to Q_o and then connected to the L and R as shown below.

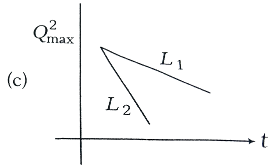
If a student plots graph of the square of maximum charge on the capacitor with time (t) for two different values L_1 and L_2 (L_1gt$L_2$of L), then which of the following represents this graph correctly (plots are schematic and not drawn to scale)

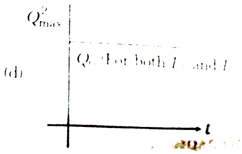


A.



B. 

C. 

D. 

Answer: A

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Assertion and Reason

1. These question consists of two statements each linked as Assertion and Reason. While answering these question you are required to choose any one of the following five responses.

Assertion: Average value of current in half the cycle an AC circuit can't be zero.

Reason: For positive half cycle average value of current is $\frac{2}{\pi} i_0$, where i_0 is the peak value current. In time interval from t_1 to t_2 average value of current will be zero.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: D

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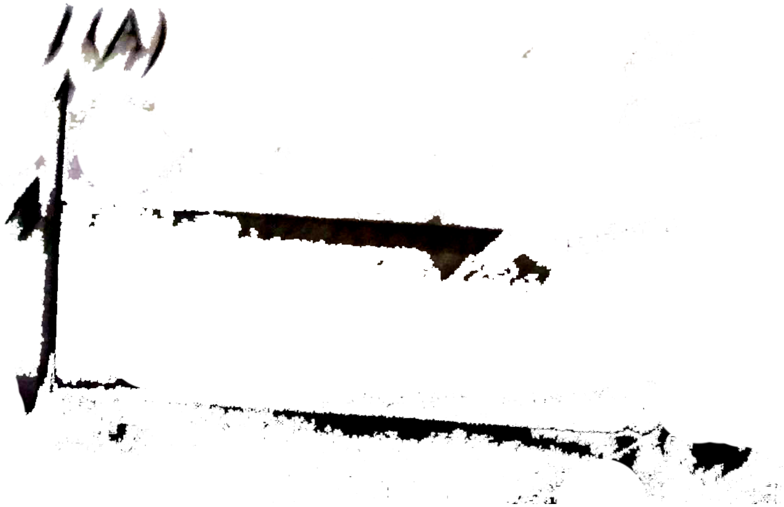
2. Assertion: Current versus time graph is as shown in figure, rms value of current is 4A.

Reason: For a constant current, rms current is equal to that constant values.

Reason: For a constant current, rms current is equal to

that constant value.



A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: A

View Text Solution

3. Assertion: Inductive reactance of an inductor in DC circuit is zero.

Reason: Angular frequency of DC circuit is zero.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: A

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4. Assertion: If an inductor coil is connected to DC source, the current supplied by it is I_1. If the same coil is connected with an AC source of same voltage. Then current is I_2, then $I_2 < I_1$.

Reason: In AC circuit, inductor coil offers more resistance.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: A

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5. Assertion: In an AC, only capacitor circuit has instantaneous power equal to zero at any instant of time.

Reason: Phase difference current function and voltage function is 90°.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: D

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6. Assertion: A capacitor is not connected in a DC circuit.

Reason: In DC circuit, current through capacitor circuit becomes zero in stady state.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: D

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7. Assertion: In series, L-C-R voltage across capacitor is always less than the applied voltage.

Reason: In series L-C-R circuit, $V = \sqrt{\left(V^2 + \left(V_L^2 - V_C^2\right)\right)}$

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: D

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8. Assertion: When a ferromagnetic rod is inserted inside an inductor, then current in L-C-R, alternating circuit will decrease.

Reason: By inserting the ferromagnetic rod inside the inductor, coefficient of self induction and hence the net impedance will increases.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If both Assertion and Reason are false.

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9. Assertion: At resonance, power factor of L-C-R series circuit is 1.

Reason: At resonance, $X_C = X_L$

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: A

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10. Assertion: At frequency greater than resonance frequency circuit is inductive in nature.

Reason: $X_L \propto \omega$

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: A

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11. Assertion: In L-C-R series AC circut, $X_L = X_C = R$ at a given frequency. When frequency is doubled, the impedance of the circuit is $\frac{\sqrt{13}}{2}$ R.

Reason: The given frequency is resonancle frequency.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: B

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12. Assertion: Averae power in an AC circuit is given by $P = I_{rms}^2 R$

Reason: In one full cycle, net power is dissipated only along a resistor.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: B

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13. Assertion: In one complete cycle, power is consumed only across a resistance in series L-C-R circuit.

Reason: Average power consumed across an inductor or a capacitor is zero.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: B

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14. Assertion: At resonance, power factor of series L-C-R circuit is zero.

Reason: At resonance, current function and voltage functions are in same phase.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: D

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15. Assertion: An AC can be transmitted over long distances without much power loss.

Reason: An AC can be stepped up or down with the help of a transformer.

A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: B

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Match the Columns

1. Angular frequency ω in an AC, L-C-R series circuit is gradually increased. Then, match the following two columns.

	Column I		Column II
A.	Capacitive reactance	(p)	will continuously increase
B.	Inductive reactance	(q)	will continuously decrease
C.	Resistance	(r)	will remain constant
D.	Total impedance	(s)	will first decrease then increase

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2. Match the following two columns for L-C-R series AC circuit.

	Column I		Column II
A.	At resonance frequency	(p)	Power factor = 0
B.	No resistance in the circuit	(q)	Power factor = 1
C.	Only resistance in the circuit	(r)	Circuit is capacitor
D.	Frequency greater than the resonance frequency	(s)	Circuit is inductive

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3. In a series L-C-R, AC circuit assuming that symbols have their usual meanings match the following two columns.

	Column I		Column II
A.	If R is decreased	(p)	I will decrease
B.	If ω is decreased	(q)	I will increase
C.	If X_L is increased	(r)	I will first decrease, then increase
D.	If Z is increased	(s)	Can't say

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4. In an AC, series L-C-R circuit, $R = X_L = X_C$ and applied AC, voltage is V. Then match the following two columns.

	Column I		Column II
A.	V_R	(p)	zero
B.	V_C	(q)	V
C.	V_{RL}	(r)	$\sqrt{2}\,V$
D.	V_{CL}	(s)	$2\,V$

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5. In an AC series $L - C - R$ circuit, applied voltage is

$V = \left(100\sqrt{2}\sin(\omega t + 45^\circ)\right)$V

Given that, $R = 30\Omega$, $X_L = 50\Omega$ and $X_C = 10\Omega$ Now match the following two columns.

	Column I		Column II
A.	Current in the circuit	(p)	120 SI units
B.	Power dissipated in the circuit	(q)	60 SI units
C.	Potential difference across resistance	(r)	2 SI units
D.	Potential difference across inductance	(s)	None

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Medical Entrance s gallery

1. A filament bulb $(500W, 100V)$ is to be used in a $230V$ main supply. When a resistance R is connected in series, it works perfectly and the bulb consumers $500W$. The value of R is

A. 230Ω

B. 46Ω

C. 25Ω

D. 13Ω

Answer: C

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2. Which of the following combinations should be selected for better turning of an LCR circuit used for communication ?

A. $R = 20\Omega$, L=1.5 H, $C = 35\mu F$

B. $R = 25\Omega$, L=2.5H, $C = 45\mu F$.

C. $R = 15\Omega$, L=3.5H, $C = 30\mu F$

D. $R = 25\Omega$, L=1/5H, $C = 45\mu F$

Answer: B

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3. The potential differences across the resistance, capacitance and inductance are $80V, 40V$ and $100V$ respectively in an $L - C - R$ circuit. The power factor of this circuit is

A. 0.4

B. 0.5

C. 0.8

D. 1

Answer: C

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4. A 100Ω resistance and a capacitor of 100Ω reactance are connected in series across a 220 V source. When the capacitor is 50% charged, the peak value of the displacement current is

A. 2.2 A

B. 0.458333333333333

C. 4.4 A

D. $11\sqrt{2}$ A

Answer: A

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5. A small signal voltage $V(t) = V_0 \sin \omega t$ is applied across an ideal capacitor C:

A. over a full cycle the capacitor C does not consume any energy from the voltage source.

B. current I(t) is in phase with voltage V(t)

C. current $I(t)$ leads voltage V(t) by 180°

D. current I(t), lags voltage V(t) by 90°.

Answer: A

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6. An inductor $20mH$, a capacitor $50\mu F$ and a resistor 40Ω are connected in series across of emf $V = 10\sin 340t$. The power loss in $A.C.$ circuit is

A. 0.67 W

B. 0.76 W

C. 0.89 W

D. 0.51 W

Answer: D

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7. A transformer is used to light a $100W$ and $110V$ lamp from a $220V$ mains. If the main current is $0.5A$, the Efficiency of the transformer is approximately:

A. 96%

B. 90%

C. 99%

D. 95%

Answer: B

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8. An alternating voltage given as, $V = 100\sqrt{2}\sin 100t$ V is applied to a capacitor of $1\mu F$. The current reading of the ammeter will be equal to .... mA.

A. 20

B. 10

C. 40

D. 80

Answer: B

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9. An inductor coil is connected to a 12V battery and drawing a current 24 A. This coil is connected to capacitor and an AC source of rms voltage rating 24 V in the series connection. The rms current through the circuit would found to be

A. 48 A

B. 36 A

C. 0

D. 24 A

Answer: A

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10. A resistance R draws power P when connected to an AC source. If an inductance is now placed in series with the resistance, such that the impedence of the circuit becomes Z, the power drawn will be

A. $P\left(\frac{R}{Z}\right)^2$

B. $P\sqrt{\frac{R}{Z}}$

C. $P\left(\frac{R}{Z}\right)$

D. P

Answer: A

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11. A condenser of $250 \mu F$ is connected in parallel to a coil of inductance $0.16 mH$ while its effective resistance is 20Ω. Determine the resonant frequency

A. 9×10^4 Hz

B. 16×10^7 Hz

C. 8×10^5 Hz

D. 9×10^3 Hz

Answer: C

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12. The electric current in AC circuit is given by the relation i $=3 \sin \omega t + 4 \cos \omega t$. The rms value of the current in the circuit in ampere is

A. $\frac{5}{\sqrt{2}}$

B. $5\sqrt{2}$

C. $\frac{\sqrt{2}}{5}$

D. $\frac{1}{\sqrt{2}}$

Answer: A

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13. In an LCR series circuit the capacitance is changed from C to $4C$ For the same resonant fequency the inductance should be changed from L to .

A. 2 L

B. $\frac{L}{2}$

C. 4L

D. $\frac{L}{4}$

Answer: D

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14. In a circuit L, C and R are connected in series with an alternating voltage source of frequency f. The current lead the voltages by 45°. The value of C is :

A. $\dfrac{1}{\pi f(2\pi f L + R)}$

B. $\dfrac{1}{\pi f(2\pi f L - R)}$

C. $\dfrac{1}{2\pi f(2\pi f L - R)}$

D. $\dfrac{1}{2\pi f(2\pi f L + R)}$

Answer: D

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15. The average power is dissipated in a pure inductor is

A. $\frac{VI^2}{4}$

B. $\frac{1}{2}VI$

C. zero

D. VI^2

Answer: C

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16. A transformer having efficiency of $90\,\%$ is working on $200V$ and $3kW$ power supply. If the current in the secondary coil is $6A$, the voltage across the secondary coil and current in the primary coil respectively are

A. 300 V, 15 A

B. 450 V, 15 A

C. 450 V, 13.5 A

D. 600 V, 15 A

Answer: B

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17. A dynamo converts

A. mechanical energy into thermal energy

B. electrical energy into thermal energy

C. thermal energy into electrical energy

D. mechanical energy into electrical energy

Answer: D

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18. Transformer is used to

A. convert AC to DC voltage

B. convert DC to AC voltage

C. obtain desired DC power

D. obtain desired AC voltage and current

Answer: D

Watch Video Solution

19. A step up transformer operates on a $230V$ line and a load current of 2 ampere. The ratio of the primary and secondary windings is $1:25$. What is the current in the primary?

A. 12.5 A

B. 50 A

C. 8.8 A

D. 25 A

Answer: B

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20. A step-down transformer has 50 turns on secondary and 1000 turns on primary winding. If a transformer is connected to 220 V, 1A C AC source, then what is output current of the transformer ?

A. $\frac{1}{20}A$

B. 20 A

C. 100 A

D. 0.08333333333333

Answer: B

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21. In an AC circuit, V and I are given by $V = 100\sin(100t) vo < s, I = 100\sin\left(100t + \frac{\pi}{3}\right) mA.$

The power dissipated in circuit is

A. 100 W

B. 10 W

C. 5 W

D. 2.5 W

Answer: D

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22. The average power dissipated in AC circuit is 2W. If a current flowing throuh a circuit is 2A, impedance is 1Ω, then what is the power factor of the circuit?

A. 0.5

B. 1

C. Zero

D. $\frac{1}{\sqrt{2}}$

Answer: A

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23. In an L-C-R series circuit, the potential difference between the terminals of the inductance is 60 V, between the terminals of the capacitor is 30 V and that across the resistance is 40 V. Then, the supply voltage will be equal to

A. 10 V

B. 50 V

C. 70 V

D. 130 V

Answer: B

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24. An alternating emf given by equation

$e = 300 \sin(100\pi)tV$

is applied to a resistance 100Ω. The rms current through the circuit is (in amperes).

A. $\frac{3}{\sqrt{2}}$

B. $\frac{9}{\sqrt{2}}$

C. 3

D. $\frac{6}{\sqrt{2}}$

Answer: A

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25. A series L-C-R circuit contains inductance 5 mH, capacitor $2\mu F$ and resistance 10Ω. If a frequency AC source is varied, then what is the frequency at which maximum power is dissipated?

A. $\frac{10^5}{\pi}$ Hz

B. $\frac{10^5}{\pi}$Hz

C. $\frac{2}{3} \times 10^5$ Hz

D. $\frac{5}{\pi} \times 10^3$ Hz

Answer: D

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26. The alternating current in a circuit is given by $I = 50 \sin 314t$. The peak value and frequency of the current are

A. I_0=25 A and f=100Hz

B. I_0=50 A and f=50 Hz

C. I_0 = 50 A and f=100 Hz

D. I_0=25 A and f=50 Hz

Answer: B

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27. A 50 Hz AC signal is applied in a circuit of inductance of $(1/\pi)$H and resistance 2100Ω. The impedance offered by the circuit is

A. 1500Ω

B. 1700Ω

C. 2102Ω

D. 2500Ω

Answer: C

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28. If the alternating current I $= I_1 \cos \omega t + I_2 \sin \omega t$, then the rms current is given by

A. $\dfrac{I_1 + I_2}{\sqrt{2}}$

B. $\dfrac{|I_1 + I_2|}{\sqrt{2}}$

C. $\sqrt{\dfrac{I_1^2 + I_2^2}{2}}$

D. $\sqrt{\dfrac{I_1^2 + I_2^2}{\sqrt{2}}}$

Answer: C

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29. A 0.01 H inductor and $\sqrt{3}\pi\Omega$ resistance are connected in series with a 220 V, 50 Hz AC source. The phase difference between the current and emf is

A. $\frac{\pi}{2} rad$

B. $\frac{\pi}{6}$ rad

C. $\frac{\pi}{3}$ rad

D. *-

Answer: B

Watch Video Solution

30. A coil of self-inductance L is connected in series with a bulb B and an AC source. Brightness of the bulb decreases when

A. frequency of the AC source is decreased

B. number of turns in hte coil is reduced

C. a capacitance of reactance $X_C = X_L$ is included in the same circuit.

D. an iron rod is inserted in the coil

Answer: D

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31. For a transformer, the turns ratio is 3 and its efficiency is 0.75. The current flowing in the primary coil is 2A and the voltage applied to it is 100 V. Then the voltage and the current flowing in the secondary coild are..............respectively.

A. 150 V, 1.5 A

B. 300 V, 0.5 A

C. 300 V, 1.5 A

D. 150 V, 0.5 A

Answer: B

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32. In R-L-C series circuit, the potential difference across each element is 20 V. Now the value of hte resistance alone is doubled, then PD across R, L and C respectively.

A. 20 V, 10 V , 10V

B. 20 V, 20 V, 20V

C. 20 V, 40 V, 40 V

D. 10 V, 20 V, 20 V

Answer: A

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33. A series combination of resistor (R), capacitor (C) is connected to an AC source of angular frequency ω. Keeping the voltage same, If the frequency is changed to $\frac{\Omega}{3}$, the current becomes half of the original current. Then, the ratio of the capacitance reactance and resistance at the former frequency is

A. $\sqrt{0.6}$

B. $\sqrt{3}$

C. $\sqrt{2}$

D. $\sqrt{6}$

Answer: A

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34. If both the resistance and the inductance in an LR AC series circuit are doubled the new impedance will be

A. halved

B. fourfold

C. doubled

D. quadrupted

Answer: C

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35. A L-C-R circuit with L=1.00 mH, C=$10\mu F$ and $R = 50\Omega$, is driven with 5V AC voltage. At resonance, the current through the circuit is

A. 0.2 A

B. 0.25 A

C. 0.15 A

D. 0.1 A

Answer: D

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36. For a series L-C-R circuit with L=1.00 mH, C=10μF and $R = 50\Omega$, is driven with 5V AC voltage. At resosance, the current through the circuit is

A. 0.2 A

B. 0.25 A

C. 0.15 A

D. 0.1 A

Answer: D

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37. An air core coil and an electric bulb are connected in series with an AC source. If an iron rod is put in the coil, then the intensity of light of the bulb will

A. remains same

B. increases

C. decrease

D. first decrease then increase

Answer: C

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38. The power factor of an AC circuit having resistance (R) and inductance (L) connected in series and an angular velocity ω is

A. zero

B. $\frac{\omega L}{R}$

C. $\frac{R}{\sqrt{R^2 + \Omega^2 L^2}}$

D. $R / \omega L$

Answer: C

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39. The self-inductance of a choke coil is $10mH$. When it is connected with a $10V DC$ source, then the loss of power is 20watt. When it is connected with $10\text{volt} AC$ source loss of power is 10watt. The frequency of AC source will be

A. 80 Hz

B. 100 Hz

C. 120 Hz

D. 220 Hz

Answer: A

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40. If the power factor is $1/2$ in a series RL circuit with $R = 100\Omega$. If AC mains, $50Hz$ is used then L is

A. πH

B. $\frac{\sqrt{3}}{\pi}H$

C. $\frac{\pi}{\sqrt{3}}H$

D. $\frac{\sqrt{2}}{\pi}$H

Answer: B

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41. In an electrical circuit R, L, C and an AC voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage and the current in the circuit is $\pi/3$. If instead, C is removed from the circuit, difference the phase difference is again $\pi/3$. The power factor of the circuit is

A. $1/2$

B. $1/\sqrt{2}$

C. 1

D. $\sqrt{3}/2$

Answer: C

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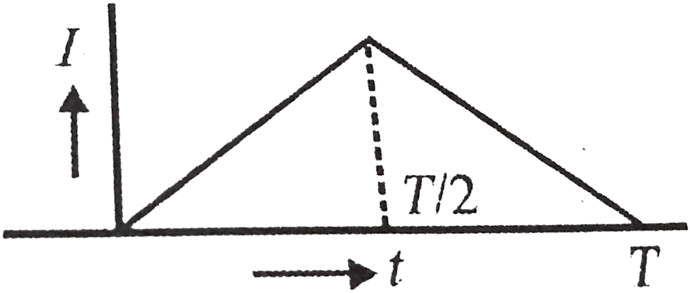
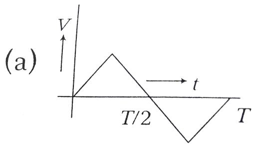
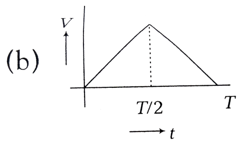
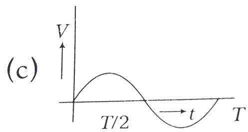
42. The current (I) in the inductance is varying with time according to the plot shown in figure.

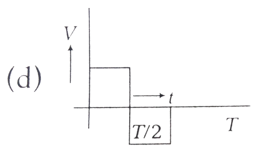


Which one of the following is the correct variation of voltage with time in the coil?

A. 

B. 

C. 

D. 

Answer: D

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43. A transformer of 100 % efficiency has 200 turns in the primary and 40,000 turns in the secondary. It is connected to a 200 V a.c. mains and the secondary feeds to a $100k\Omega$ resistance. Calculate the output potential difference per turn and the power delivered to the load.

A. 1.1 V

B. 25 V

C. 18 V

D. 11 V

Answer: A

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44. A step-down transformer is used on a $1000V$ line to deliver $20A$ at $120V$ at the secondary coil. If the efficiency of the transformer is 80% the current drawn from the line is.

A. 3A

B. 30 A

C. 0.3A

D. 2.4 V

Answer: A

45. An electric motor runs a $D.C.$ source of e.m.f. $200V$ and draws a current of $10A$. If the efficiency is 40% , then ressistance of the armature is:

A. 2Ω

B. 8Ω

C. 12Ω

D. 16Ω

Answer: C

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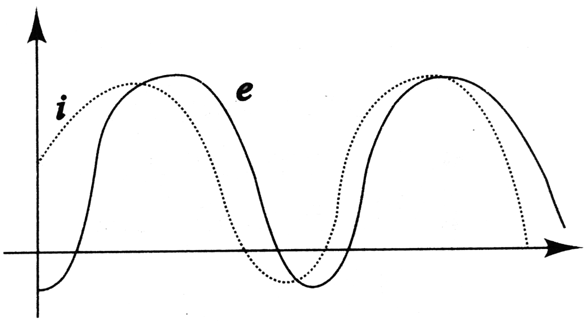
46. When an ac source of emf$e=E_0 \sin(100t)$ is connected across a circuit, the phase difference between emf e and currnet I in the circuit is observed to be $(\pi)/(4)$ as shown in fig. If the circuit consists possibly only of R-C or R-C of L-R series, find the relationship find the relationship between the two elements.



A. $R=1k\Omega$, C=$10\mu F$

B. R=$1k\Omega, C=1\mu F$

C. $R = 1k\Omega$, L=10H

D. $R = 1\Omega$ L=1H

Answer: C

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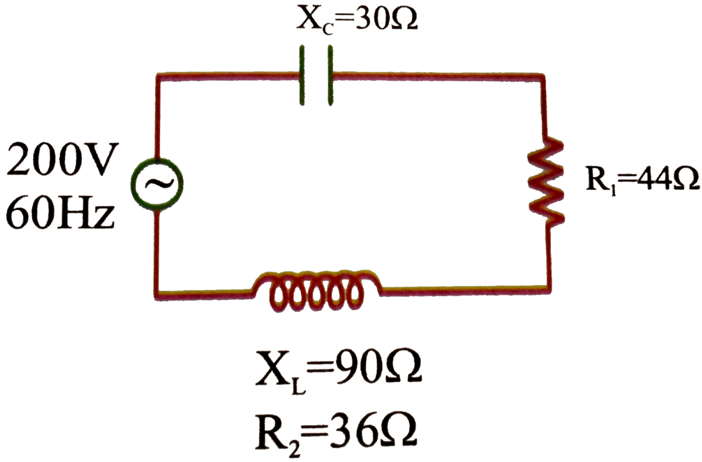
47. A series circuit connected across a $200V, 60Hz$ line consists of a capacitive reactance 30Ω non inductive resistor of 44Ω and a coil of inductive reactance 90Ω and resistance 36Ω as shown in the diagram



The power dissipated in the inductance coil is

A. 320 W

B. 176 W

C. 144 W

D. 0

Answer: A

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48. A generator at a utility company produces 100 A of current at 4000 V. The voltage is stepped up to 240000 V by a transformer before it is sent on a high voltage transmission line. The current in transmission line is

A. 3.67 A

B. 2.67 A

C. 1.67 A

D. 2.40 A

Answer: C

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49. The r.m.s current in an AC circuit is $2A$. If the wattless current be $\sqrt{3}A$, what is the power factor?

A. $\frac{1}{2}$

B. $\frac{1}{3}$

C. $\frac{1}{\sqrt{3}}$

D. $\frac{1}{\sqrt{2}}$

Answer: A

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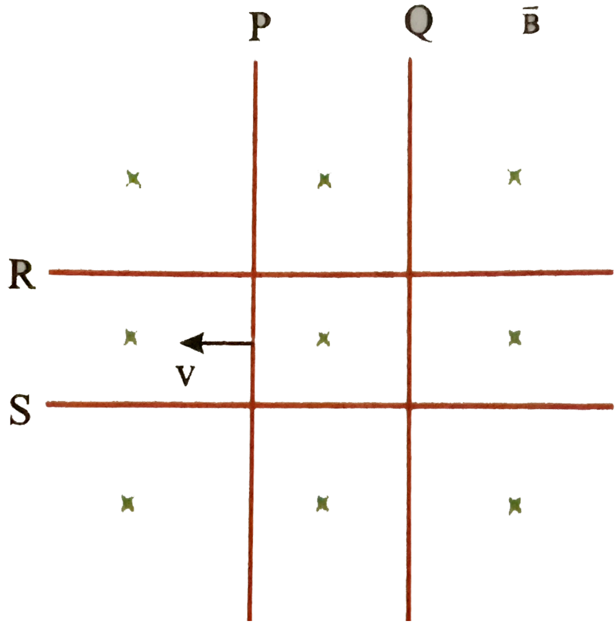
Others

1. Two identical conductors P and Q are placed on two friction less rails R and S in a uniform magnetic field directed into the plane. If P is moved in the direction shown in figure with a constant speed, then rod Q



A. will be attracted towards P

B. will be repelied away from P

C. will remian stationary

D. mary be repelled or attracted towards P

Answer: A

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2. A conducting circular loop of raidus and resistance R is kept on a horioznte1 plane. A vertical time varing magnetic field B=2t is switched on at time t=0. Then

A. power generated in the coil at any time t is constant

B. flow of charge passed through any section between time

C. total charge passed through any section between time $\left(t = 0\text{to} = 2is\left(\frac{4\pi a^2}{R}\right)\right.$.

D. All of the above

Answer: D

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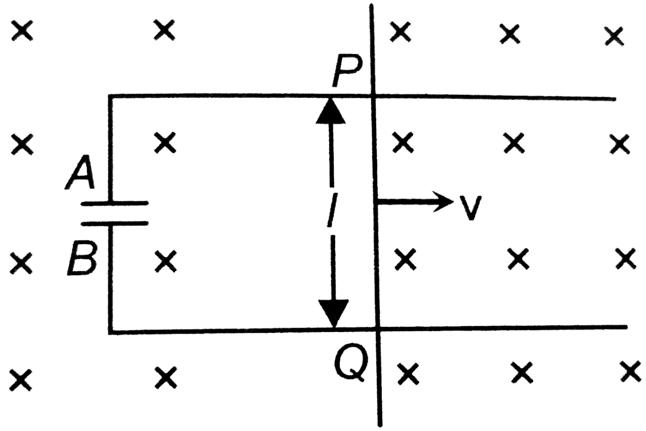
3. A conducting rod PQ of length $l = 1.0m$ is moving with a uniform speed $v2.0m/s$ in a uniform magnetic field $B = 4.0T$ directed into the paper.

A capacitor of capacity $C = 10\mu F$ is connected as shown in figure. Then



A. $q_A = +80\mu C$ and $q_B = -80\mu C$

B. $q_A = -80\mu C$ and $q_B = +80\mu C$

C. $q_A = 0 = q_B$

D. charge stored in the capacitor increases expontially with time

Answer: A

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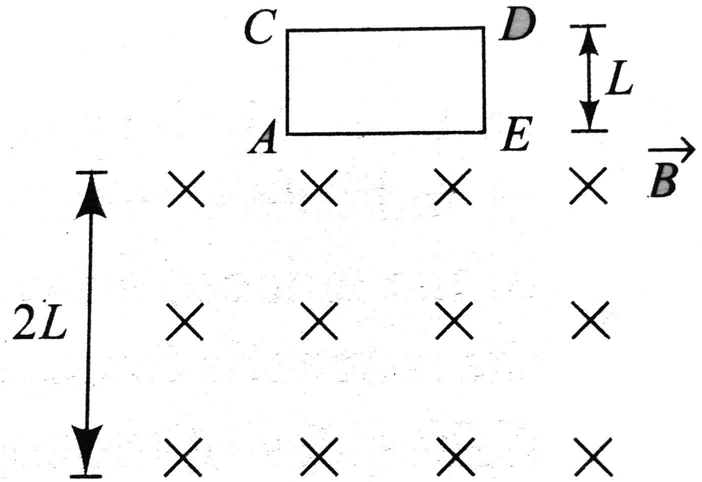
4. A square coil $ACDE$ with its plane vertically is released from rest in a horizontal uniform magnetic field $\overrightarrow{B}$ of length $2L$. The accelaration of the coilis



A. less than g for all the time till thr elooop crosses the magnetic field completely

B. less than g when it enters thte field and greter than when it comes out of the field

C. g all the time

D. less than g when it enters and comes out of the field but equal to g when it is within the field

Answer: D

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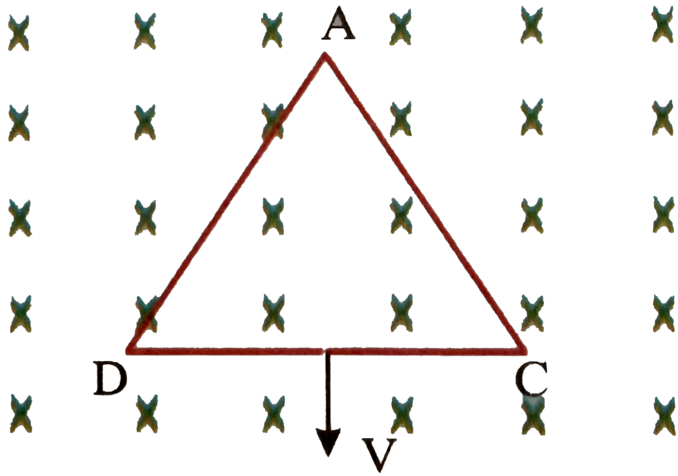
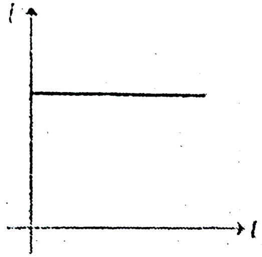
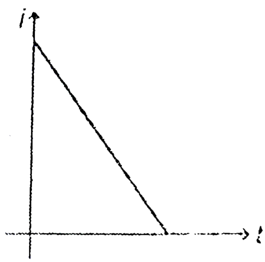
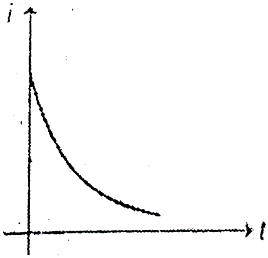
5. An equilateral triangular loop ADC having some resistance is pulled with a constant velocity v out of a uniform magnetic field directed inot the paper. At time $t = 0$, side DC of the loop at is at edge of the magnetic field.

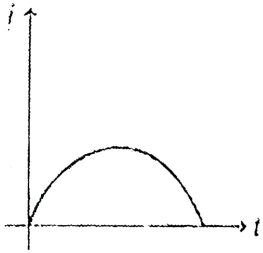


The induced current (i) versus time (t) graph will be as

A. 

B. 

C. 

D. 

Answer: B

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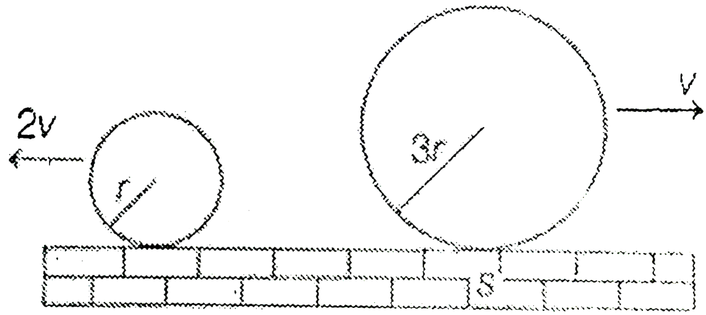
6. Two conducting rings P and Q of radius r and 3r move in opposite directions with velocities 2v and v respectively on a conducting surface S. There is a uniform magnetic field of magnitude B perpendicular to the plane of the rings.

The potential difference between the highest points of the two rings a



A. zero

B. 2Brv

C. 6Brv

D. 10Brv

Answer: D

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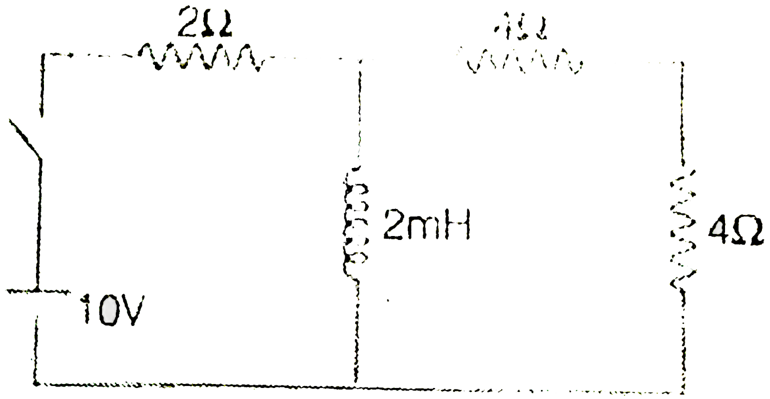
7. In the given circuit find the ratio of $i_1 \text{to} i_2$. Where is the initial (at t=0) current, and i_2 is steady state $(at t = \infty)$ current the battery



A. 0.2

B. 0.8

C. 1.2

D. 1.5

Answer: A

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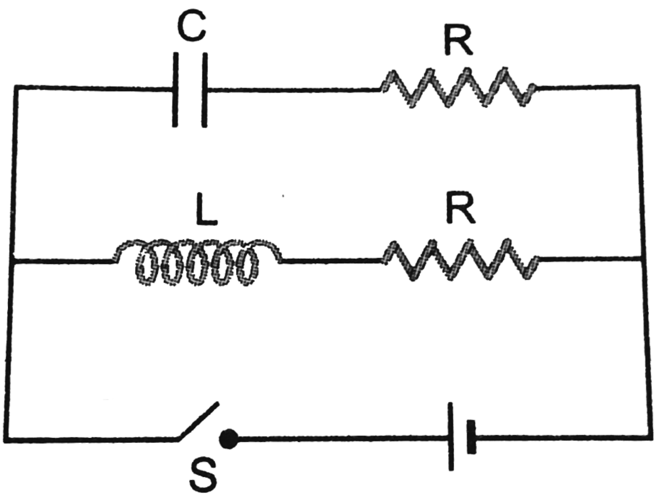
8. In the circuit shown if Fig. the switch S is closed at time t = 0. The current through the capacitor and inductor will be equal at time t equal (given $R = \sqrt{L/C}$



A. CR

B. CR In (2)

C. $\frac{L}{RIn(2)}$

D. LR

Answer: B

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9. In L-C oscillatios of a circuit , which of the following is true at $t = 3T/4$ (T=time period of the oscillation). Assume that at t=0, the capacitor is fully charged?

A. Energy stored in then inductor is zer, while in capacitor is maximum

B. Energy in the inductor and capacitor is shared equallly

C. Energy in the inductor is maximum while in the capacitor is zero

D. none of the above

Answer: C

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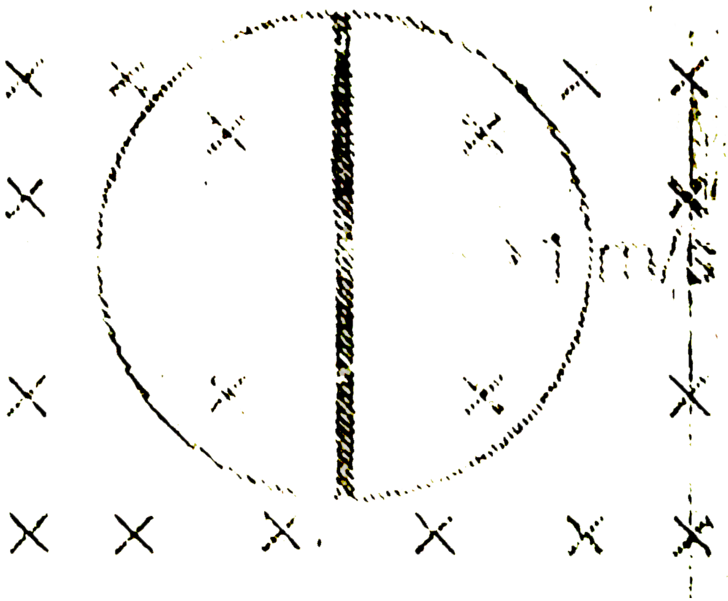
10. A cirular loop of radius 1m is kept in a magnetic field of strength 2T (plane of loop is perpendicular to direction of magnetic field). Resistance of the loop wire is $\frac{2}{\pi}\Omega / m$. A conductor of legth 2m in sliding with a speed 1ms as shown in figure. Find the instantaneous force acting on the road (assume rod has negligible resistance).



A. 8N

B. 16N

C. 32N

D. 64N

Answer: B

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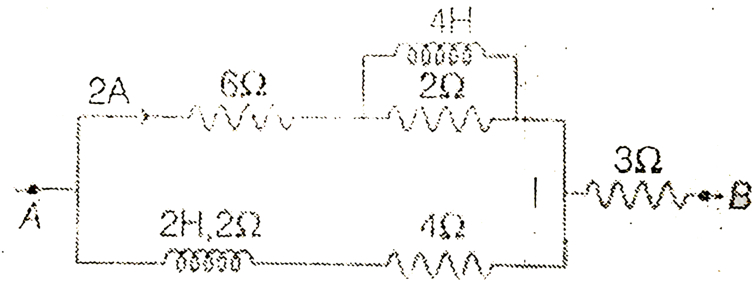
11. Find $V_A - V_B$ in steady state



A. 8V

B. 16V

C. 24V

D. none of the above

Answer: C

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12. An alternating voltage, of angular frequency ω is induced in electric circuit consisting of inductance L and capacitance C, connected in parallel. Then across the inductance coil

A. current is maximum when $\omega^2 = \frac{1}{LC}$

B. current is minimum when $\omega^2 = \frac{1}{LC}$

C. voltage is minimum when $\omega^2 = \frac{1}{LC}$

D. voltage is maximum when $\omega^2 = \frac{1}{LC}$

Answer: BD

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13. An rms voltage of 110 V is applied across a series circuit having a resistance 11Ω and an impedance 22Ω. The power consumed is

A. 275W

B. 366W

C. 550W

D. 1100W

Answer: A

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14. The current through an inductor of $1H$ is given by $i = 31 \sin t$. Find the voltage across the inductor.

A. $3 \sin t + 3 \cos t$

B. $3 \cos t + 3 \sin t$

C. $3 \sin t + 3t \cos t$

D. $3t \cos t + \sin t$

Answer: C

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15. The electric current in a circuit is given by

i=3t

Here, t is in second and I in ampere. The rms current for the period to=0 to t=1 s is

A. 3A

B. S

C. $\sqrt{A}$

D. $3\sqrt{3}A$

Answer: C

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16. At a certain frequency ω_1, the reactance of a certain capacitor equals that of a certain inductor. If the frequency is changed to$\omega_2 = 2\omega_1$, the raito of reactance of the inductor to that of the capacitor is :

A. $4:1$

B. $\sqrt{2}:1$

C. $1:2\sqrt{2}$

D. $1:2$

Answer: A

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17. Choose the correct statement.

A. The diamension of $\frac{\omega L}{R}$ are same as that of strain

B. The diamensions of $\frac{1}{\sqrt{LC}}$ are same as that of angular velocity

C. The dimension of LCR are same as that of time

D. none of the above

Answer: C

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18. An alternating voltage given by $V = 300\sqrt{2}\sin(50t)$ (in volts) is connected across a $1\mu F$ capacitor through an AC ammeter. The reading of the computer will be

A. 10mA

B. 40mA

C. 100mA

D. 15mA

Answer: D

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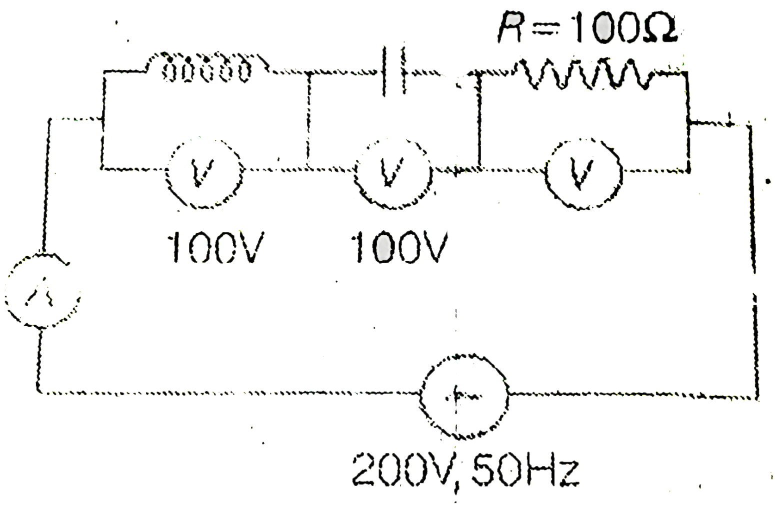
19. What will be the reading if the voltmeter across in resistance and ammetere in the cirucit shown in the figure?



A. 300V,2A

B. 800V,2A

C. 100V,2A

D. 200V,2A

Answer: D

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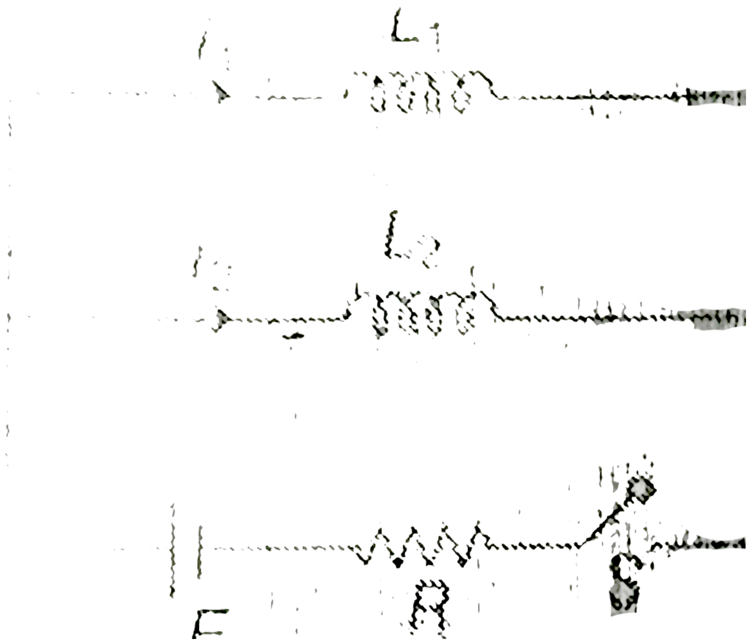
20. In the circuit shown in the figure The steady state currents i_1 and i_2 in the coils after the switch S is closed are



A. $i_1 = \frac{EL_2}{R(L_1 + L_2)}$

B. $i_1 = \frac{EL_1}{R(L_1 + L_2)}$

C. $i_2 = \frac{EL_2}{R(L_1 + L_2)}$

D. $i_2 = \frac{E\sqrt{L_1 L_2}}{RL_2}$

Answer: A

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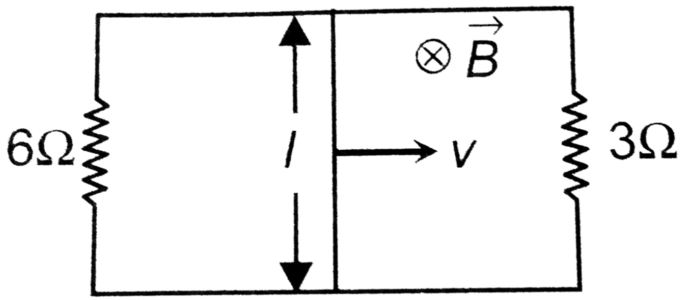
21. A rectangle loop with a sliding connector of length $l = 1.0m$ is situated in a uniform magnetic field $B = 2T$ perpendicular to the plane of loop. Resistance of connector is $r = 2\Omega$. Two resistance of 6Ω and 3Ω are connected as shown in figure. the external force required to keep the connector moving with a constant velocity

$v = 2m / s$ is



A. 6N

B. 4N

C. 2N

D. 1N

Answer: C

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22. A metal rod of resistance 20Ω is fixed along a diameter of a conducting ring of radius $0.1m$ and lies on $x - y$ plane. There is a magnetic field $\overrightarrow{B} = (50T)\overrightarrow{k}$. The ring rotates with an angular velocity $\omega = 20rads^{-1}$ about its axis. An external resistance of 10Ω is connected across the center of the ring and rim. The current external resistance is

A. $\frac{1}{4}A$

B. $\frac{1}{2}A$

C. $\frac{1}{3}A$

D. ZERO

Answer: C

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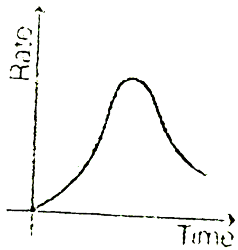
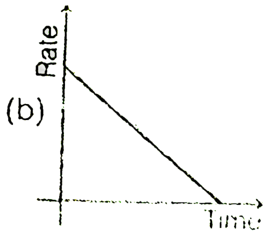
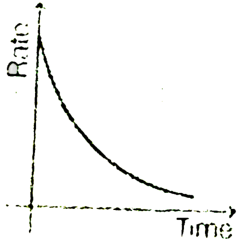
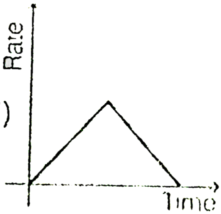
23. In an LR circuit connected to a battery, the rate at which energy is stored in the inductor is plotted against time during the growth of current in the circuit. Which of the following best represents the resulting curve?

A. 

B. 

C. 

D. (d) 

Answer: A

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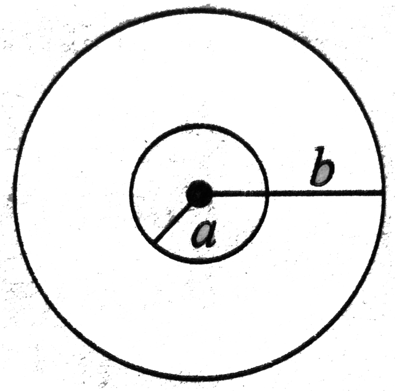
24. Two concentric and coplanar coils have radii a and $b(>>a)$ as shows in Fig. Resistance of the inner coil is R. Current in the outer coil is increased from 0 to i, then the total charge circulating the inner coil is



A. $\dfrac{\mu_0 i a^2}{2Rb}$

B. $\dfrac{\mu_0 i b}{2R}$

C. $\dfrac{\mu_0 i}{2a}\dfrac{\pi b^2}{R}$

D. $\dfrac{\mu_0 i B}{2\pi R}$

Answer: A

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25. A current i_0 is flowing through an $L - R$ circuit of time constant t_0. The source of the current is switched off at time $t = 0$. Let r be the value of $(-di/dt)$ at time $t = 0$.Assuming this rate to be constant, the current will reduce to zero in a time interval of

A. t_0

B. et_0

C. $\frac{t_0}{e}$

D. $\left(1 - \frac{1}{e}\right)t_0$

Answer: A

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26. A metal disc of radius a rotates with a constant angular velocity ω about its axis. The potential difference between the center and the rim of the disc is $(\mathrm{m} = \text{mass of electron, e} = \text{charge on electro})$

A. $\dfrac{m\omega^2a^2}{e}$

B. $\dfrac{1}{2}\dfrac{m\omega^2a^2}{e}$

C. $\dfrac{m\omega^2a^2}{2m}$

D. $\dfrac{m\omega^2a^2}{m}$

Answer: A

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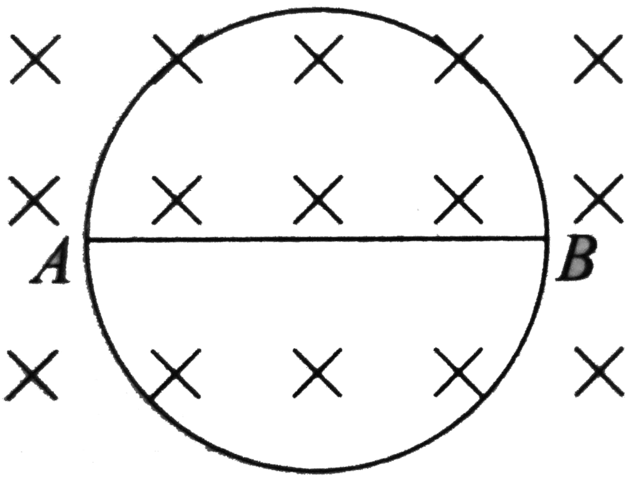
27. The radius of the circular conducting loop shown in is R. magnetic field is decreasing at a constant rate α. Resisitance per unit length of the loop is ρ.

Then, the current in wire AB is (AB is one of the diameters)



A. $\frac{R\alpha}{2\rho}$ from A to B

B. $\frac{R\alpha}{2\rho}$ from B to A

C. $\frac{2R\alpha}{\rho}$ from A to B

D. zero

Answer: D

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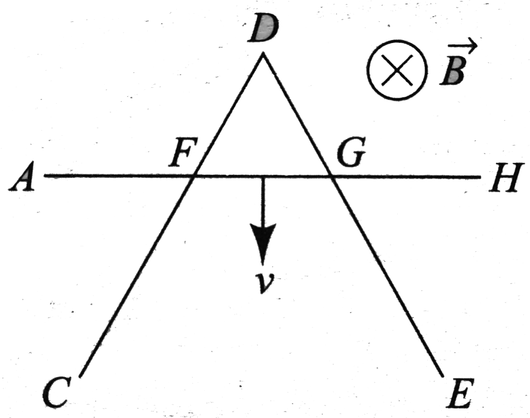
28. A long conducting wire AH is moved over a conducting triangular wire CDE with a constant velocity v in a uniform magnetic field $\overrightarrow{B}$ directed into the plane of the paper. Resistance per unit length of each wire is ρ.

Then



A. a constant clockwise induced current will flow in

closed loop

B. an increasing anticlockwise indiced current will flow

in the closed loop

C. a decreasing anticlockwise induced current will flow

in the closed loop

D. a constant anticlockwise induced current will flow in the closed loop

Answer: D

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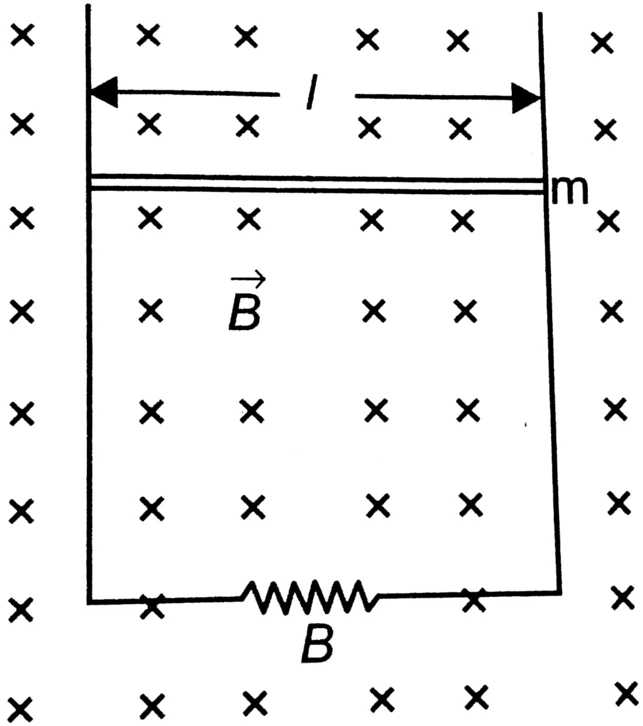
29. A horizontal wire is free to slide on the verticle rails of a conducting frame as shown in figure. The wire has a mass m and length l and the resistance of the circuit is R. If a uniform magnetic field B is directed perpendicular to the frame, the terminal speed of the wire as it falls under the force of gravity is



A. $\dfrac{mgR}{BI}$

B. $\dfrac{mgi}{BR}$

C. $\dfrac{B^2I^2}{mgR}$

D. $\dfrac{mgr}{B^2I^2}$

Answer: D

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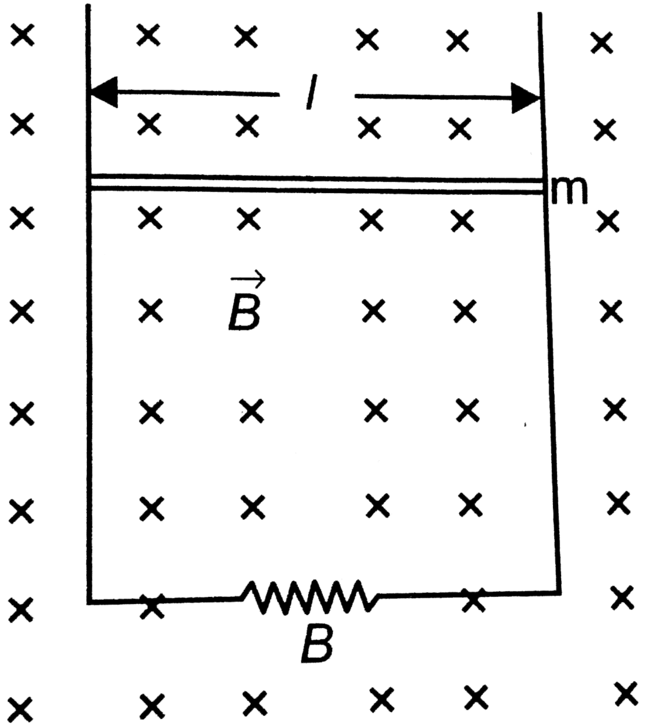
30. A horizontal wire is free to slide on the verticle rails of a conducting frame as shown in figure. The wire has a mass m and length l and the resistance of the circuit is R. If a uniform magnetic field B is directed perpendicular to the frame, the terminal speed of the wire as it falls under the force of gravity is



In the above problem if $m = 1kg$ and teminal velocity attained by its is 4m/s after falling a height of 1m, the energy dissipated as heat till then is $(g = 10m/s^2)$

A. 10J

B. 2J

C. epsilonJ

D. 12J

Answer: B

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31. In a problem number 34 energy dissipated in resistance per unit time, once the terminal speed is attained is

A. 20J

B. 10J

C. 40J

D. ZERO

Answer: C

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32. A non-conducting ring having q uniformly distributed over its circumference is placed on a rough horizontal surface. A vertical time varying magnetic field $B = 4t^2$ is switched on at time t = 0. Mass of the ring is m and radius is R.

The ring starts rotating after 2 s, the coefficient of friction between the ring and the table is

A. $\frac{4qmR}{g}$

B. $\frac{2qmR}{g}$

C. $\frac{8qR}{mg}$

D. $\frac{qR}{2mg}$

Answer: C

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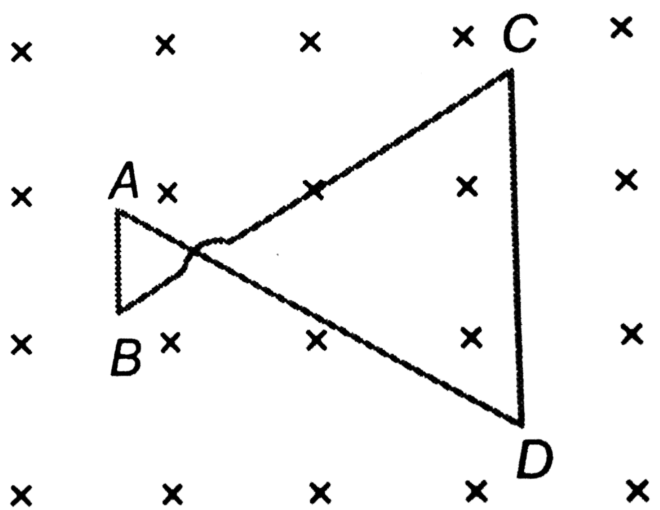
33. A conducting wire frame is placed in a magnetic field which is directed into the paper. The magnetic field is increasing at a constant rate. The direction of induced current in wire AB and CD are



A. B to A and D to C

B. A to B and C to D

C. A to B and D to C

D. B to A and C to D

Answer: A

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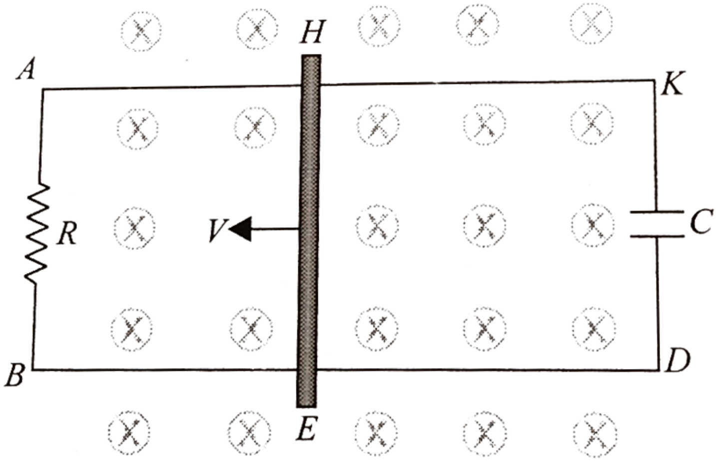
34. In the circuit shown in Fig. A conducting wire HE is moved with a constant speed v towards left. The complete circuit is placed in a uniform magnetic field $\vec{B}$ perpendicular to the plane of circuit inwards. The current in HKDE is



A. clockwise

B. anticlockwise

C. altenating

D. ZERO

Answer: D

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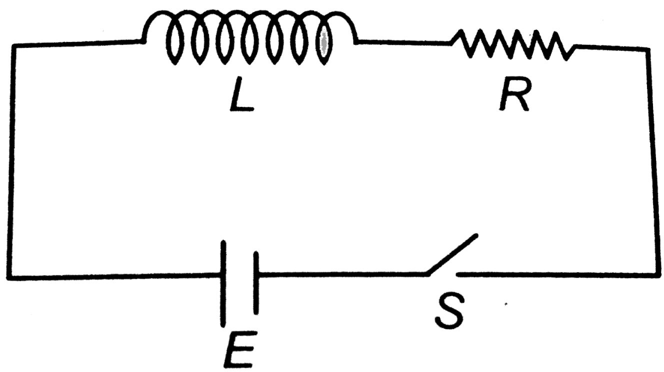
35. In the circuit shown in figure switch S is closed at time $t = 0$. The charge which passes through the battery in one time constant is



A. $\dfrac{eR^2E}{L}$

B. $E\left(\dfrac{L}{R}\right)$

C. $\dfrac{EL}{eR^2}$

D. $\dfrac{eL}{R}$

Answer: C

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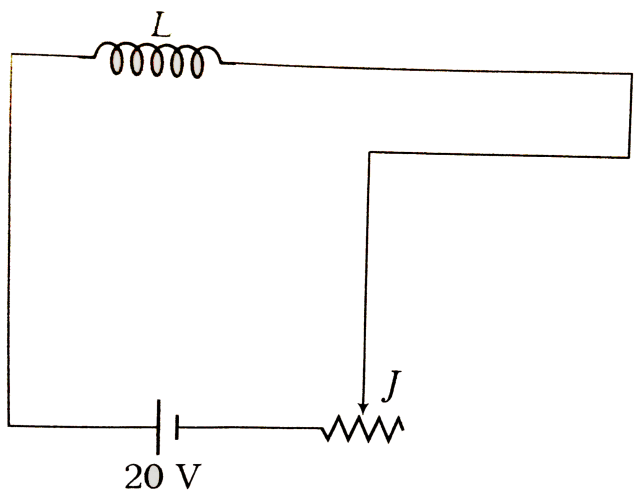
36. In the circuit shown in the figure, the jockey J is being pulled towards right, so that the resistance in the circuit is increasing. It's a value at some instant is 5Ω. The current in the circuit at this instant will be



A. 4A

B. less than 4A

C. more than 4A

D. may be less than or more than 4A depending on the value of L

Answer: C

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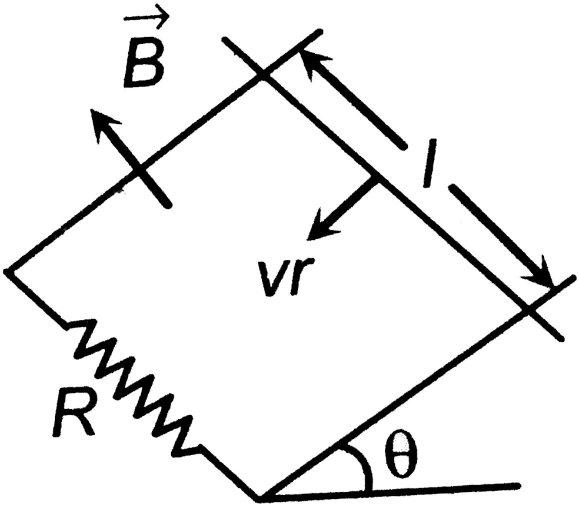
37. A copper rod of mass m slides under gravity on two smooth parallel rails l distance apart set at an angle θ to the horizontal. At the bottom, the rails are joined by a resistance R.



There is a uniform magnetic field perpendicular to the plane of the rails. the terminal valocity of the rod is

A. $\dfrac{mgR\cos\theta}{B^2 I^2}$

B. $\dfrac{mgR\sin\theta}{B^2 I^2}$

C. $\dfrac{mgR\tan\theta}{B^2 I^2}$

D. $\dfrac{mgR\cos\theta}{B^2 I^2}$

Answer: B

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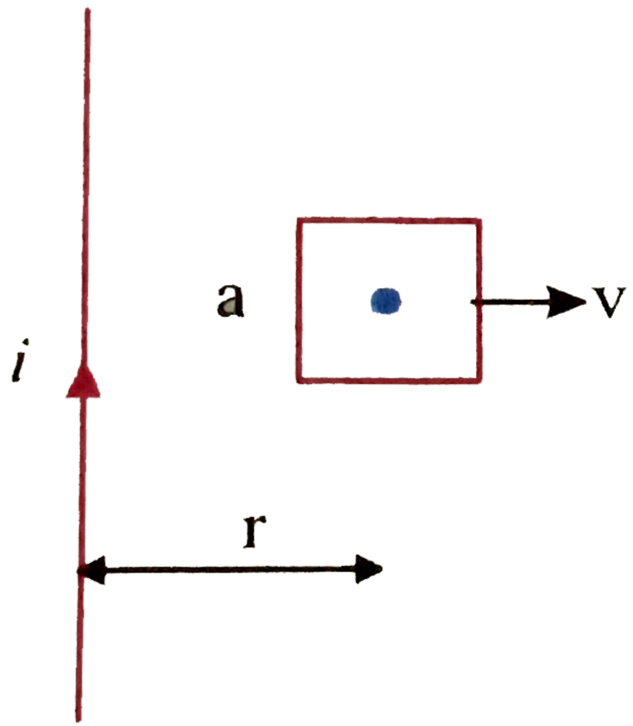
38. A square loop of side a is placed in the same plane as a long straight wire carrying a current i. The centre of the loop is at a distance r from wire where $r > \; > a$. The loop is moved away from the wire with a constant velocity v.

The induced $e.m.f$ in the loop is



A. $\frac{\mu_0 i v}{2\pi}$

B. $\frac{\mu_0 i a v}{2\pi r}$

C. $\frac{\mu_0 i a^2 v}{2\pi r^2}$

D. $\frac{\mu_0 i a^3 v}{2\pi r^3}$

Answer: C

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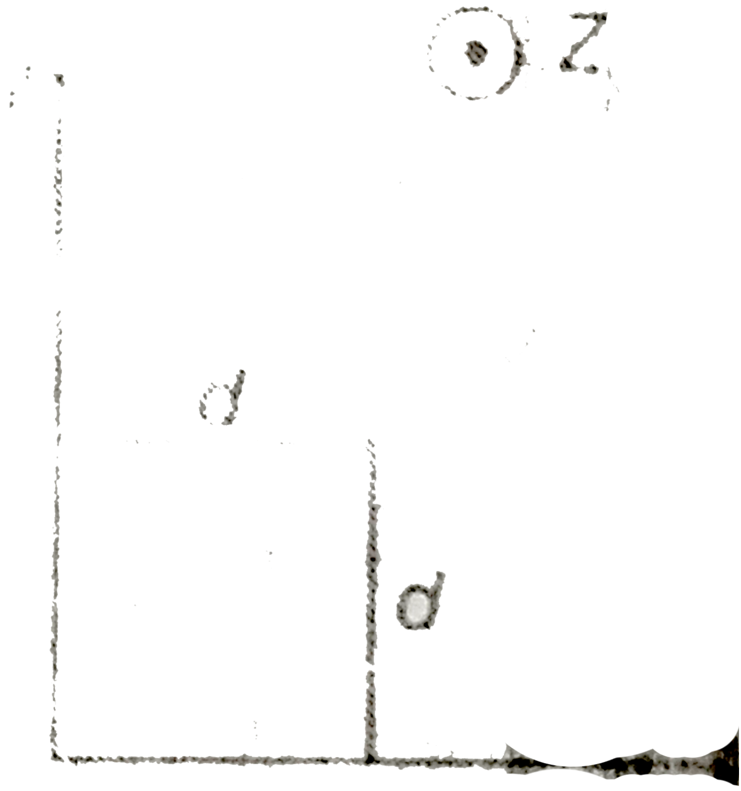
39. The magnetic field I nan reigion is given by $B = B_0 \frac{X}{a} K$. A Squrae edges along the x and y axis. The loop is moved with a constant velocity . The emf induced in the loop is



A. $B_0 v_0 d$

B. $\dfrac{B_0 v_0 d^2}{2a}$

C. $\dfrac{B_0 v_0 d^3}{a^2}$

D. $\dfrac{B_0 v_0 d^2}{a}$

Answer: D

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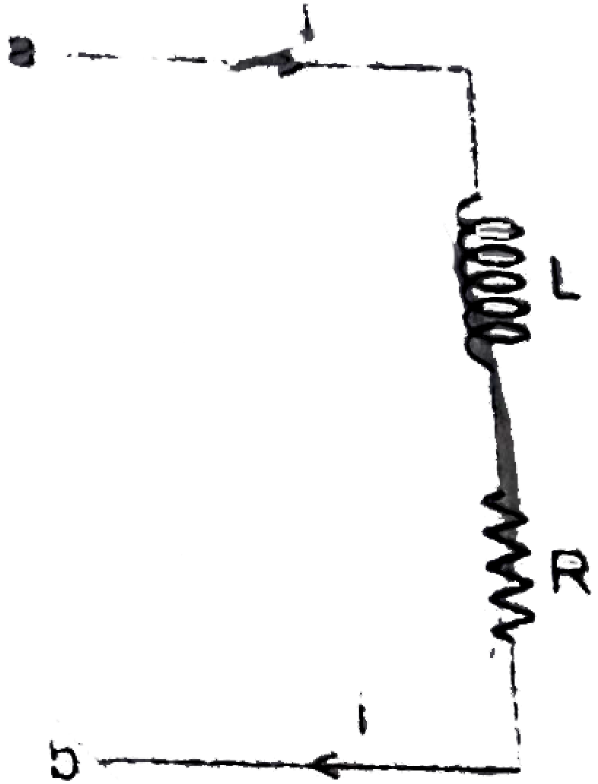
40. When the current in the portion of the circuit shown in the figure is $2A$ and increasing at the rate of $1A/s$,the measured potential difference $V_a - V_b = 8V$.However when the current is $2A$ and decreasing at the rate of $1A/s$, the measured potential difference $V_a - V_b = 4V$

.The values of R and L are:



A. 3Ω and 2H, respectively

B. 2Ω and 3H, respectively

C. 3Ω and 2H, respectively

D.

Answer: A

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41. When $100V$ DC is applied across a solenoid, a current of $1.0A$ flows in it. When $100V$ AC is applied across the same coil. The current drops to $0.5A$. If the frequency of the ac source is $50Hz$, the impedance and inductance of the solenoid are

A. $100\Omega, 0.75H$

B. $100\Omega, 0.60H$

C. $200\Omega, 0.55H$

D. $200\Omega, 0.75H$

Answer: C

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42. In a series LCR the voltage across resistance, capacitance and inductance is 10V each. If the capacitance is shor t circulated, the voltage across the inducatance will be

A. $\frac{10}{\sqrt{2}}V$

B. 10V

C. $10\sqrt{2}V$

D. 20V

Answer: A

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43. The voltage over a cycle varies as

$$V = V_0 \sin \omega t \text{ for } 0 \le t \le \frac{\pi}{\omega}$$

$$= -V_0 \sin \omega t \text{ for } \frac{\pi}{\omega} \le t \le \frac{2\pi}{\omega}$$

The average value of the voltage one cycle is

A. $\frac{V_0}{\sqrt{2}}$

B. $\left(\frac{2}{\pi}\right)V_0$

C. $\left(\frac{2}{\pi}\right)V_0$

D. ZERO

Answer: B

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44. Choose the correct statement.

A. The peak voltage across the inductor can be greater than the peak voltage of the source in an LCR circuit.

B. In a circuit containing a capacitor and an AC source the current is zero a the instant the source voltage is maximum

C. An AC source is connected to a capacitor. The rms current in the circuit gelts increased if a dielectric slab is iserted into the capacitor.

D. none of the above

Answer: D

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45. An AC source producing emf $V = V_0$ "["sin omega t+sin 2omegat"]" is connected in series with a capacitor and a resistor. The current found in the circuit is

A. $i_1 - i_2$

B. $i_1 < i_2$

C. $i_1 > i_2$

D. i_1 may be less than, equal to or greater than i_2

Answer: B

View Text Solution

46. An alternating current is given by

$$I = i_1 \cos \omega t + i_2 \sin \omega t.$$

The rms current is given by

A. $\frac{7}{\sqrt{2}} A$

B. $\frac{1}{\sqrt{2}} A$

C. $\frac{5}{\sqrt{2}} A$

D. information is insufficient to find the rms current

Answer: C

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47. For a resistance R and capacitance C in series the impedence is twice that of a parallel combinations of the same elements. The frequency of the applied emf shall be

A. $\frac{2\pi}{RC}$

B. $\frac{1}{2\pi RC}$

C. $\frac{2\pi}{\sqrt{RC}}$

D. $\frac{1}{2\pi\sqrt{RC}}$

Answer: B

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48. A coil a capacitor and an AC source of rms voltage $24V$ are connected in series. By varying the frequency of the source, a maximum rms current of 6 A is observed. If coil is connected is at DC batteryof emf 12 volt and internal resistance 4Ω, then current through it in steady state is

A. 2.0A

B. 1.5A

C. 3.0A

D. 2.5A

Answer: B

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49. A dc ammeter and a hot wire ammeter are connected to a circuit in series. When a direct current is passed through circuit, the dc ammeter shows 6 A. When ac current flows through circuit, the ac ammeter shows 8A. What will be reading of each ammeter if dc and ac current flow simulataneously through the circuit?

A. the DC ammeter will shown zero current

B. the DC ammeter will shown 6A current

C. the AC ammeter will shown 14A current

D. the AC ammeter will shown zero current

Answer: B

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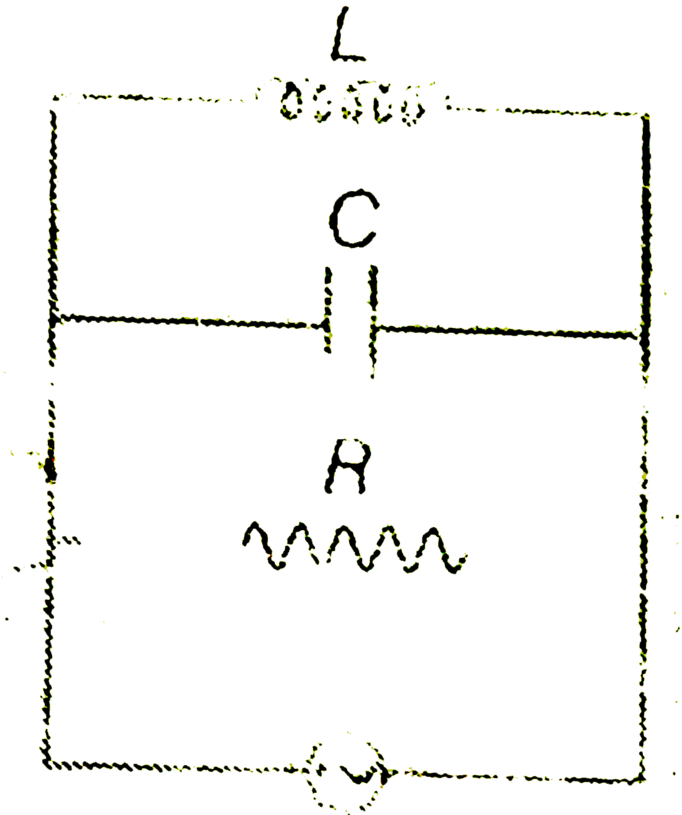
50. Figures shows a parallel LCR circuit connected to a 200V, AC source. L=5H, $C = 80\mu F$ and $R = 40\Omega$. At resonance let I_1 and i_2 be the rs currents through L,C and R. Then



A. $i_1 = i_2$ and $i_1 > i_2$

B. $i_1 = 0 = i_2$

C. $i_1 = i_2$ and $i_1 < i_2$

D. $i_1 = i_2$ and $i_1 > i_2$

Answer: C

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51. A 120V, 620W lamps is run froma 240V, 50Hz mains supply sing a capacitor connected connected in series with the lamp and supply. What is the teoretical value of the capacitor required to operate the lamp at its normal rating?

A. $3.8\mu F$

B. $6.6\mu F$

C. $0.7\mu F$

D. $13.3\mu F$

Answer: C

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52. In the above question size element will raise the power factor to unity?

A. an inductor should be placed in series

B. a capacitor should be placed in series

C. a resistance should be placed in series

D. an inductor or a resistance should be placed in series

Answer: D

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53. In the circuit shown in the figure $X_L = \frac{X_C}{2}\Big) = R$ the peck value current i_0 is

A. An inductor of 0.103H

B. An inductor of 0.25H

C. A resistance of $6.\ \Omega$

D. A resistance of 100Ω

Answer: A

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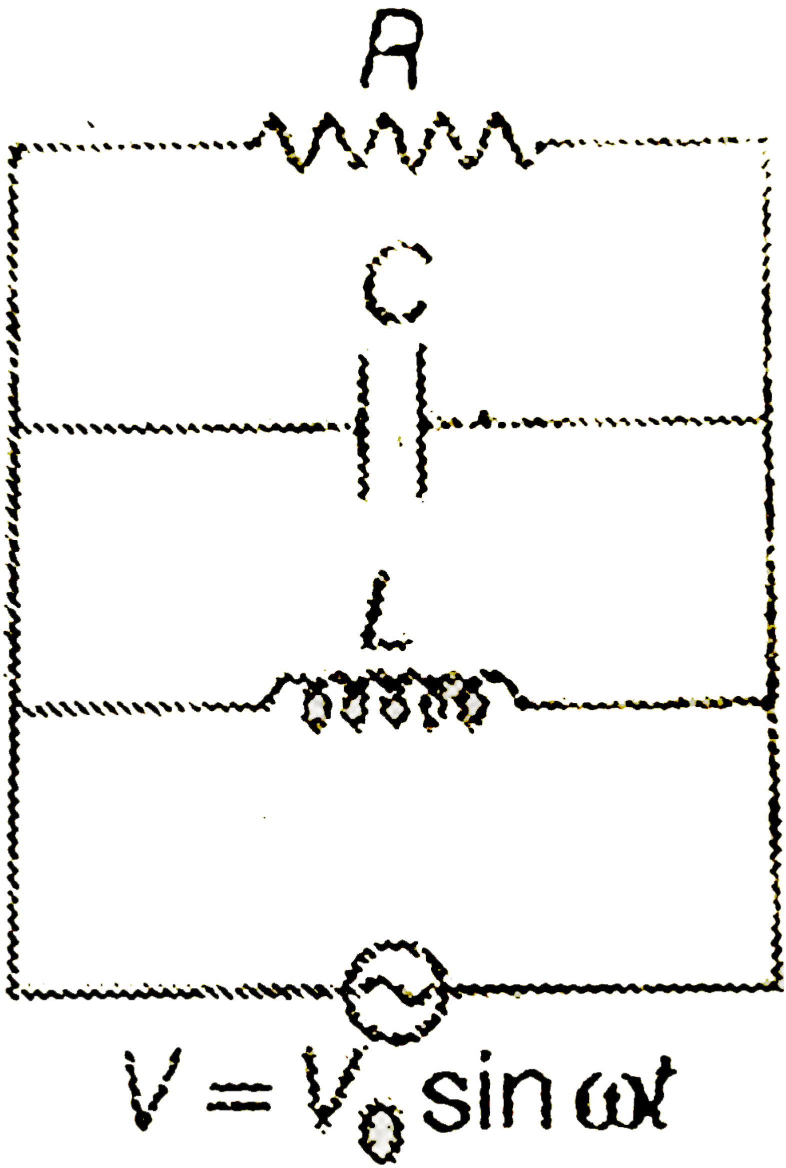
54. A series circuit has an impendence of 50.0Ω and a power factor of 0.63 to 60Hz. The voltage lags the current.

To raise the power factor of the circuit



A. $\frac{\sqrt{5}V_0}{2E}$

B. $\dfrac{V_0}{2\sqrt{2}R}$

C. $\dfrac{V_0}{2R}$

D. $\dfrac{V_0}{2\sqrt{3}R}$

Answer: A

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55. 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 statements(s) from the following

A. The entire rod is at same electric potential

B. There is an electric field in the rod

C. The electric potential is highest at the center of the rod and decreases towards its ends

D. The electric potential is lowest at the center of the rod and increases towards its ends

Answer: B

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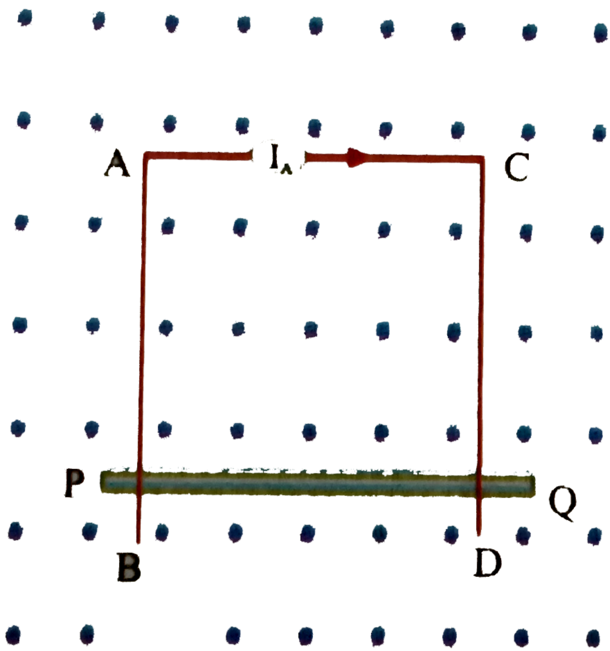
56. AB and CD are fixed conducting smooth rails placed in a vertical plane and joined by a constant current source at its upper end. PQ is a conducting rod which is free to slide on the rails. A horizontal uniform magnetic field exists in space as shown in figure. If the rod PQ is released from rest then,



A. The rod PQ may move downward with ocnstant acceleration

B. The rod PQ may move upward with constant acceleration

C. The rod wil move downward with decreasing acceleration and finally acquire a constant velocity

D. either a or b

Answer: D

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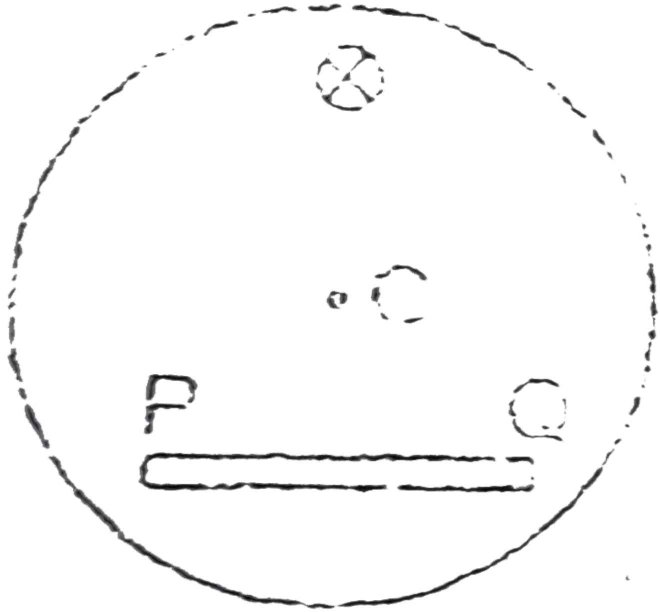
57. In a cylindrical region uniform magnetic field which is perpendicular to the plane of the figure is in increasing with time and a conducting rod PQ is placed in the region.If C is the centre of the circle then



A. P wil be at thigher potential than Q

B. Q will be at higher potential than P

C. Both P and Q will be at zero potential

D. No potential difference will be developed across the

rod

Answer: A

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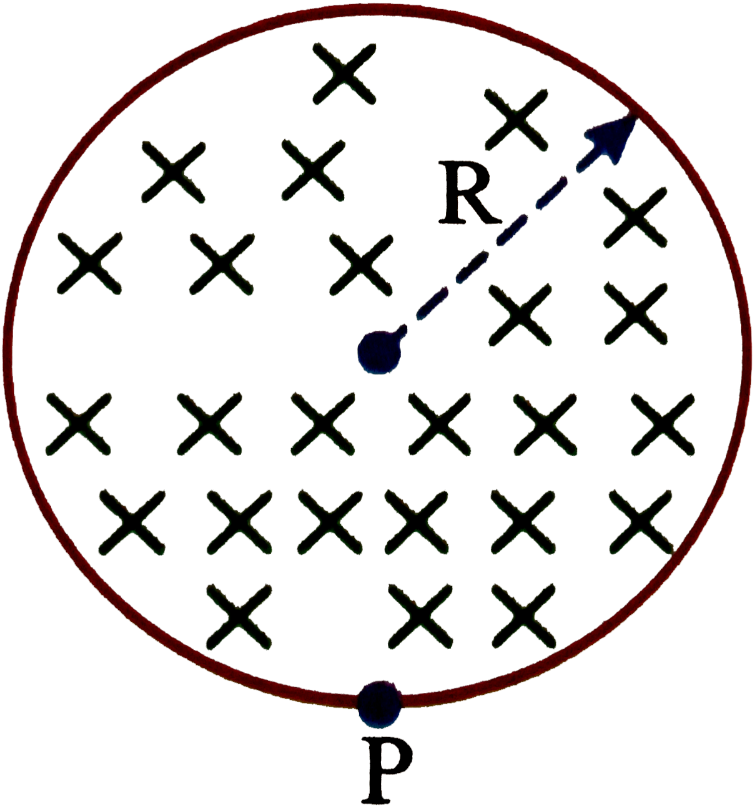
58. A uniform magnetic field of induction B is confined to a cyclindrical region of radius R. The magnetic field is increasing at a constant rate of dB/dt (tesla / second). A charge e of mass m, placed at the point P on the periphery of the fixed experiences an acceleration :



A. $\frac{1}{2}\frac{eR}{m}\frac{dB}{dt}$ toward left

B. $\frac{1}{2}\frac{eR}{m}\frac{dB}{dt}$ toward right

C. $\frac{eR}{m}\frac{dB}{dt}$ toward left

D. zero

Answer: A

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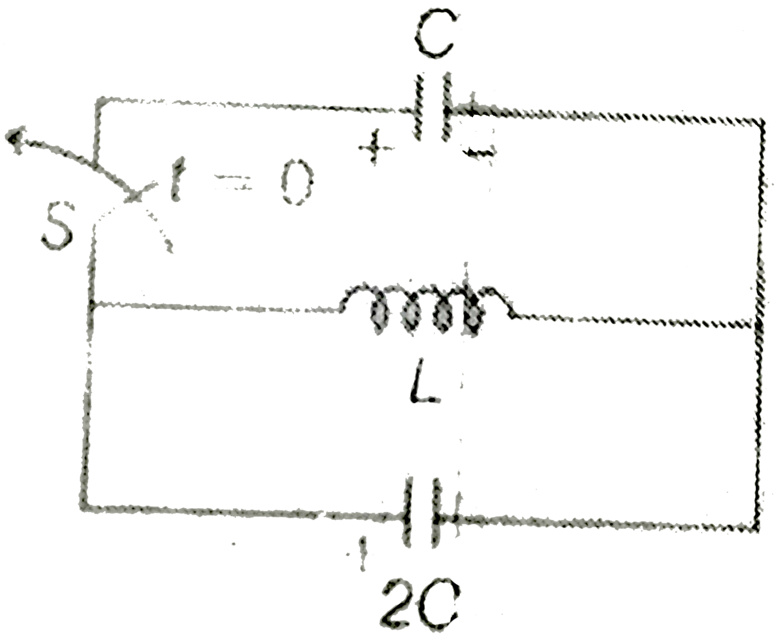
59. In the given LC circuit,if initially capacitor C has charge Q on it and 2C has charge 2Q. The polar ar as shown in figure. Then after closing switch S and t=0



A. energy will get equally distributed in both the capacitors ust after closing the switch

B. initial rate of groqth of current in inductor will be 2Q/3CL

C. maximum energy in the inductor will be $3Q^2/2C$

D. none of these

Answer: C

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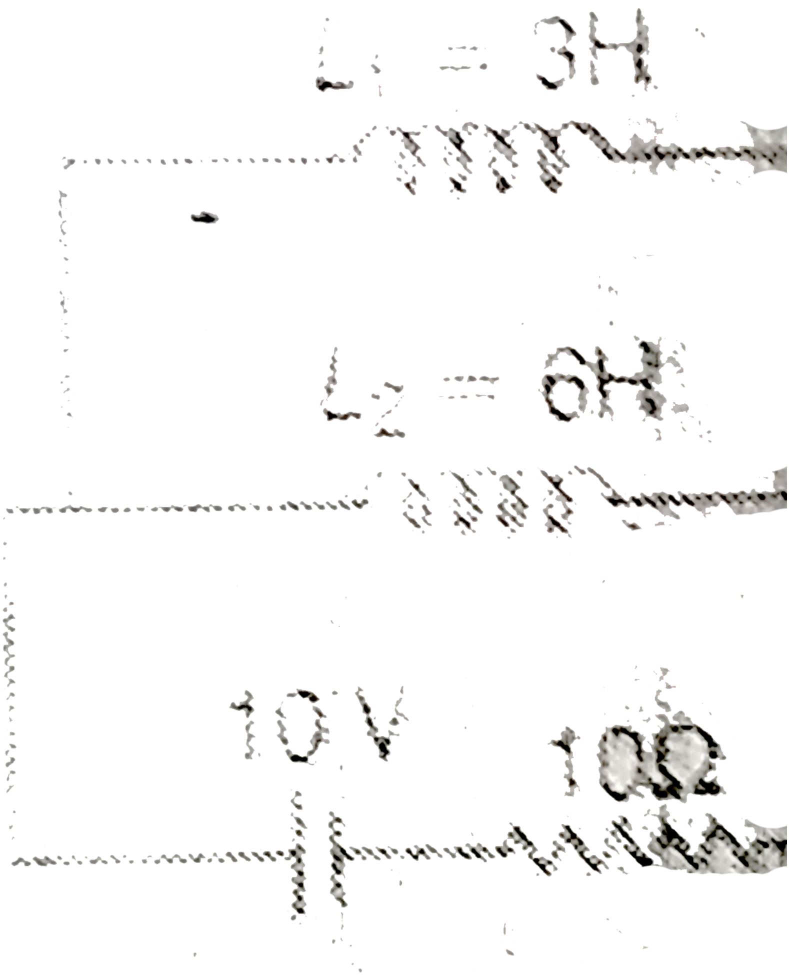
60. Two inductors coils of self inductance 3H and 6H respectively are connected with a resistance 10Ω and a battery 10V as shown is figure. The ratio of total energy stored at steady state in the inductors to that of heat developed in resistance in10second at hte steady state is (neglect mutual inductance between L_1 and L_2



A. $\frac{1}{10}$

B. $\frac{1}{100}$

C. $\frac{1}{1000}$

D. 1

Answer: B

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61. Power factor of an L-R series circuit is 0.6 and that of a C-R series circuit is 0.5. If the element (L. C, and R) of the two circuits are joined in series the power factor of this circuit is found to be 1. The ratio of the resistance in the L-R circuit to the resistance in the C-R circuit is

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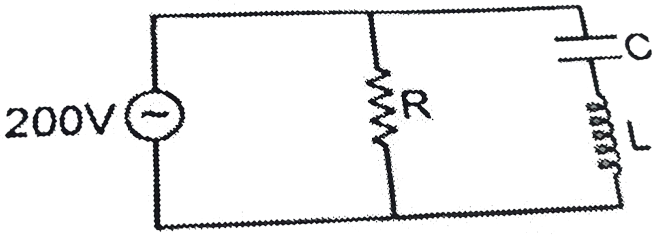
62. In the circuit diagram show,

$X_C = 100\Omega, X_L = 200\Omega, \& R = 100\Omega$



A. $\frac{6}{5}$

B. $\frac{5}{6}$

C. $\frac{4}{3\sqrt{3}}$

D. $\frac{3\sqrt{3}}{4}$

Answer: A

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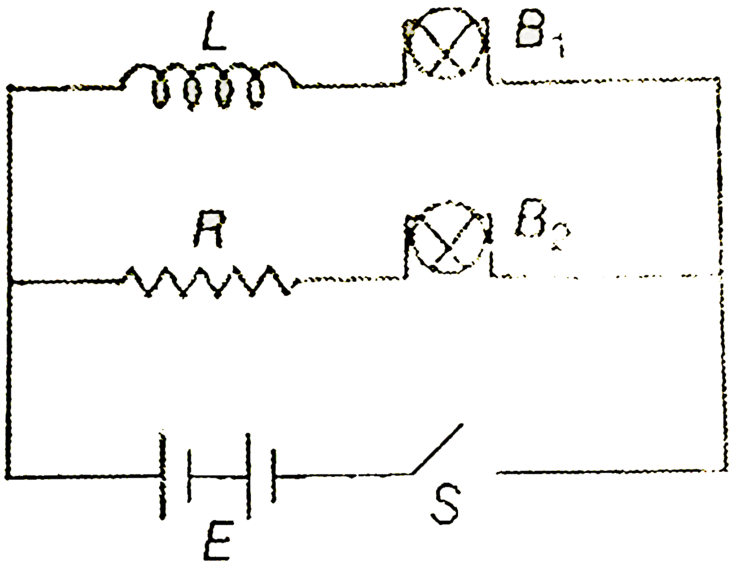
63. An inductor L, a resistanc eR and two identical bulbs B_1 and B_2 are connected to a battery through a switch S as shown in the figure . The resistance of coil having inductance L is also R. Which of the following statement gives the corrrect description of the happenings when the switch S is closed?



A. B_2 lights earlier than B_1 and finally both the bulbs shine equally bright.

B. B_1 light up earlier and finally both the bulbs acquire equal brightnesss,

C. B_2 lights up earlier and finally B_1 shines brighter than B_2

D. B_2 lights up together with equal brightness all the time.

Answer: A

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64. A Capacitor and a coil in series are connected to a 6volt ac source. By varying the frequency of the source, maximum current of 600mA is observed. If the same coil is now connected toa cell of emf 6volt dc and internal resistance of 2ohm, the current h through it will be

A. 0.5A

B. 0.6A

C. 1.0A

D. 2.0A

Answer: A

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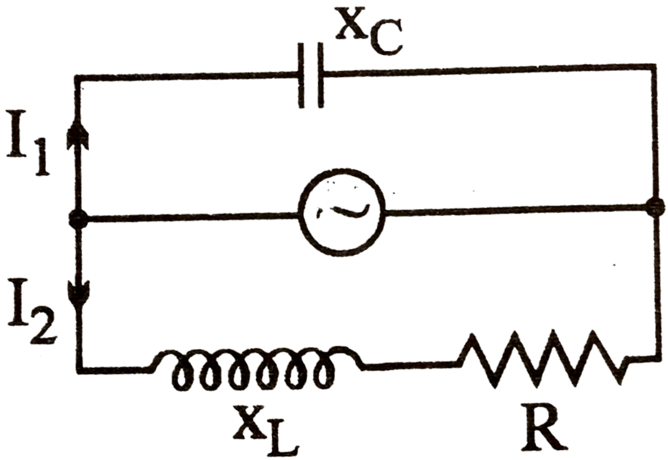
65. In the shown AC circuit phase different between current I_1 and I_2 is



A. $\frac{\pi}{2} - \tan^{-1}. \frac{x_L}{R}$

B. $\tan^{-1} - \frac{X_L - X_C}{R}$

C. $\frac{\pi}{2} + \tan^{-1}. \frac{x_L}{R}$

D. $\tan^{-1}. \frac{X_L - X_C}{R} + \frac{\pi}{2}$

Answer: C

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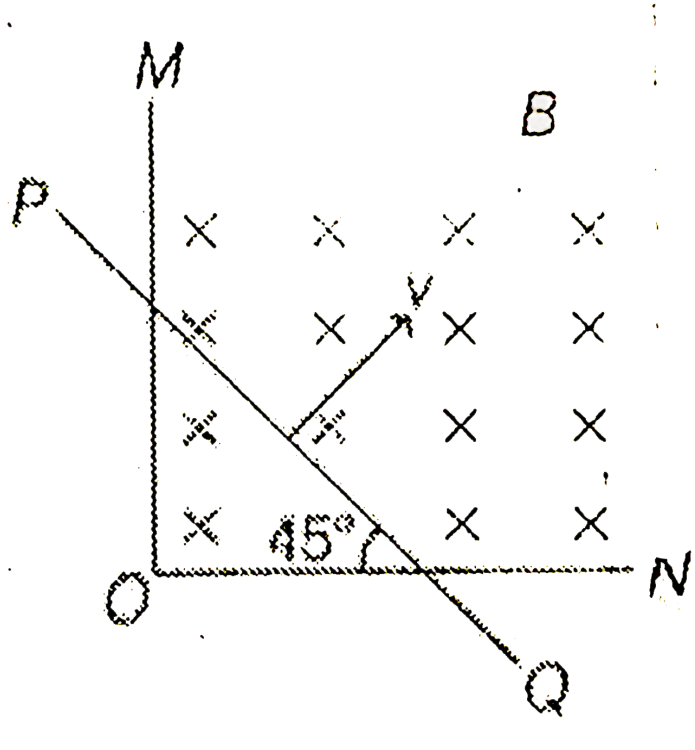
66. Electric circuit is composed of three conducting rods MO, ON and PQ as shown in the figure. The resistance of the rods per unit length is known to be 1. The rod PQ slides as shown in the figure. At t=0, rod PQ is at O. The whole system is embledded ina uniform magnetic field B, which is directed perpendicularly into page. The induced electric current is:



A. Proportional to time t

B. Inversibly proportional to time t

C. Proportional to square at time t

D. Independent of time t

Answer: D

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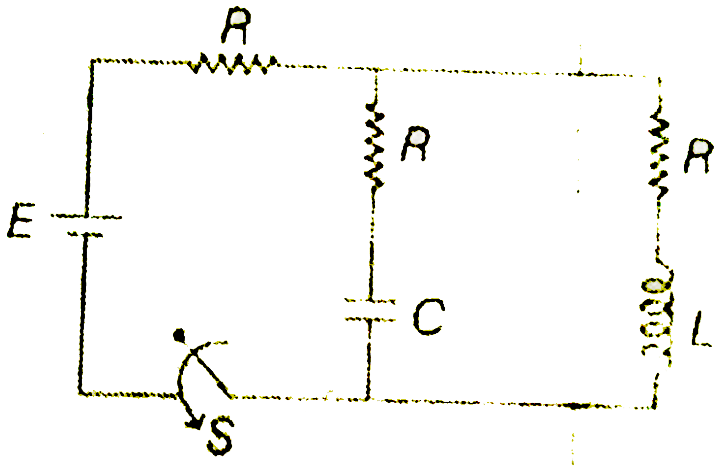
67. In the circuit as shown in the figure, switch S is added at t=0. Then:



A. after a long time interval potential differences across capacitor and inductor will be equal

B. after a long time interval charge on a capacitor will be EC

C. after a long time interval curent in the inductory will be E/R

D. after a long time interval current through battery willl be same as the curren through it initially

Answer: D

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68. A pure resistive circuit element X when connected to an sinusoidal AC supply peak voltage $200V$ gives a peak current of $5A$ which is in phase with the voltage. A second circuit element Y, when connected to the same AC supply also gives the same value of peak currrent but the current lags behind by 90^0. If the series combination of X and Y is connected to the same supply. the rms value of current is

A. $\dfrac{10}{\sqrt{2}} amp$

B. $\dfrac{5}{\sqrt{2}} amp$

C. $\left(\frac{5}{2}\right)amp$

D. 5amp

Answer: C

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69. A current is made of two components a dc component $i_1 = 3A$ and an ac component $i_2 = 4\sqrt{2}\sin\omega t$. Find the reading of hot wire ammeter?

A. 4amp

B. $4\sqrt{2}amp$

C. $(3 + 4\sqrt{2})amp$

D. 5amp

Answer: D

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70. The self inductance of a choke coil is 10mH. When it is connected witrh a 10V dc source loss of power is 10watt. The frequency of a csource will be:

A. 50Hz

B. 60Hz

C. 80Hz

D. 100Hz

Answer: C

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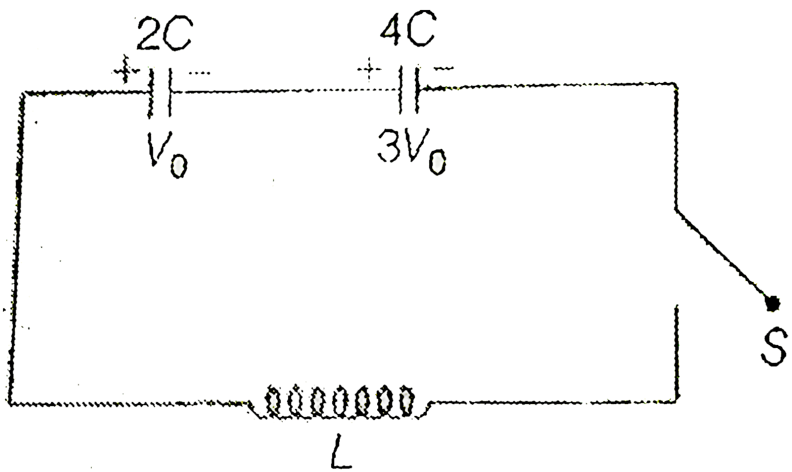
71. Two capacitors 2C and 4C initially charged to potential difference of V_0 and $3V_0$ with the potential as show are connected to an inductor of inductance L. Initial curren tin the inductor is zer. Now the swtich 'S' is closed. The maxmimum current in the circuit is



A. $\frac{V_0}{8}\sqrt{\frac{C}{3L}}$

B. $(8V_0)\sqrt{\frac{C}{3L}}$

C. $\frac{V_0}{4}\sqrt{\frac{C}{3L}}$

D. $4V_0\sqrt{\frac{C}{3L}}$

Answer: B

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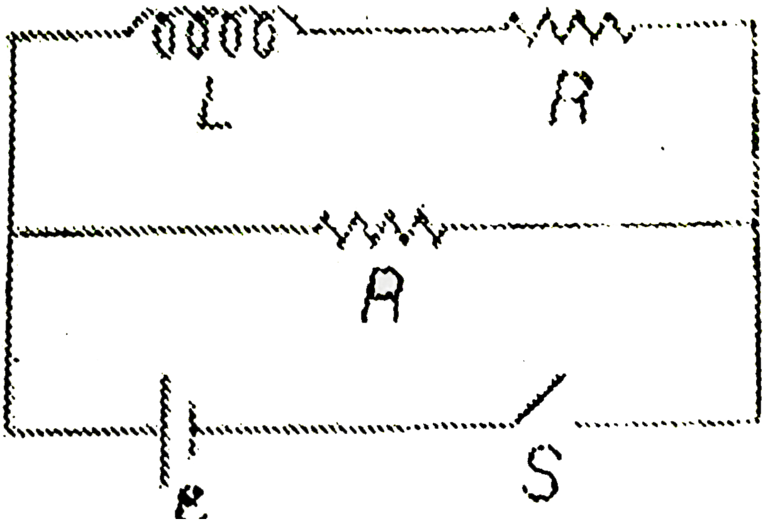
72. In the circuit shown in figure switch S is closed at time t=0, which statement is true after one time constant of L-R circuit?



A. charge passes through inductor $\frac{2L\varepsilon}{R}\left(1 - e^{-1}\right)$

B. current through battery $\frac{\varepsilon}{2R}\left(1 - e^{-1}\right)$

C. charge passes through inductor $\frac{L\varepsilon}{R^2}\left(e^{-1}\right)$

D. Current through battery is $\frac{2\varepsilon}{R}$

Answer: C

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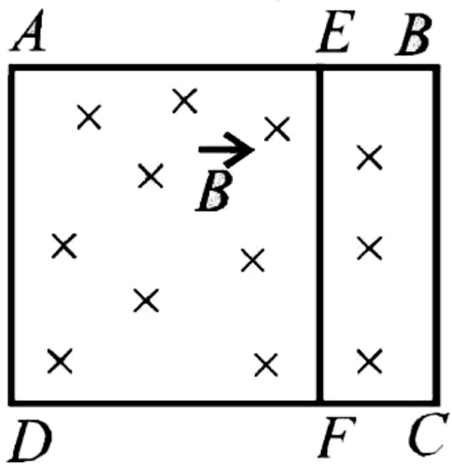
73. A rectangular frame ABCD, made of a uniform metal wire, has a straight connection between E and F made of the samae wire, as shown in fig. AEFD is a square of side 1m, and EB=FC=0.5m. The entire circuit is placed in steadily increasing, uniform magnetic field directed into the plane of the paper and normal to it. The rate of change of the magnetic field is $1T/s$. The resistance per unit length of the wire is $1\omega/m$. Find the magnitude and directions of the currents in the segments AE, BE and EF.



A. 2

B. 4

C. 43468

D. 43471

Answer: D

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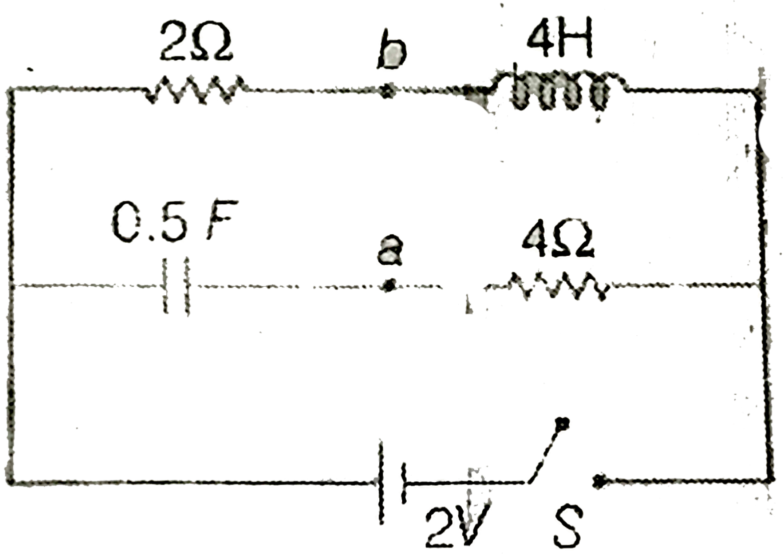
74. In the circuit shown. Initially the capacitor is uncharged. The switch S is closed at time t=0. Then



A. $(V_a - V_b)$ is increasing with time

B. $(V_a - V_b)$ is deceasing with time

C.

D.

Answer: D

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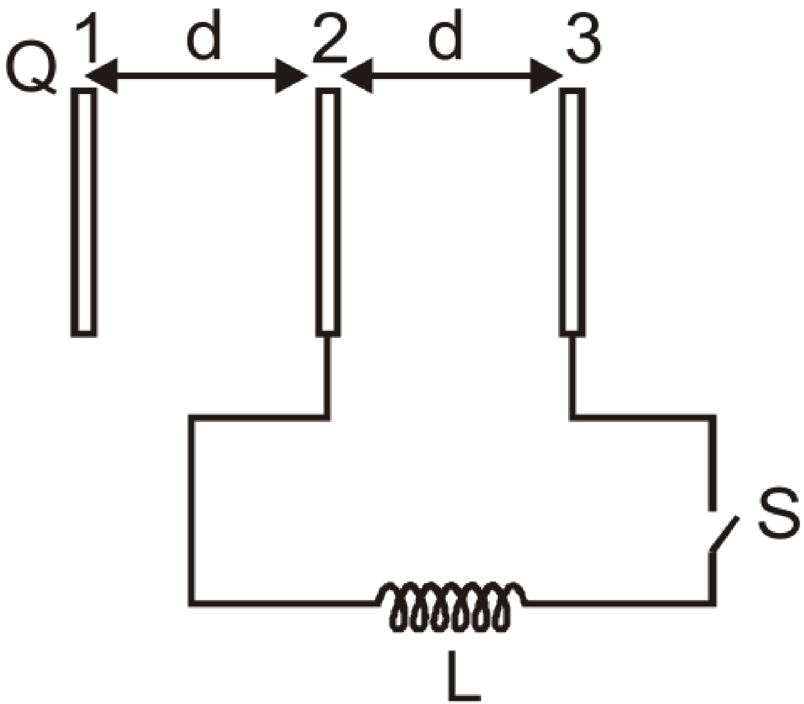
75. Three identical large plates are fixed at separation of d from each other as shown in figure. The area of each plate is A. Plate 1 is given charge $+Q$ while plates 2 and 3 are neutral and are connected to each other through coil of inductances L and switch S. If resistance of all connected wires is neglected the maximum current flow through coil after closing switch is ($C = \varepsilon e_0 \frac{A}{d}$) (neglect fringe effect)



A. $\frac{Q}{\sqrt{LC}}$

B. $\frac{Q}{2\sqrt{LC}}$

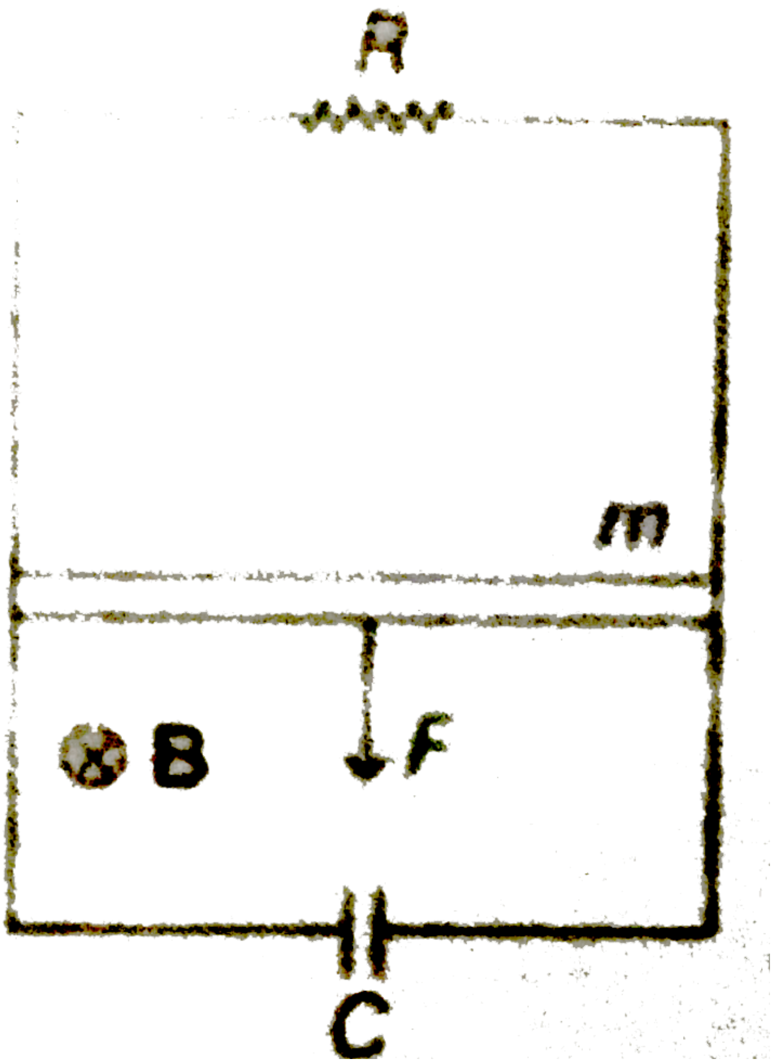
C. `(V_(a)-V_(b))=ZERO

D. $\frac{Q}{2\sqrt{LC}}$

Answer: C

Watch Video Solution

76. Two long rails are hporizontal and parallel to each. On one end, the rails are connected by a resistance R and on the other end a cpacitor of capacitance C is connected as shown in the figure . A connecter of mass m and length l can slide on the rails without friction. Uniform magnetic field B, perpendicular to he plane of hte gigure exists in space. A constant horizontal force F starts acting on hte connector. What is the acceleration of connector when its veleocity is $\frac{3}{4}$ of its terminal velocity?



A. $\dfrac{3F}{4(m + CB^2I^2)}$

B. $\dfrac{F}{(m + CB^2I^2)}$

C. $\dfrac{F}{4(m + CB^2I^2)}$

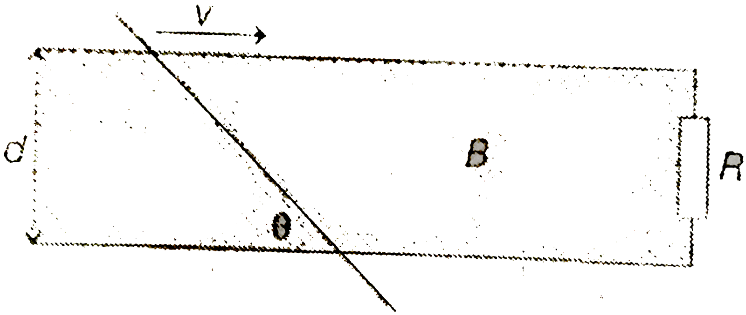
D. $\dfrac{4F}{3(m + CB^2I^2)}$

Answer: B

View Text Solution

77. A conducting rod with resistance r per unit length is moving inside a vertical magnetic field B with spee v on two smooth horizontal parallel ideal conducting rails. The end of the rails are connected to a resistor R. the separation between the rails is d. The rod maintains a tilted angle θ to the rail. Find the external force F required

to keep the rod moving



A. $F = \dfrac{B^2 d^2 v}{R + dr}$

B. $F = \dfrac{B^2 d^2 v}{(R + dr)/\sin\theta}$

C. $F = \dfrac{B^2 d^2 v \sin\theta}{(R + dr)/\sin\theta}$

D. $F = \dfrac{B^2 d^2 v \cos\theta}{(R + dr)/\cos\theta}$

Answer: C

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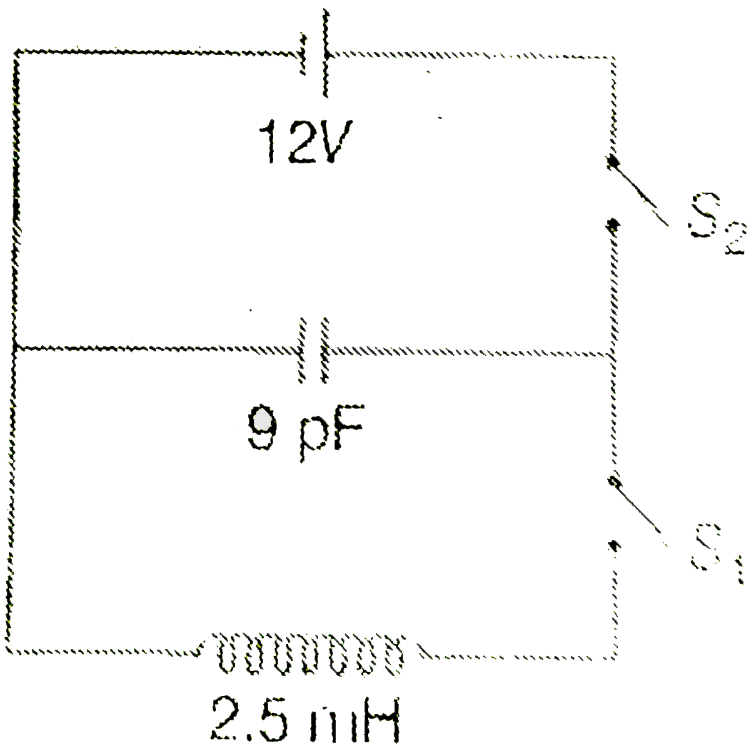
78. In the circuit shown, the capacitor initially charged with a 12V batteryy, when switch S_1 is open and switch S_2 is closed. The maximum value of current in the circuit when S_2 is opened and S_2 is closed is



A. $10^{-6}A$

B. $7.2\mu A$

C. $720\mu A$

D. $360\mu A$

Answer: C

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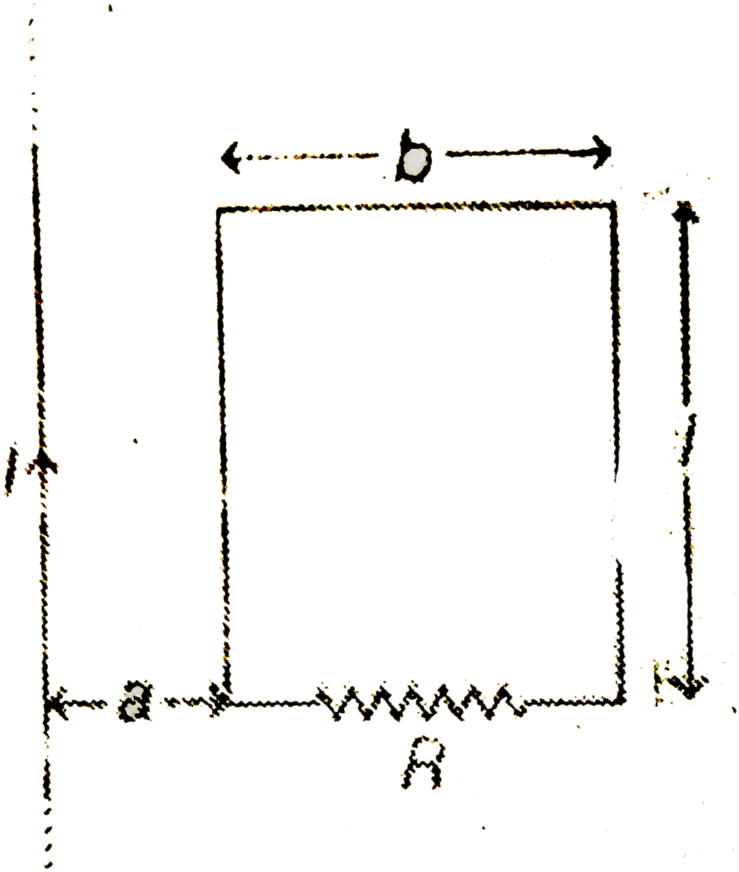
79. In the figures shown current in the long straight wire varies as $I = I_0\left(\frac{t_0 - t}{t_0}\right)$ where I_0 is the initial current The charge flown through resistance in the time t_0 is



A. $\frac{\mu_0}{2\pi}\frac{lbl_0}{R}$

B. $\frac{\mu_0}{2\pi}\frac{ll_0}{R}In\left(\frac{b}{a}\right)$

C. $\frac{\mu_0}{2\pi}\frac{ll_0}{R}In\left(\frac{a+b}{a}\right)$

D. $\frac{\mu_0}{2\pi}\frac{al_0}{R}In\left(\frac{b}{l}\right)$

Answer: C

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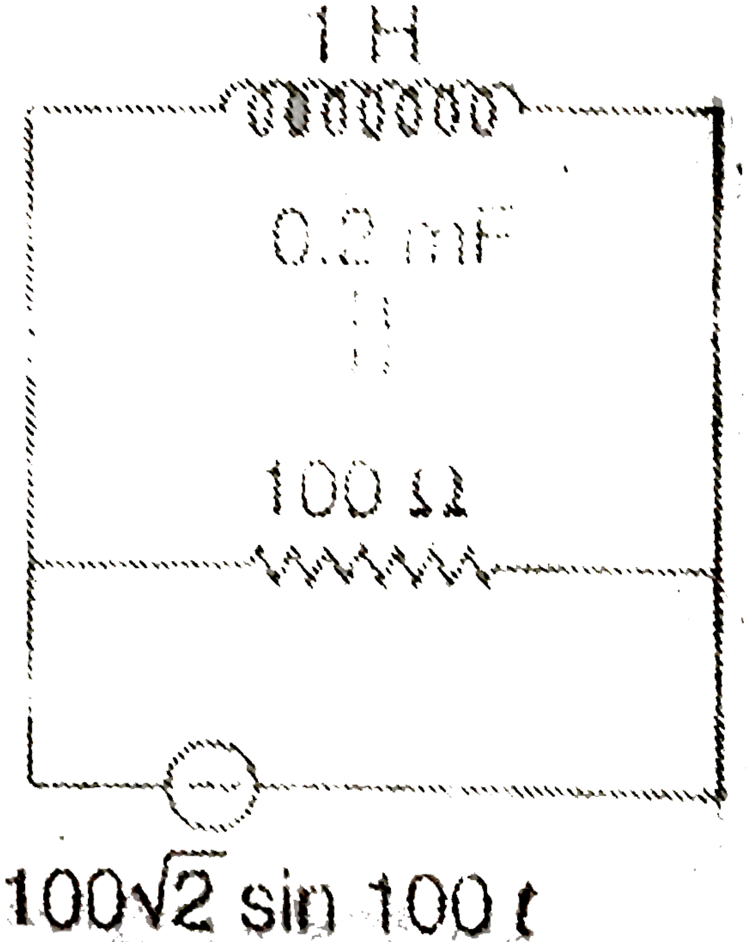
80. Consider the shown circuit. The net current supplied as a function of time is



A. $\left(2\sqrt{2}\sin 100t\right)A$

B. $2\sin(100t + 45^\circ)A$

C. $\left(2\sqrt{2}\sin(100t + 45^\circ)\right)A$

D. None of these

Answer: B

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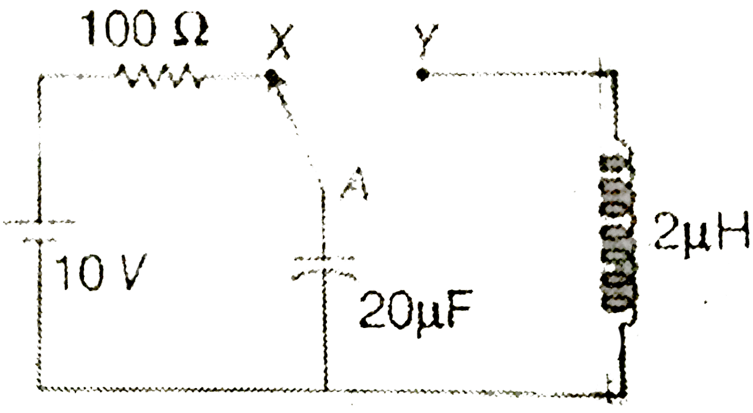
81. A' is first connected with X for $2 \times 10^{-3} s$ with capacitor initially being uncharged. Then, the switch is thrown to Y at t=0. The time interval after which the potential difference across the capacitor becomes 3.15V is approximately



A. $\frac{\pi}{3} \times 10^{-4} s$

B. $\frac{2\pi}{3} \times 10^{-4} s$

C. $\pi \times 10^{-4} s$

D. $\frac{\pi}{2} \times 10^{-4} s$

Answer: B

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82. In case of AC circuits the relation $V = iZ$, where Z is impedance, can directly applied to

A. peak valuie of voltage an dcurren t

B. rms values of voltage and current

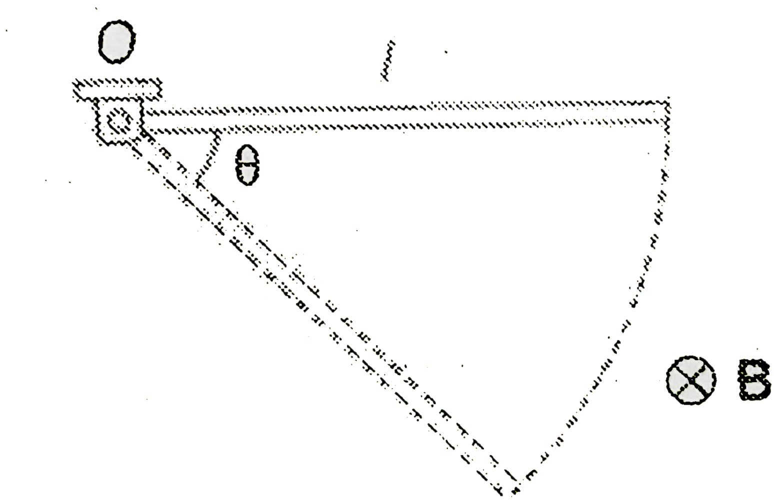
C. instantaneous values of voltage and current

D. steady state values of voltage and current

Answer: A::B

Watch Video Solution

83. A conducting rod of length l is hinged at point O. It is a free to rotate in a verical plane. There exists a uniform magnetic field B in horizontal direction. 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

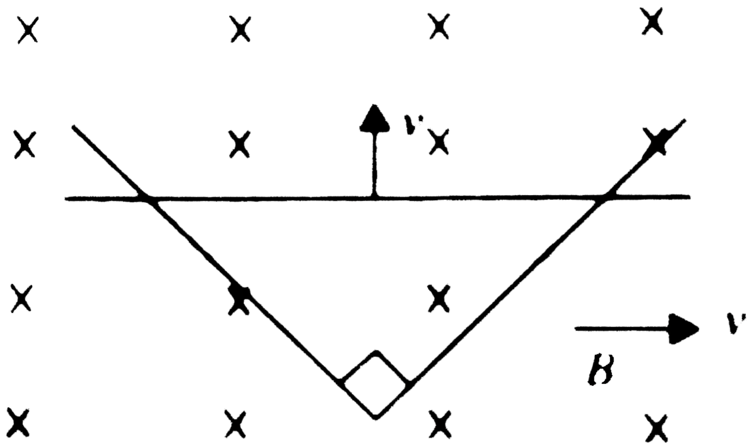
C. $\sin\theta$

D. $(\sin\theta)^{1/2}$

Answer: A::D

Watch Video Solution

84. Two straight conducting rails form 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 Fig. 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

C. Voltage of source will lead the current through

D. v^2

Answer: B::D

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85. An LC cirucit has capacitance $C_1 = C$ and inductance $L_1 = L. A \sec ond \circ uithas$C_(2)=C//2 and L_(2)=2L and $athird \circ uithas$C_(3)=2C and L_(3)=(L)/(2)`. All the three capacitors are charged to the same potential V and then made to oscilate. Then

A. angular frequency of oscillation is same for all the three circuits

B. angular frequency of oscillation is different for all three circuits

C. maximum current is greatest in second circuit

D. mamimum current is greatest in third circuit

Answer: A::D

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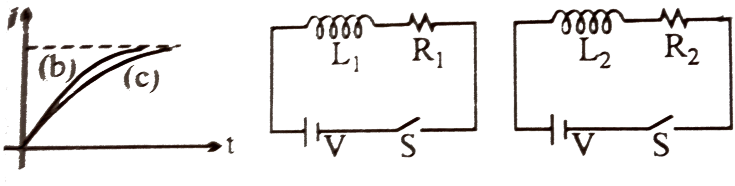
86. Current growth in two L-R circuits (b) and (c) as shown in figure (a). Let L_1, L_2, R_1 and R_1 be the corresponding values in two circuits. Then



(a) (b) (c)

A. $R_1 > R_2$

B. $R_1 = R_2$

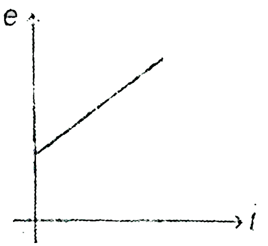
C. $L_1 > L_2$

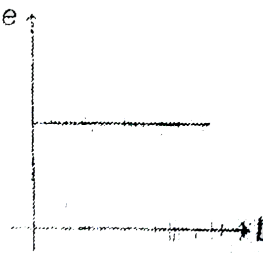
D. $L_1 < L_2$

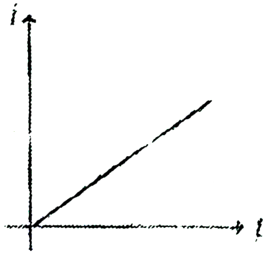
Answer: B::D

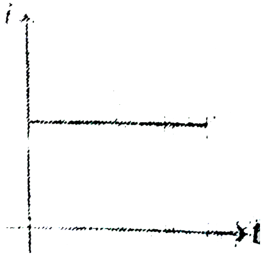
Watch Video Solution

87. Two parallel long straight conductors lie on a smooth horizontal surface. Two other parallel conductor rest on them at right angles so as from B exits vertical. A uniform magnetic field B exists a vertical direction. Now all the four conductors stock moving outwards with a constant velocity v. The induced emf e and induced current i will vary wide time t as

A. 

B. 

C. 

D. 

Answer: A::D

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88. the uniform magnetic field perpendicular to the plane of a conducting ring of radius a change at the rate of α, then

A. all the points ont the ring are the same potential

B. the emf induced in the ring is $\pi a^2 \alpha$

C. electric field intensity E at anny point on the ring is zero

D. $E = \frac{a\alpha}{2})$

Answer: A::B::D

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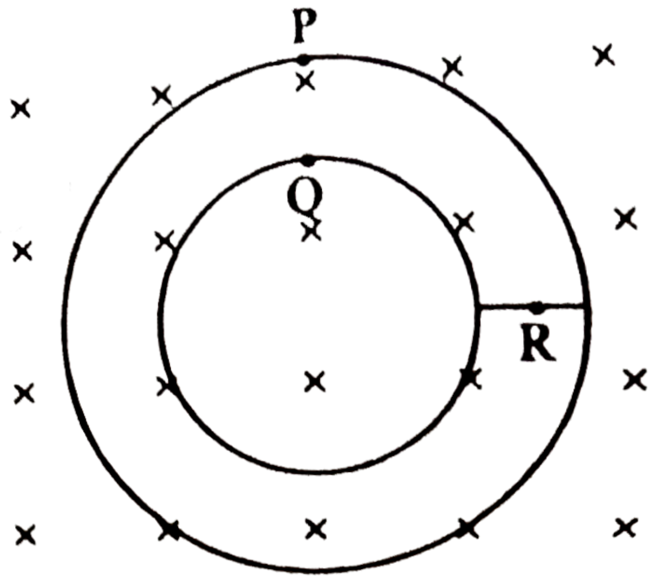
89. Figure shown plane figure made of a conductor located in a magnetic field along the inward normal to the plane of the figure. The magnetic field starts diminishing. Then the induced current



A. at point P is clockwise

B. at point Q is anticlockwise

C. at point Q is clockwise

D. at point Q is clockwise

Answer: A::B::D

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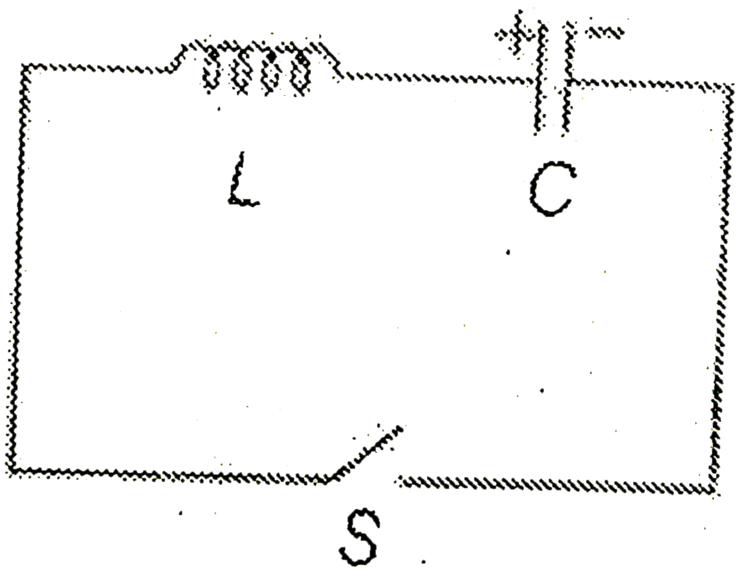
90. A capacitor is charged to a potential of V_0. It is connected with an inductor through a switch S. The switch is closed at time t=0. Which of the following statement(s) is/are correct?



A. The maximum current in the circuit is $V_0\sqrt{\frac{C}{L}}$

B. Potential across capacitor becomes zero for the first time at $t = \pi\sqrt{LC}$

C. Energy stored in the inductor at time $t = \frac{\pi}{2}\sqrt{LC}$ is $\frac{1}{4}CV_0^2$

D. Maximum energy stored in the inductor $\frac{1}{2}CV_0^2$

Answer: A::D

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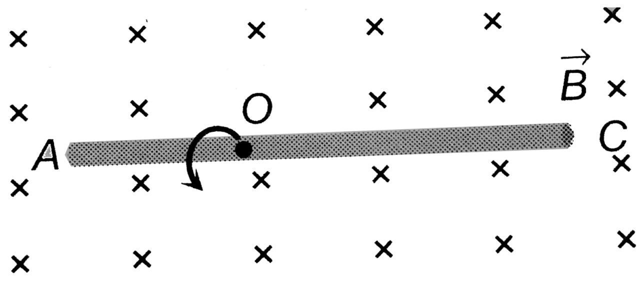
91. A conducting rod AC of length $4l$ is rotate about a point O in a uniform magnetic field $\vec{B}$ directed into the paper. $AO = l$ and $OC = 3l$. Then



A. $V_A - V_0 = \dfrac{B\omega l^2}{2}$

B. $V_0 - V_C = \dfrac{9}{2} B\omega l^2$

C. $V_A - V_C = 4B\omega l^2$

D. $V_C - V_0 = \dfrac{9}{2} B\omega l^2$

Answer: B::C

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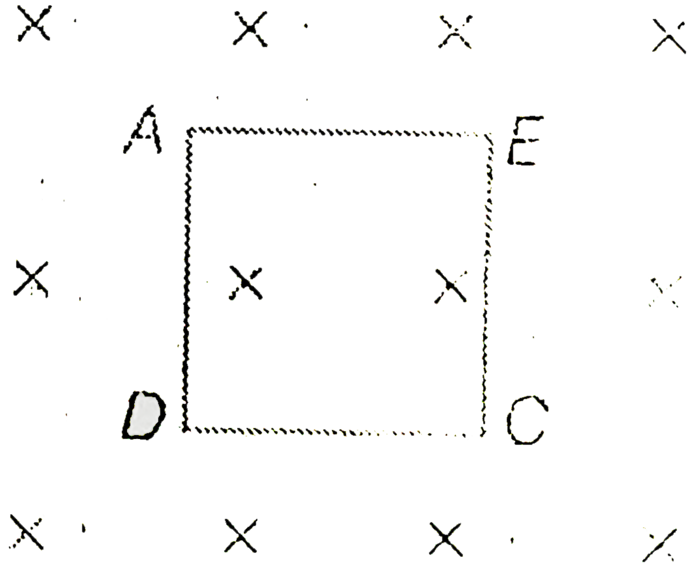
92. A square coil AECD of side 0.1m is placed in a magnetic field $B = 2t^2$. Here, t is in seconds and B is Tesla. The magnetic field is into the paper. At time t=2s, induced field in DC in



A. 0.05v/M

B. along DC

C. alond CD

D. 0.2V/m

Answer: B::D

Watch Video Solution

93. Which of the following statement(s) is/are correct regarding the electic field produced by the changing magnetic field?

A. It is conservative in nature

B. It is non conservative in nature

C. Potential can be defined corresponding to this field

D. The lines of this field are closed curves

Answer: B::D

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94. Magnetic flux passing through a coil varies with time as, $\phi = (2t^2 - 4)$ weber, Resistance of the coil is 10Ω.

A. At time t=2s, induced current in the coil is 0.8A

B. Induced current increases lineralu with time

C. From t=0 to t=2s,0.8C charge has flown in the coil

D. in the above time interval net flow of charge is zero

Answer: A::B::C

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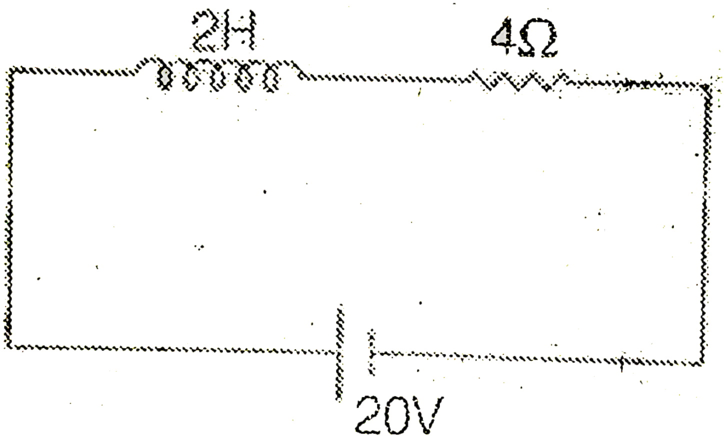
95. In the L-R circuit as shown in figure, potential difference across the resistance at some instant is 4 V. Then



A. current is increasing at a rate of 8A/s at this instant

B. power supplied by the battery at this instant is 20W

C. power stored in the magnetic field at this instant is 16W

D. current in the circuit at this instant is 1A

Answer: A::B::C::D

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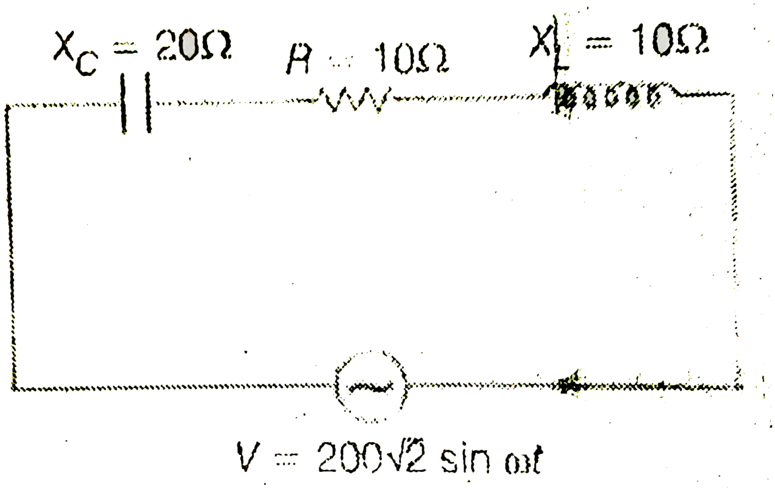
96. In LCR circuit as shown in figure



A. current will lead the voltage

B. rms value of current is 20A

C. power factor of circuit is $\dfrac{1}{\sqrt{2}}$

D. voltage drop across resistance is 100V

Answer: A::C

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97. In LCR circuit during resonance

A. power factor is zero

B. power factor is one

C. power developed acrtoss resistance is zero

D. power developed across capacitance is zero

Answer: B::D

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98. In an L-R circuit, if an iron core is inserted inside the coil

A. steady state current will increase

B. steady state current will remain unchanged

C. time constant will increase

D. time constant will increase

Answer: B::D

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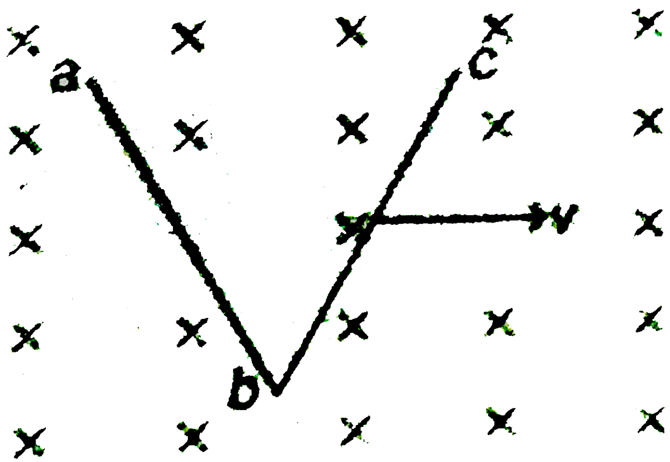
99. A V-shaped conducting wire is moved inside a magnetic field as shown in figure. Magnetic fiel d is perpendicular to paper inwards. Then



A. $V_a = V_c$

B. $V_a > V_c$

C. $V_a > V_b$

D. $V_c > V_b$

Answer: A::C::D

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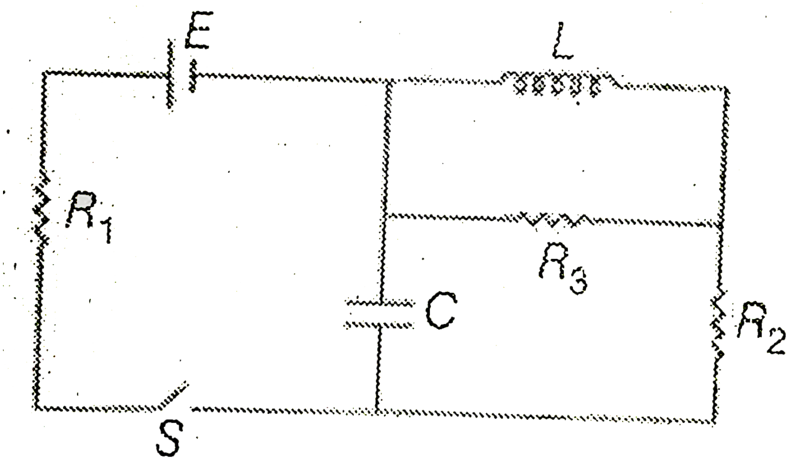
100. Current in R_3



A. just after closing the switch is zero

B. long after closing the switch is zero

C. just after closing the switch is $\frac{E}{R_3}$

D. long after clolsing the switch is $\frac{E}{R_3}$

Answer: A::B

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101. Current (i) passing through a coil varies with time t as $i = 2t^2$. At 1 s total flux passing through the coil is 10 Wb. Then

A. self inductance of the coil is 10H

B. self inductance of the coil is 5H

C. induced emf across the coil at 1second is 20V

D. induced emf across the coil at 1second is 10V

Answer: C::D

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102. A capacitor of capacity $2\mu F$ is charged to a potential difference of 12V. It is then connected across an inductor of inductance 0.2mH. At an instant when potential difference across the capacitor is 6v

A. current in the circuit is 1.04A

B. magnetic energy in the magnetic field is $108\mu J$

C. current in the circuit is 1.04A

D. angular frequency of the circuit is $5 \times 10^4 \frac{rad}{s}$

Answer: A::B::C::D

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103. Uniform magnetic field B=10T is acting in a region of length L=2m as shown. A squre loop of side $\frac{L}{2}$ enters in it with constant acceleration $\alpha = 1m/s^2$. Resistance per unit length of the square frame is `1Omega//m. At, t=1s

A. induced current in the square frame is clockwise

B. induced current in the frame is 2.5A

C. magnetic froce on the frame is 25N

D. magnetic torque on the frame is zero

Answer: B::C::D

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104. Self inductance of a soleniod can be increased by

A. increaing the current passing through the solenoid

B. decreasing the current passing through the solenoid

C. inserting an iron core in the solenoid

D. incresing number of turns per unit length

Answer: C::D

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105. Comparing the L-C oscillations with the oscillations of a spring-block system

A. L is equivalent to m

B. C is equivalent to K

C. current is equivalent to speed

D. rate of change of current is equivalent to accelerate

Answer: A::C::D

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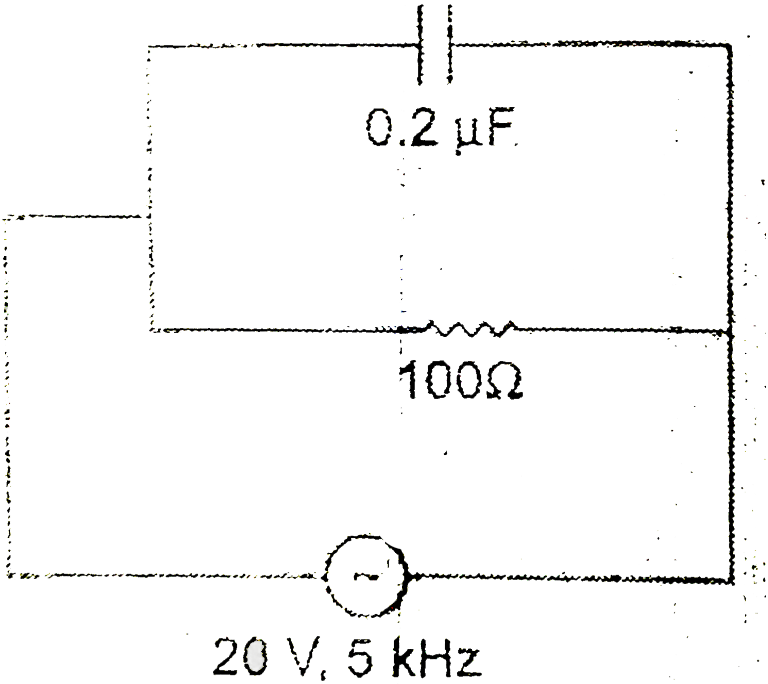
106. A signal geberatir supplies a sine wave if 20V, 5 to the circuit shown in the figure. Then.



A. the current in the resistive branch is 0.2A

B. the current in the capacitive branch is 0.126A

C. total line current is =0.24A

D. current in both the branches is same

Answer: A::B::C

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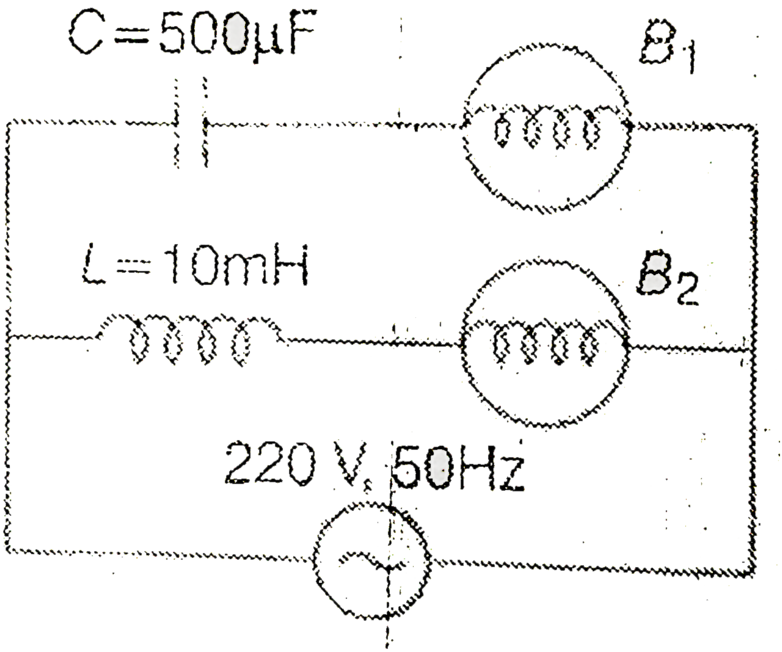
107. In the circuit shown in the figure, if both the bulbs B_1 and B_2 are identical



A. their brightness will be the same

B. B_2 will be greater than B_1

C. as frequency of supply volatage is increased brightness of bulb B_1 will increase and that of B decrease

D. Brightness of both bulbs is independent o frequency

Answer: B::C

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108. In a series LCR circuit with an AC so $(E_{rms} = 50V)$ and $f = 50/\pi$ Hz), R=30 C=0.02mF, L=1.0H, which of the follwing is correct

A. the rms current in the circuit is 0.1 A

B. the rms potential difference acrosss the capacitor is

50V

C. the rms potential difference acrosss the capacitor is

50V

D. the rms current in the circuit is 0.14A

Answer: A::B

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109. A circuit is set up by connecting L=100mH, C $= 5\mu F$ and R $= 100\Omega$ in series. An alternating emf of 150` sqrt(2)V,(500)/(pi) Hz is applied across this series combination. Which of the following is correct:

A. the impedence of the circuit is 1.41Ω

B. the average power dissipated across resistance is 225W

C. the average power dissipated across inuctor is zero

D. the average power dissipated across capacitor is zero

Answer: A::B::C::D

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110. A circuit containing an inductance and a resistance connected in series, has an AC source of 200V, 50Hz connected across it. An AC current of 10A rms flows through th ecircuit and the power loss is measured to be 1W.

A. The inductance of the circuit is $\frac{\sqrt{3}}{10\pi}H$

B. The frequency of the AC when the phase difference between the current and emf becomes $\frac{\pi}{4}$, with the above components is $\frac{50}{\sqrt{3}}Hz$

C. The frequency of the AC when the phase difference between the current and emf becomes $\pi/3$, with the above components is $\frac{25}{\sqrt{3}}Hz$

D. The frequency of the AC when the phase difference between the current and emf becomes $\pi/4$, with the above components is $\frac{25}{\sqrt{3}}Hz$.

Answer: A::B

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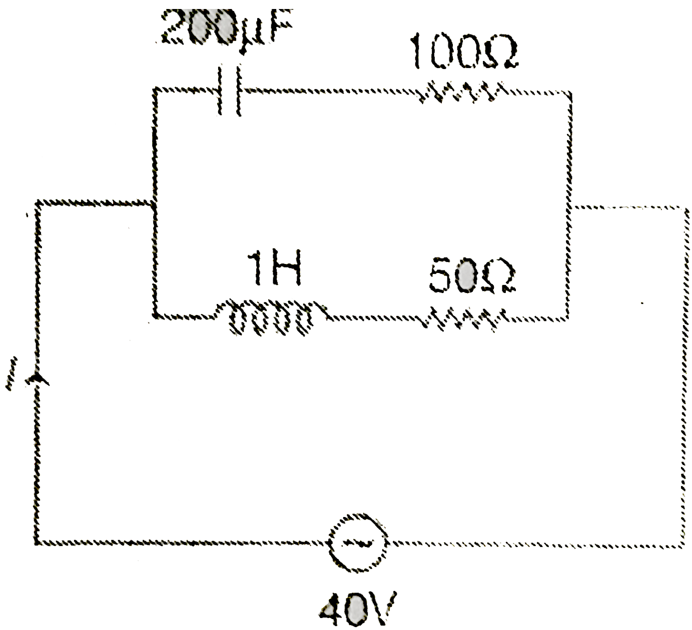
111. In the given circuit, then AC source has $\omega = 50 rad/s$ Considering the indcutor and capacitor and capacitor to be ideal, the correct choice(s) is (are):



A. The voltage across 100Ω resistor $20\sqrt{2}V$

B. The voltage across 50Ω resistor $20\sqrt{2}V$

C. The current through the circuit, I is $\frac{2}{\sqrt{10}}A$

D. The current through the circuit, I is 1.2A

Answer: A::B::C

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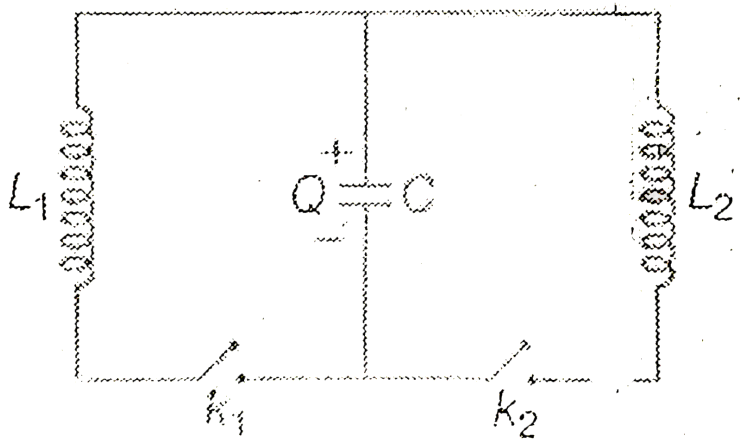
112. The given arrangement carries a capacitor with capacitance 40mF and two inductors $L_1 = 25H$ and $L_2 = 100H$. If the capacitor initially carries a charge of 10mC, then



A. the maximum current through the inductor L_1 when

key K_1 is closed is 20mA

B. the maximum current through the inductor L_2 when

key K_2 is closed is 5mA

C. the maximum current through the inductor L_2 when

both the keys are closed is $\sqrt{5}A$

D.

Answer: B::C::D

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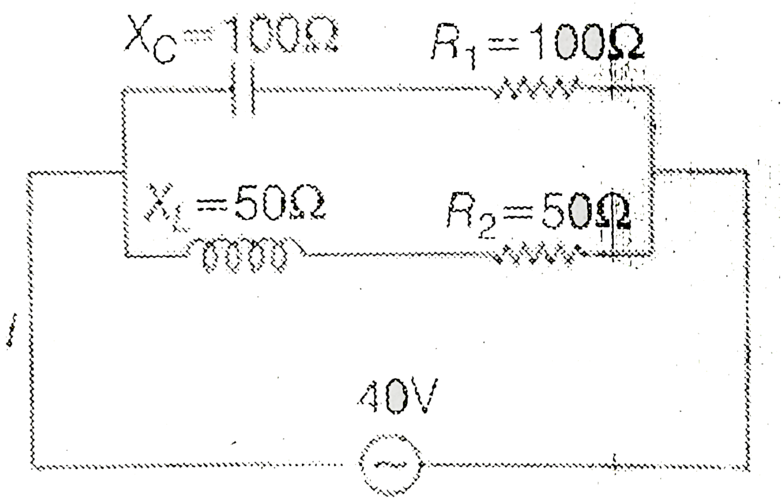
113. In the given circuit, the AC source has $\omega = 50 rad/s$. Considering the inductor and capacitor to be ideal, the correct choice (s) is (are):



A. The voltage across 100Ω resistor $20\sqrt{2}V$

B. The voltage across 50Ω resistor $20\sqrt{2}V$

C. The curren through the circuit, $\frac{2}{\sqrt{10}}A$

D. The current through the circuit, I is 1.2A

Answer: A::B::C

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114. A series RLC circuit is driven by a generator at frequency 1000Hz. The inductance is 90.0 mH, capacitance is $0.5\mu F$ and the phase constant has magnitude of 60° $(Take\pi^2 = 10)$

A. Here current leads the voltage in phase

B. Here voltage leads the current in phase

C. Resistance of circuit is $\frac{80\pi}{\sqrt{3}}\Omega$

D. At resonance $\frac{\sqrt{2}}{3} \times 10^4 rad / \sec$

Answer: B::C::D

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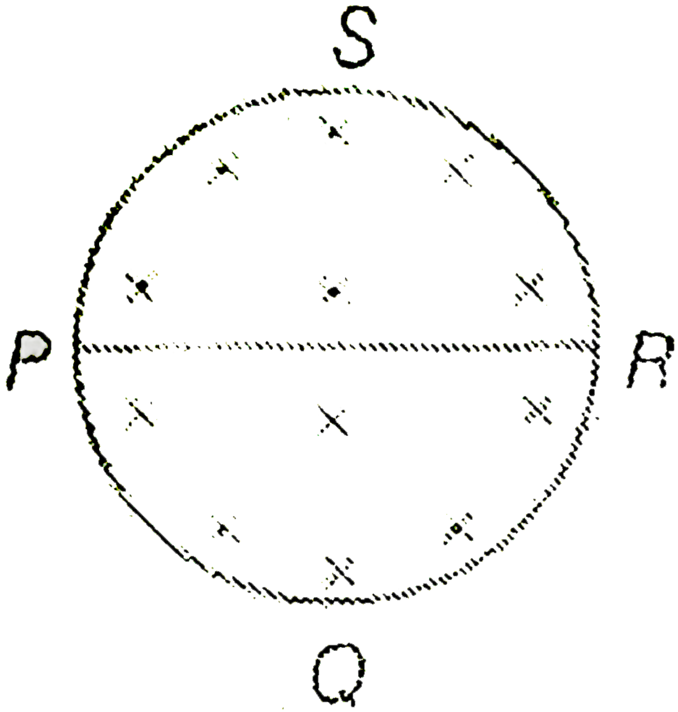
115. The radius of circular loop is 'a'. Magnetic field is incerasing at a constant rate a. Magnetic field of a confined with the axis of the loop. Resistance per unit length of the wire of loop is ρ. Choose the correct option(s):



A. Current in the loop PQRS $\frac{a\alpha}{2\rho}$ anticlockwise

B. Current in the loop PQRS is $\frac{a\alpha}{ho}$ clockwise

C. Current in the wire PR is zero

D. Current in the wire PR is $\frac{\pi a\alpha}{2\rho}$

Answer: A::C

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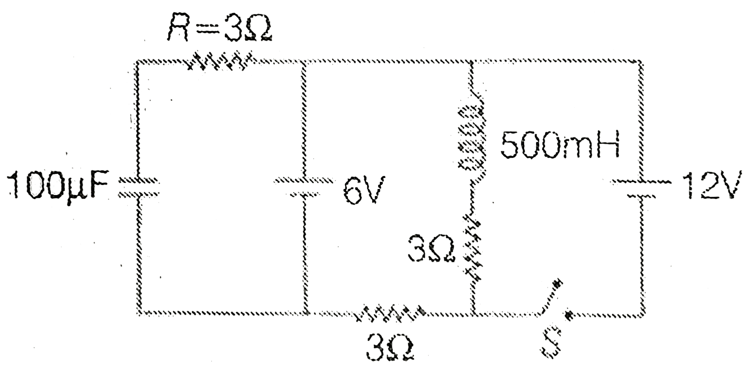
116. In the circuit diagram shown in figure, initially switch S is opened and the circuit is in steady state. At time t=0, the switch S is closed and the new steady state is reached after some time. Choose the correct option(s)



A. Current in the indcutor when the circuit reaches the new steady state is 4A.

B. The net change in the magnitic flux is the inductor is 1.5Wb

C. The net change in the magnetic flux in the conductor is 9volt when the circuit reaches the new steady state.

D. The charge stored in the capacitor in the new steady state is 1.2mC

Answer: A::B

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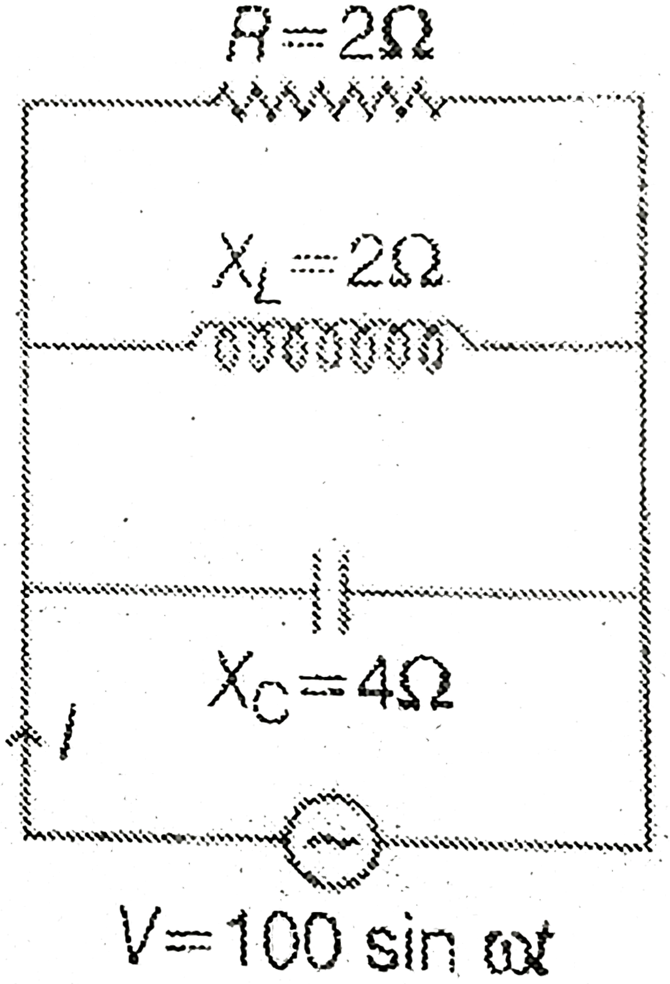
117. Resistor, inductor and capacitor are connected in parallel to an AC source of emf $V = 100 \sin \omega t$ If

$R = 2\Omega$, $X_L = 2\Omega$ and $X_C = 4\Omega$, , then choose correct option:



A. rms current through the source will be 50A

B. power factor of the circuit is $\frac{2}{\sqrt{5}}$)

C. Voltage of source will lead the current through source by $\tan^{-1}\left(\frac{1}{2}\right)$

D. Impendance of parallel combination is $\frac{4}{\sqrt{5}}\Omega$

Answer: B::C::D

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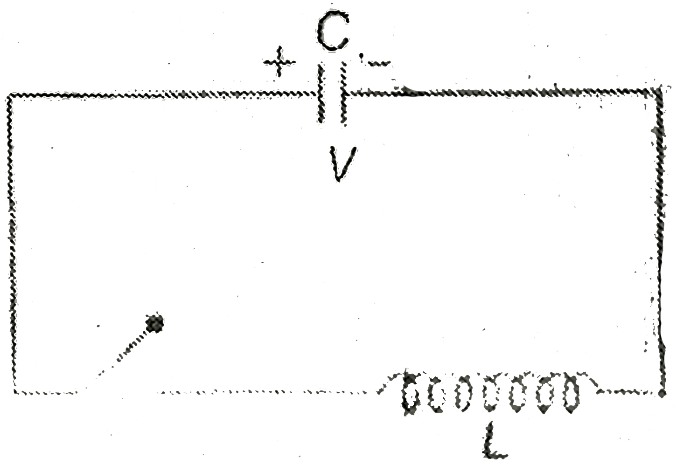
118. A capacitor of capacitnace C is charged to a potential difference V and then disconnected from the battery. Now it is connected to an inductor of inductance L at t=0. Then



A. Energy stored in capacitor and inductor will be equal

at time $t = \frac{\pi}{2}\sqrt{LC}$

B. Potential difference across inductor will be $\frac{V}{2}$ at

time $t = \frac{\pi}{3}\sqrt{LC}$

C. The rate of increase of energy in magnetic field will

be maximum at $\frac{\pi}{4}\sqrt{LC}$

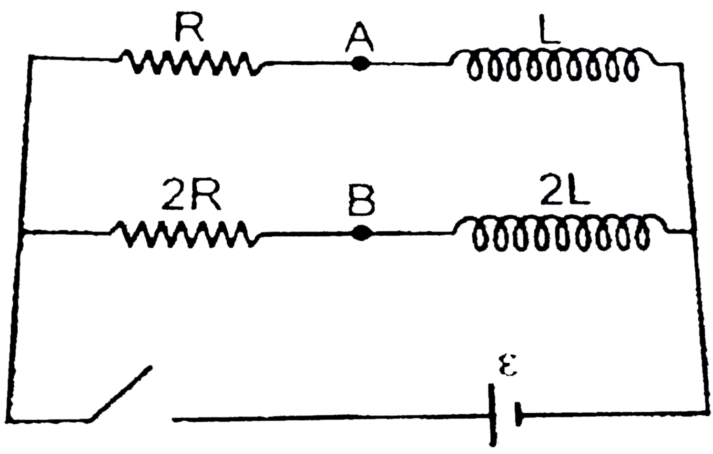
D. When the potentail difference across the capacitor

$$\sqrt{\left(\frac{3C}{L}\right)}$$

Answer: B::C::D

View Text Solution

119.



In given LR circuit the switch S is closed at time $t = 0$ then

A. The ratio of induced emfs in the inductors of inductances L and 2L will be correct

B. The ratio of indued emfs in the inductor of inductances L and 2L will decrease with time

C. The potential difference $V_A - V_B$ increase with time

D. The potential difference $V_A - V_B$ will be constant

Answer: A::D

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120. A capacitor in an LC oscillation has a maximum potential difference of 1.5 and a maximum energy $360 \mu J$.

At a certain instant $t = t_0$, the potential difference across the capacitor is V volt?

A. The value of capacitance is

B. The value of capacitance is

C. The value of V is 5 volt

D. The value of V is 10volt

Answer: B::C

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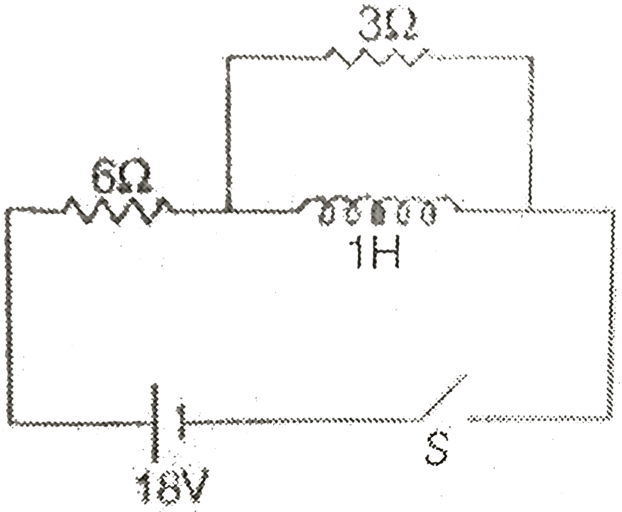
121. In the circuit shown in figure switch S is closed at time t=0



Current I from the battery at time t is given by

A. $3\left(1-e^{-2t}\right)$

B. $3+e^{-2t}\big)$

C. `3(1-e^(-t/9))

D. $3-e^{-2t}$

Answer: D

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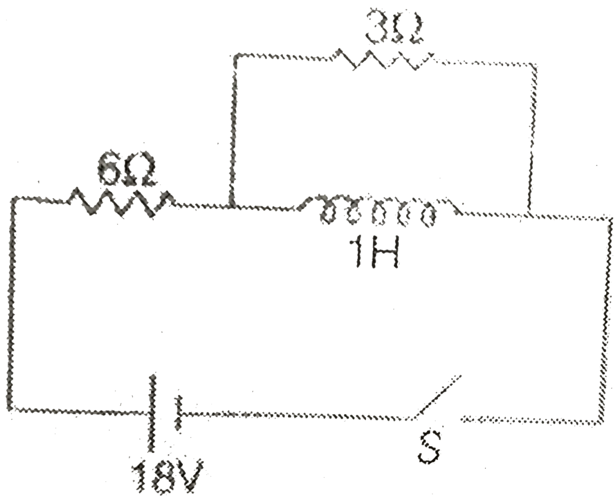
122. In the circuit shown in figure switch S is closed at time t=0



Potential difference across 3Ω resistance at time t is given by

A. $9e^{-21}$

B. $6e^{-2t}$

C. $3e^{-2t}$

D. $18\left(1-e^{-t/9}\right)$

Answer: B

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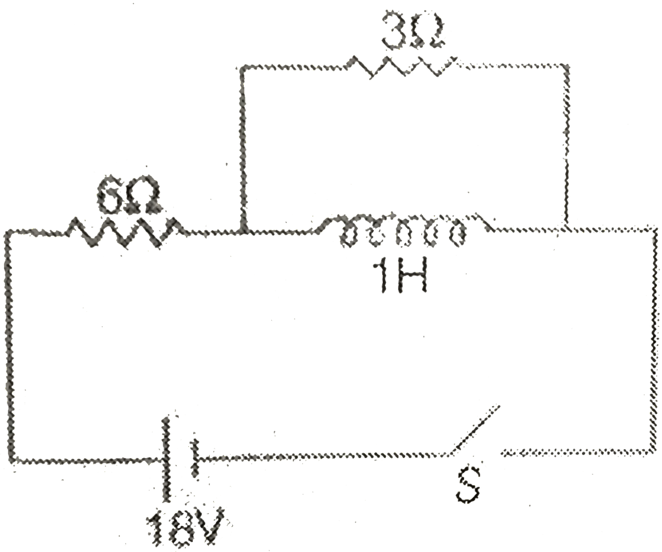
123. In the circuit shown in figure switch S is closed at time

t=0



At what time current through 3Ω resistance and 1H inductor are equal?

A. $In\sqrt{\frac{5}{3}}$

B. $In\left(\frac{8}{3}\right)$

C. $In\left(\frac{5}{3}\right)$

D. $In\sqrt{\frac{8}{3}}$

Answer: A

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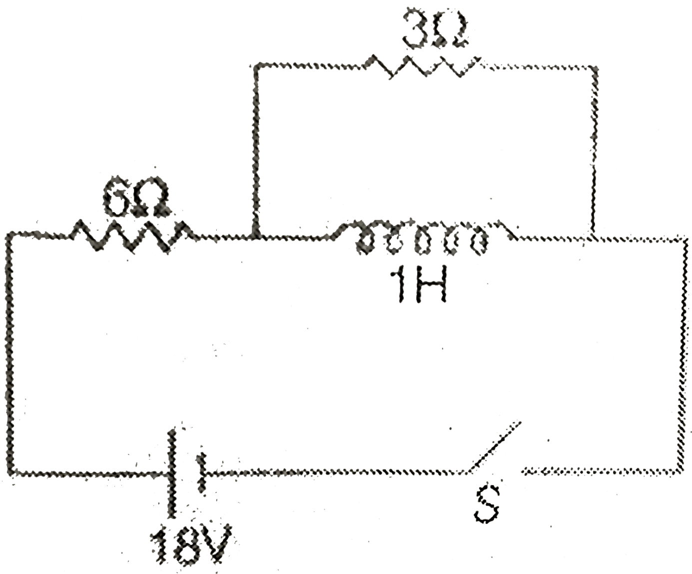
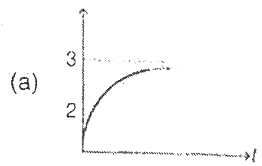
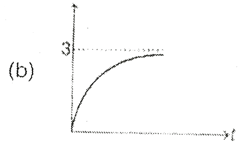
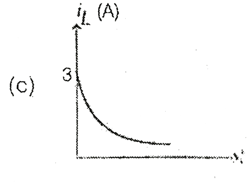
124. In the circuit shown in figure switch S is closed at time t=0

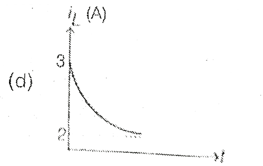


Takin left to right current through the indcutor as apositive current, current through inductor varies with time as

A.


B.


C. 

D. 

Answer: B

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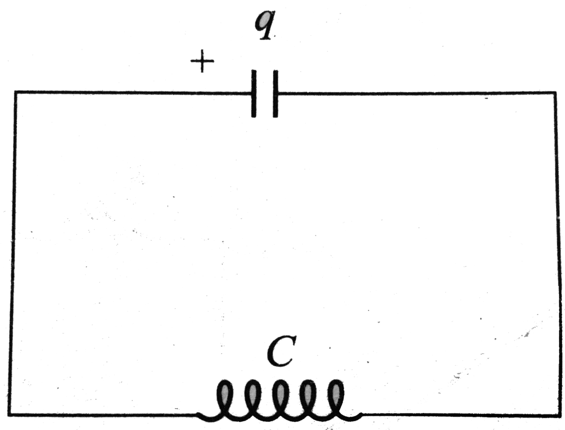
125. In an LC circuit shows in Fig. $C = 1F$, $L = 4H$. At time $t = 0$, charge in the capacitor is $4C$ and it is decreasing at the rate of $\sqrt{5}Cs^{-1}$. Choose the corrent statement.



A. 6 C

B. 8 C

C. 10 C

D. 12 C

Answer: A

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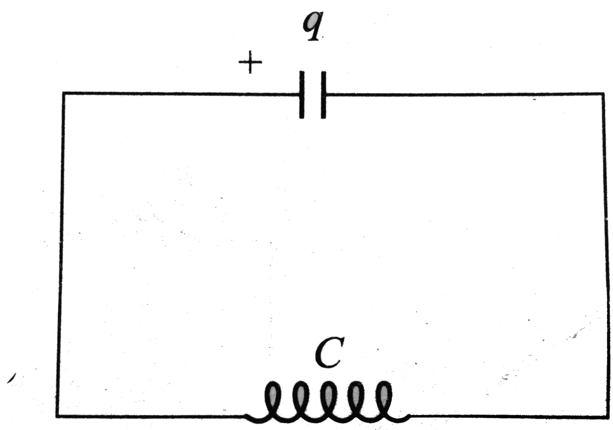
126. In an LC circuit shows in Fig. $C = 1F$, $L = 4H$. At time $t = 0$, charge in the capacitor is $4C$ and it is decreasing at the rate of $\sqrt{5}Cs^{-1}$. Choose the corrent statement.



A. $2\sin^{-1}\left(\frac{2}{3}\right)$

B. $2\cos^{-1}\left(\frac{2}{3}\right)$

C. `2tan^(-1)((2)/(3))

D. None of these

Answer: D

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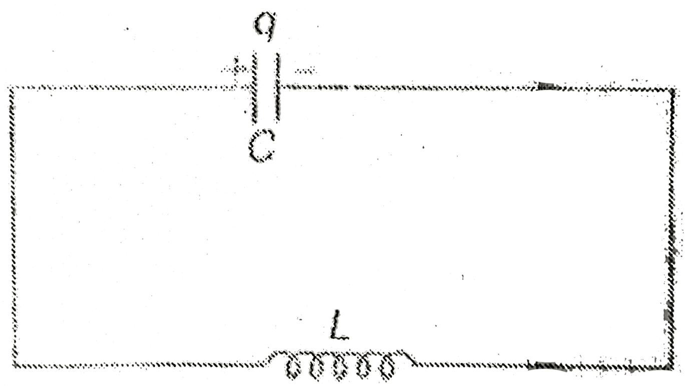
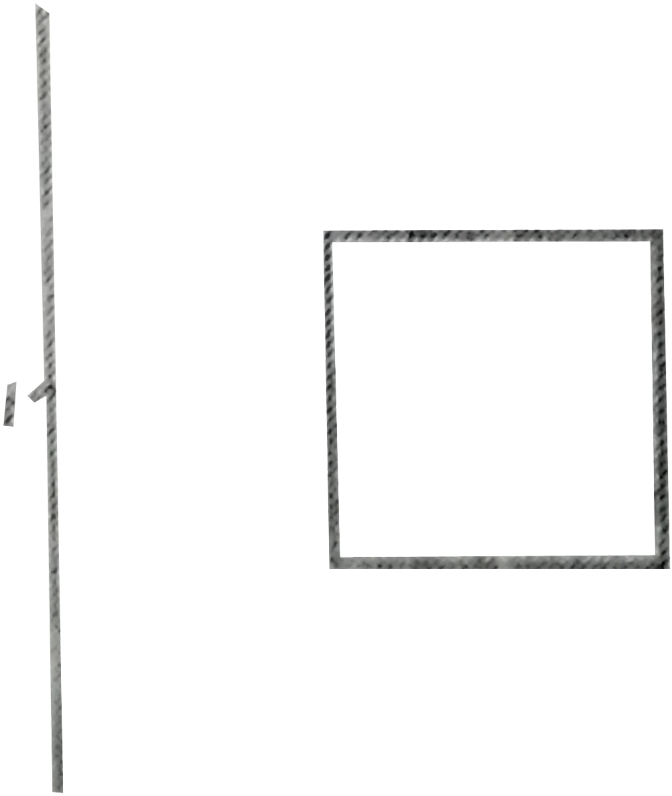
127. In an L-C circuit shown in figure

C=1F, L=4H

At time t=0, charge in the capacitor is 4C and it is decreasing at a rate of $\sqrt{5}C/s$



Choose the correct option



A. maximum current in the circuit is 4A

B. When current is half its maximum value, charge in capacitor is less than is maximum value

C. Both a and b are correct

D. Both a and b are wrong

Answer: B

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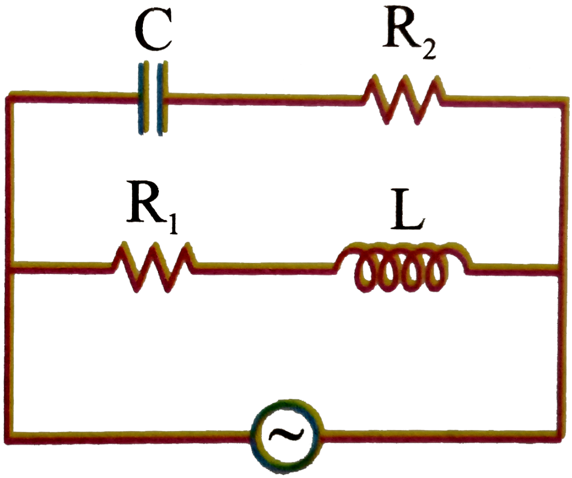
128. In the circuit shown in figure :

$R = 10\Omega, L = \dfrac{\sqrt{3}}{10}H, R_2 = 20\Omega$ and $C = \dfrac{\sqrt{3}}{2}mF.$

Current in $L - R_1$ circuit is I_1 in $C - R_1$ circuit is I_2 and the main current is I



$V = 200\sqrt{2}\sin(100t)V$

Phase difference between I_1 and I_2 is

A. 0°

B. 90°

C. 180°

D. 60°

Answer: B

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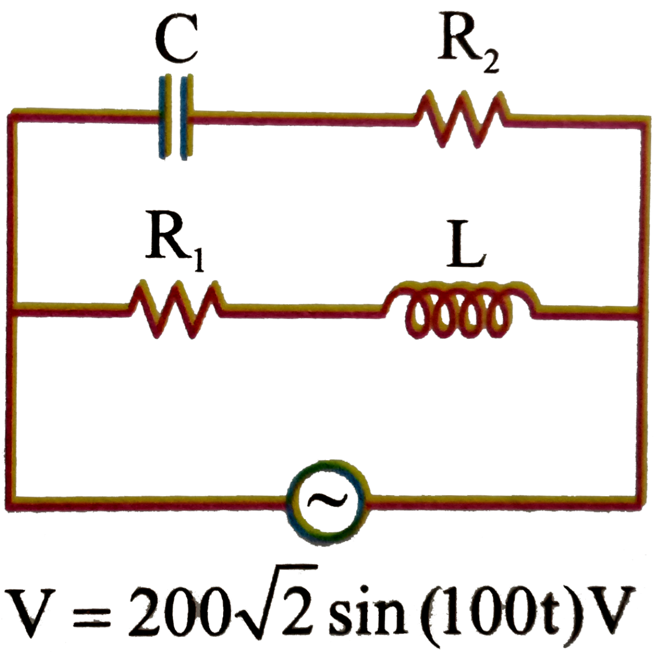
129. In the circuit shown in figure :

$R = 10\Omega, L = \frac{\sqrt{3}}{10} H, R_2 = 20\Omega$ and $C = \frac{\sqrt{3}}{2} mF.$

Current in $L - R_1$ circuit is I_1 in $C - R_1$ circuit is I_2 and the main current is I



At some instant current in $L - R_1$ circuit is $10A$. At the same instant current in $C - R_2$ branch will be

A. $5A$

B. $5\sqrt{2}A$

C. $5\sqrt{6}A$

D. $5\sqrt{3}A$

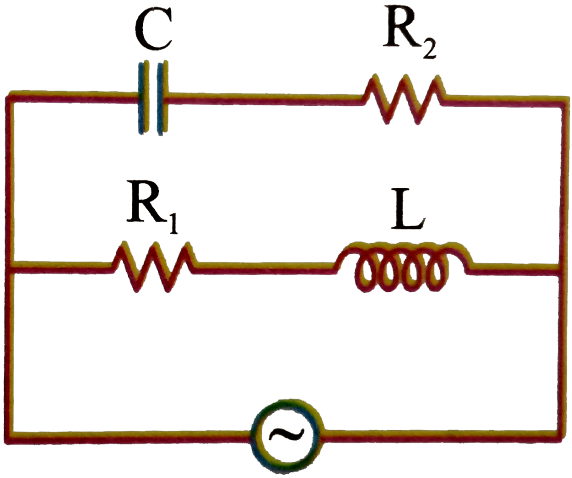
Answer: D

Watch Video Solution

130. In the circuit shown in figure :

$R = 10\Omega, L = \dfrac{\sqrt{3}}{10}H, R_2 = 20\Omega$ and $C = \dfrac{\sqrt{3}}{2}mF.$

Current in $L - R_1$ circuit is I_1 in $C - R_1$ circuit is I_2 and the main current is I



$$V = 200\sqrt{2}\sin(100t)V$$

Phase difference between I_1 and I_2 is

A. $20A$

B. $10\sqrt{2}A$

C. $20\sqrt{2}A$

D. $25A$

Answer: B

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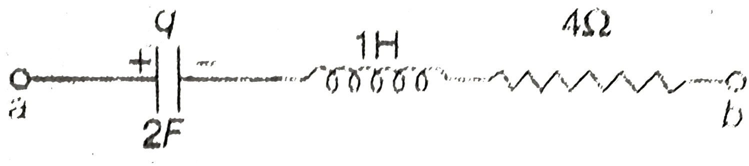
131. In the circuit shown in figure q varies with time t as $q = (t^2 = 16)$. Here q is in coulomb and t in second.



Find $V_{ab} = (V_a - V_b) att = 3s$

A. $-24.5V$

B. $18.5V$

C. $-25.5V$

D. $22.5V$

Answer: D

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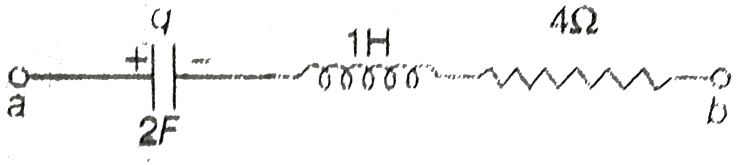
132. In the circuit shown in figure q varies with time t as $q = (t^2 = 16)$. Here q is in coulomb and t in second.



Find $V_{ab} \mathrm{at} t = 5s$

A. 50 V

B. 35.5 V

C. 46.5 V

D. 40.2 V

Answer: C

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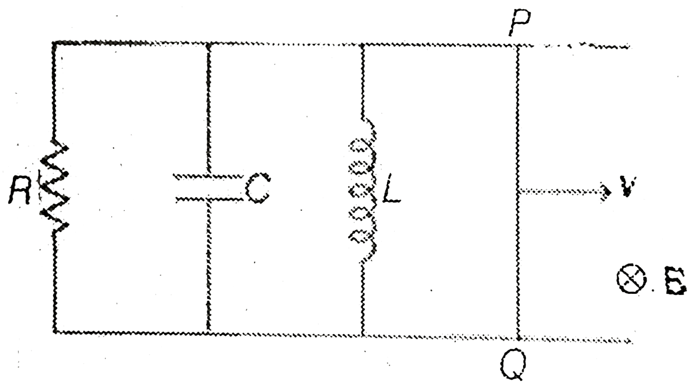
133. In the figure shown, a conducting wire PQ of length l=1m, is moved in a uniform magnetic field B=4T with constant velocity v=2m/s towards right. Given $R = 2\Omega$, $C = 1F$ and $L = 4H$.



Currents through resistor, capacitor and inductor at any time t are l_1, I_2 and I_3 respectively. Current through wire PQ is I.

At l=2s, the value of I_3 is

A. 0

B. $2A$

C. $4A$

D. $6A$

Answer: C

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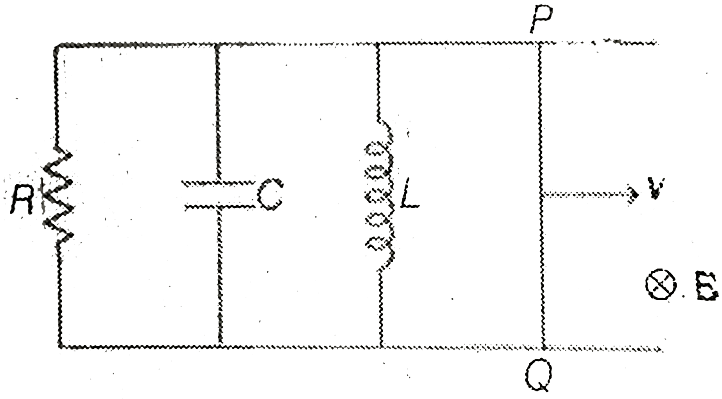
134. In the figure shown, a conducting wire PQ of length l=1m, is moved in a uniform magnetic field B=4T with constant velocity v=2m/s towards right. Given $R = 2\Omega, C = 1F$ and $L = 4H$.



Currents through resistor, capacitor and inductor at any time t are l_1, I_2 and I_3 respectively. Current through wire PQ is I.

Find the force required to move the wire with the given constant velocity of 2m/s at t=2s

A. $8N$

B. $16N$

C. $24N$

D. $32N$

Answer: D

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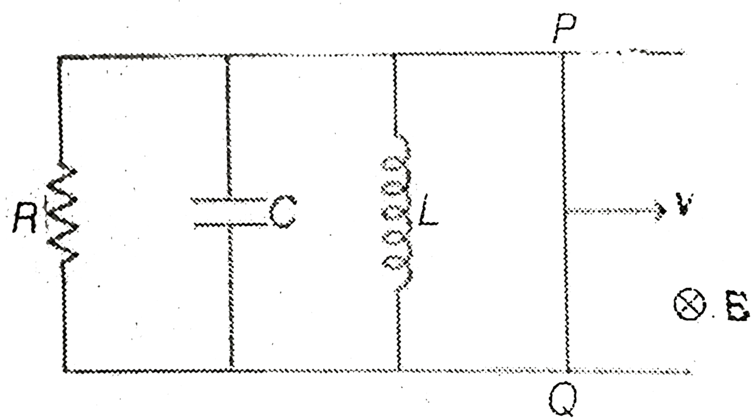
135. In the figure shown, a conducting wire PQ of length l=1m, is moved in a uniform magnetic field B=4T with constant velocity v=2m/s towards right. Given $R = 2\Omega, C = 1F$ and $L = 4H$.



Currents through resistor, capacitor and inductor at any time t are l_1, I_2 and I_3 respectively. Current through wire

PQ is I.

At t=2s, suppose P is the initial power generated by the applied force. P_1 the power generated by the applied for, P_1 the power stored in magnetic field of inductor and P_2 the power dissipated in resistance. The

A. $P = 72J/s$

B. $P_1 = 40J/s$

C. $P_2 = 32J/s$

D. None of these

Answer: C

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136. The current in ampere through an inductor is

$i(10+20t)$

Here t is in second. The induced emf in the inductor 4V.

The self inductance of the indicator is, L.....H,

A. 0.2

B. 0.4

C. 0.1

D. 1.0

Answer: A

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137. The current in ampere through an inductor is

$i(10+20t)$

Here t is in second. The induced emf in the inductor 4V.

Total flux linked with the inductor at t= 2 is

A. 10 Wb

B. 20 Wb

C. 30 Wb

D. 40 Wb

Answer: A

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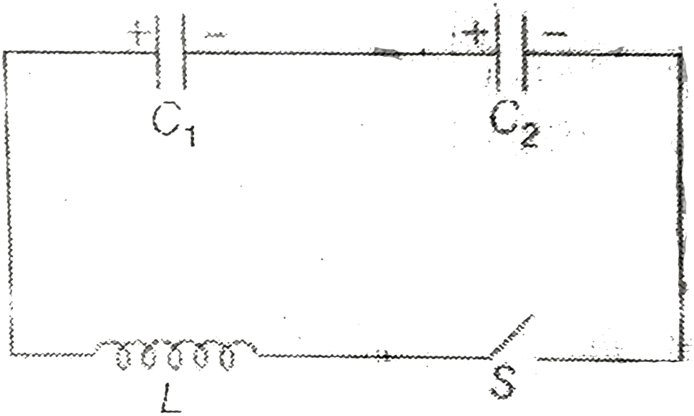
138. In the figure shown $C_1 = 1F, C_2 = 2F$ and $L = 5H$. Initially C_1 is charged 50V and C_2 to 10V. Switch S is closed at time t=D. Suppose at some instant charge on C_1 is 20C with the same polarties as shown in the figure



Energy stored in capacitor C_2 at this instant will

A. 10 J

B. 15 J

C. 25 J

D. 40 J

Answer: C

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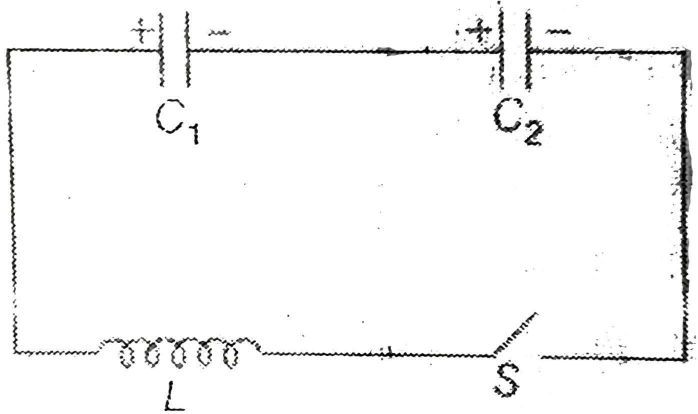
139. In the figure shown $C_1 = 1F, C_2 = 2F$ and $L = 5H$. Initially C_1 is charged 50V and C_2 to 10V. Switch S is closed at time t=D. Suppose at some instant charge on C_1 is 20C with the same polarties as shown in the figure



`Current in the circuit at this instant will be

A. $10\sqrt{2}A$

B. $15\sqrt{2}A$

C. $10A$

D. $20A$

Answer: B

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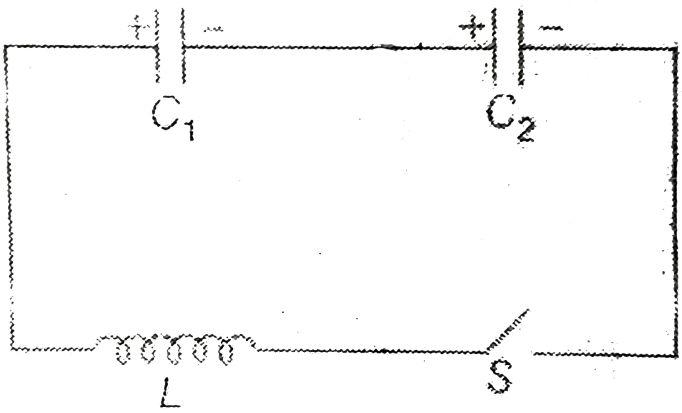
140. In the figure shown $C_1 = 1F, C_2 = 2F$ and $L = 5H$. Initially C_1 is charged 50V and C_2 to 10V. Switch S is closed at time t=D. Suppose at some instant charge on C_1 is 10C with the same polarties as shown in the figure



Maximum current in the circuit will be

A. $4\sqrt{30}A$

B. $16\sqrt{2}A$

C. $20\sqrt{3}A$

D. $12\sqrt{6}A$

Answer: A

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141. In an L-C -R series circuit connected to an AC source

$V = V_0 \sin\left(100\pi(t) + \frac{\pi}{6}\right)$

$V_R = 40V, V_L = 40$ and $V_C = 10V$, resistance $R = 4\Omega$

Choose the correct option

A. $10\sqrt{2}A$

B. $15\sqrt{2}A$

C. $20\sqrt{2}A$

D. $25\sqrt{2}A$

Answer: A

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142. In an L-C -R search circuit connected to an AC source

$V = V_0 \sin\left(100\pi + \frac{\pi}{6}\right)$

$V_R = 40V, V_L = 40$ and $V_C = 10V$, resistance $R = 4\Omega$

Choose the correct option

A. $L = \frac{1}{25\pi}H$

B. $C = \frac{1}{50\pi}$

C. both (a) and (b) are correct

D. Both a and b are wrong

Answer: A

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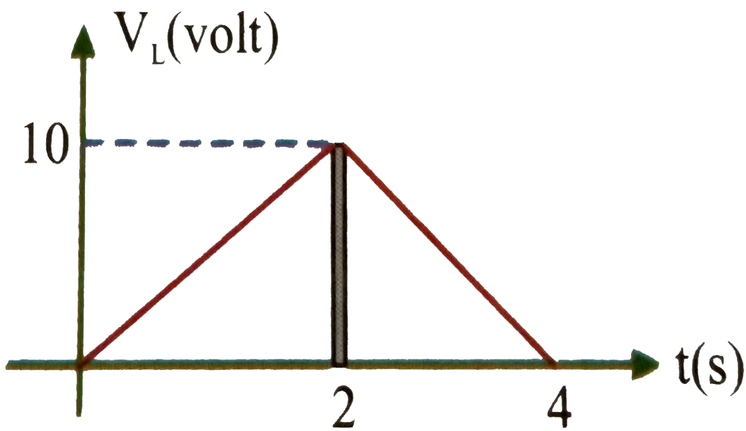
143. The potential difference across a $2H$ inductor as a function of time is shown in figure. At time $t = 0$, current is zero

Current $t = 2$ second is



A. $1A$

B. $3A$

C. $4A$

D. $5A$

Answer: D

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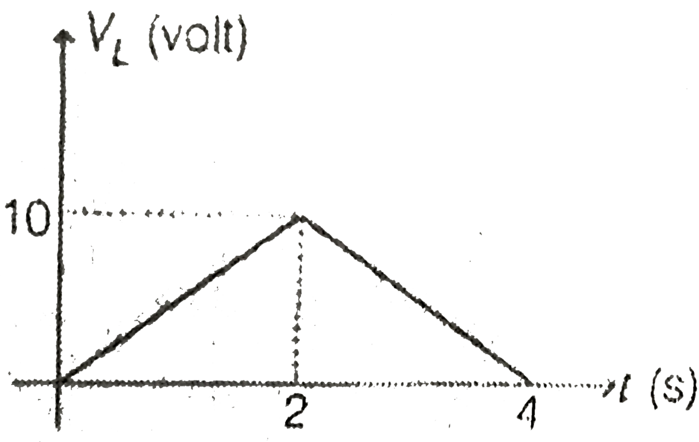
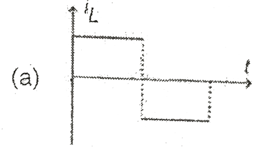
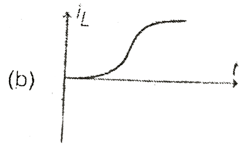
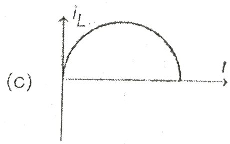
144. The potentiak difference across a 2H inductor as a function of time is shown in the figure. At time t=0, current is zero.

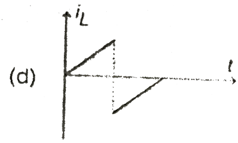


Current versus time graph across the inductor will be

A. 

B. 

C. 

D. 

Answer: B

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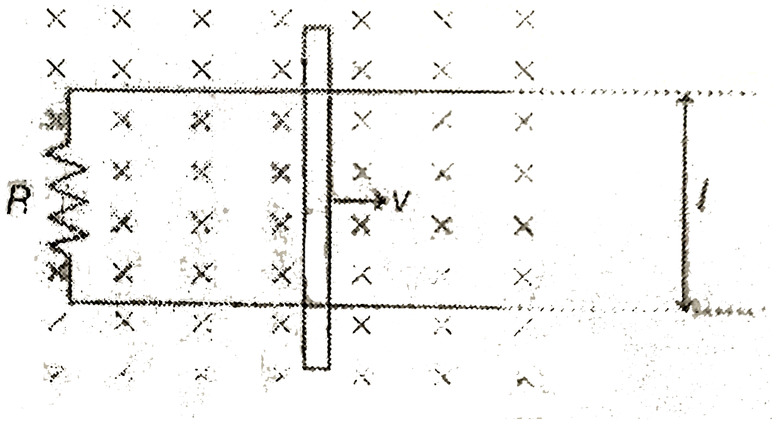
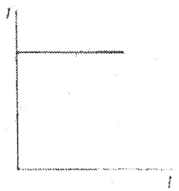
145. A conducting bar is slid at a constant velocity v along two conducting rods. The rods ar seprated by a distance l and connected across a resistor R. The entire apparatus is placed in an external magnetic field B directed into the page

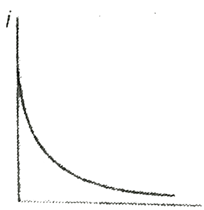


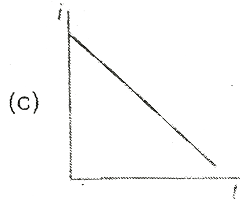
Which of the following represents the current i generated by the apparantus?

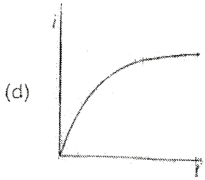
A. (a)



B. (b)



C. 

D. 

Answer: A

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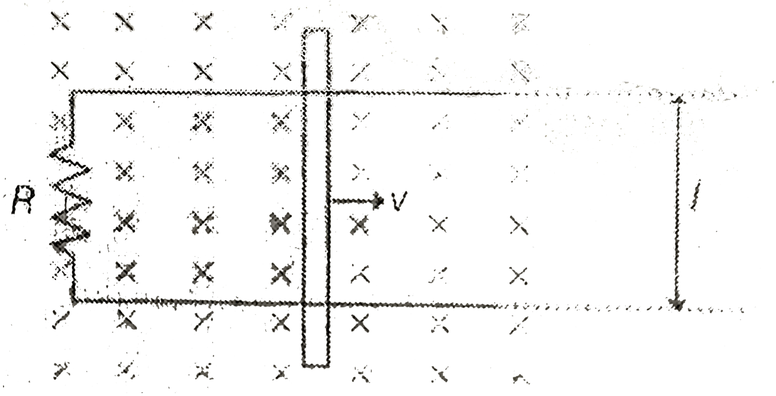
146. A conducting bar is slid at a constant velocity v along two conducting rods. The rods ar seprated by a distance l and connected across a resistor R. The entire apparatus is placed in an external magnetic field B directed into the page



An increase in which of the following would NOT increase the current generated by the apparatus?

A. v

B. l

C. R

D. B

Answer: C

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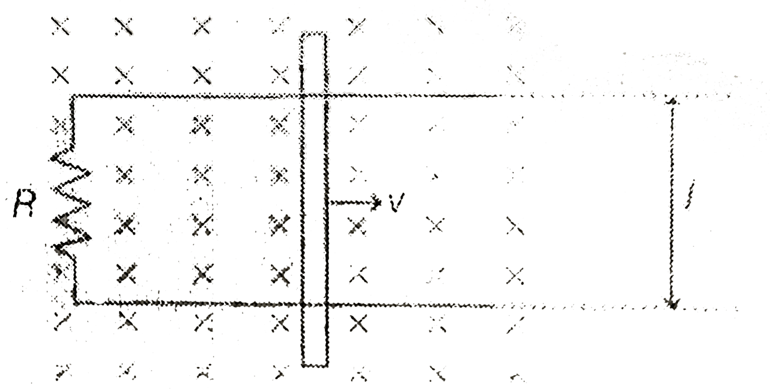
147. A conducting bar is slid at a constant velocity v along two conducting rods. The rods ar seprated by a distance l and connected across a resistor R. The entire apparatus is placed in an external magnetic field B directed into the page



The induced current in the above circuit is:

A. sinusoidal

B. clockwise

C. counterclockwise

D. there is not enough information to determine the direction and nature of the current

Answer: C

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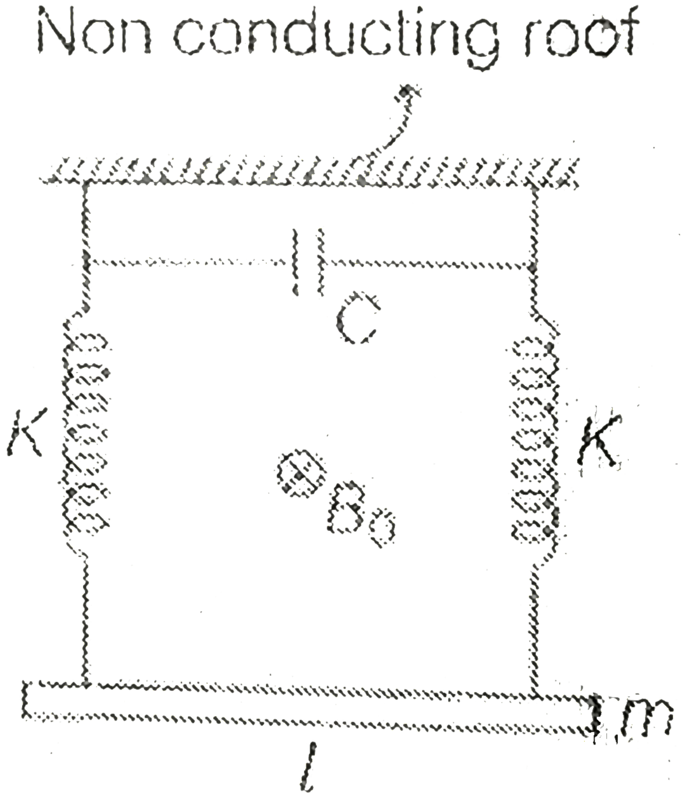
148. In the figure shown a uniform conducing rod of mass m and length l is suspended invertical plane by two conducing springs of spring constant k each. Upper end of springs are connected to each other by a capacitor of capacitance C. A uniform horizontal magnetic field (B_0) perpendicular to plane of springs in space initially rod is in equillibrium. If the rod is pulled down and released, it performs SHM. (Assume resistance of springs and rod are negligible)



Find the period of oscillation of rod.

A. $2\pi\sqrt{\frac{m}{K}}$

B. $2\pi\sqrt{\frac{B_0^2 l^2 C}{K}}$

C. $2\pi\sqrt{\frac{m + B_0^2 l^2 C}{K}}$

D. None of these

Answer: D

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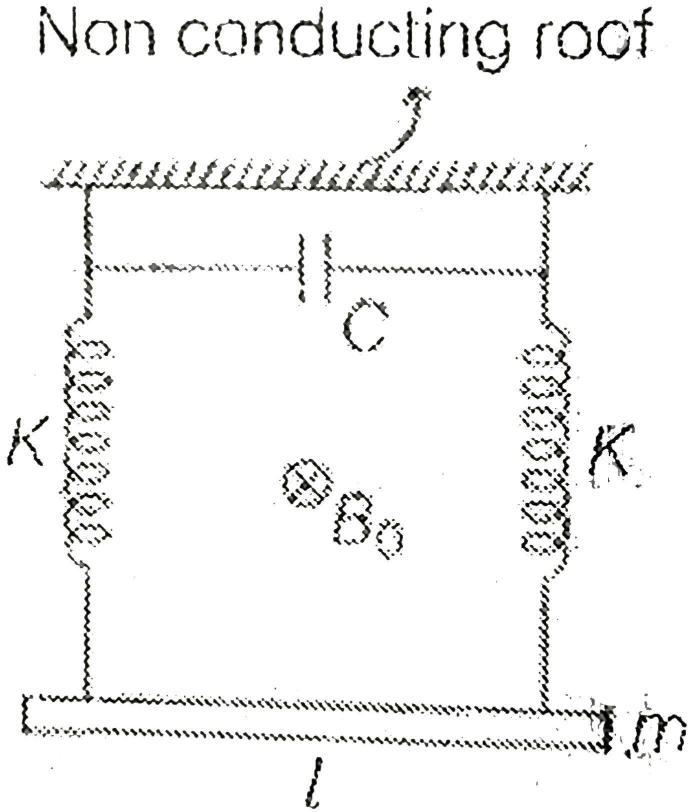
149. In the figure shown a uniform conducing rod of mass m and length l is suspended invertical plane by two conducing springs of spring constant k each. Upper end of springs are connected to each other by a capacitor of capacitance C. A uniform horizontal magnetic field (B_0) perpendicular to plane of springs in space initially rod is in equillibrium. If the rod is pulled down and released, it performs SHM. (Assume resistance of springs and rod are negligible)



Choose the correct options from the followng:

A. Electrical energy stored in capacitor is maximum

B. Electrical energy stored in capacitor is maximum when rod is at its mean position

C. Current in rod in maximum at mean position of rod

D. None of the above

Answer: B

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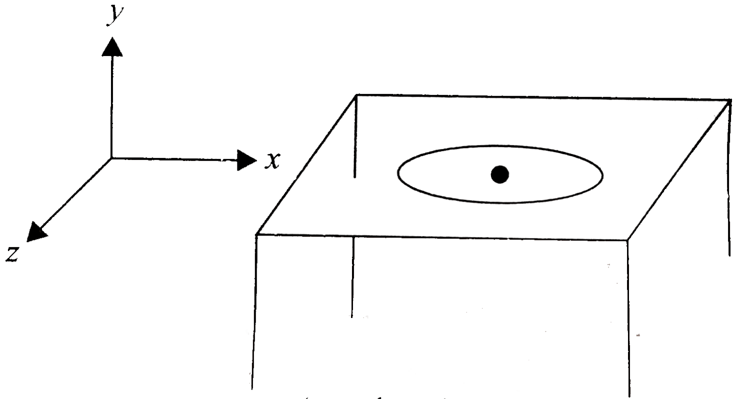
150. A uniform conducting ring of mass π kg and radius 1 m is kept on smooth horizontal table. A uniform but time varying magnetic field $B = \left(\hat{i} + t^2\hat{j}\right)T$ is present in the region, where t is time in seconds. Resistance of ring is $2(\Omega)$. Then



(x-z plane is horizontal plane)

Time (in second) at which ring start toppling is

A. $\frac{10}{\pi}s$

B. $\frac{20}{\pi}s$

C. $\frac{5}{\pi}s$

D. $\frac{25}{\pi}s$

Answer: A

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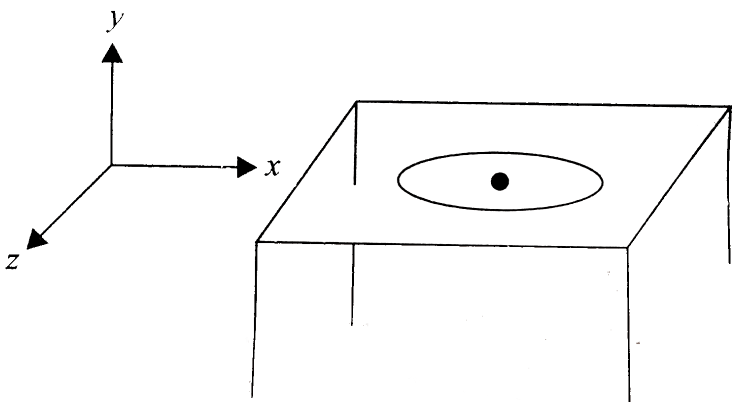
151. A uniform conducting ring of mass π kg and radius 1 m is kept on smooth horizontal table. A uniform but time varying magnetic field $B = \left(\hat{i} + t^2\hat{j}\right)T$ is present in the region, where t is time in seconds. Resistance of ring is $2(\Omega)$. Then



(x-z plane is horizontal plane)

Heat generated (in kJ) through the ring till the instant when ring start toppling is

A. $\dfrac{1}{3\pi} kJ$

B. $\dfrac{2}{\pi} kJ$

C. $\frac{2}{3\pi}kJ$

D. $\frac{1}{\pi}kJ$

Answer: C

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152. Comparing L-C oscillation with the oscillation if spring-block-system, match the following table.

Comparing L-C oscillations with the oscillations of spring-block sytem, match the following table

Table-1 (LC oscillations)		Table-2 (Spring-block oscillations)	
(A)	L	(P)	k
(B)	C	(Q)	m
(C)	i	(R)	v
(D)	$\frac{di}{dt}$	(S)	x
		(T)	None

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153. During current growth in L-R circuit, match the following table,

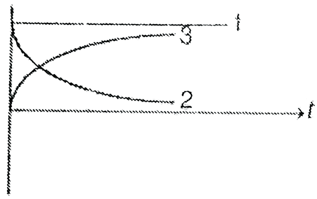

Table-1	Table-2
(A) V_L	(P) Graph-1
(B) V_R	(Q) Graph-2
(C) Net emf of the circuit	(R) Graph-3
(D) Current in the circuit	(S) None

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154. Match the following

	Table-1		Table-2
(A)	L	(P)	$[M^0L^0T^{-2}]$
(B)	Magnetic Flux	(Q)	$[ML^2T^{-2}A^{-1}]$
(C)	LC	(R)	$[ML^2T^{-2}A^{-2}]$
(D)	CR^2	(S)	None

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155. In the circuit diagram shown in Figure E=18V , L=2H, $R_1 = 3\Omega$, $R_2 = 6\Omega$. Switch S is closed at t=0 Match the following:

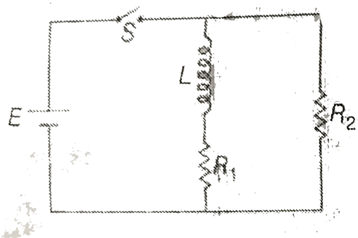

Table-1	Table-2
(A) Current through R_1 at $t=0$	(P) 6 A
(B) Current through R_1 at $t=\infty$	(Q) 3 A
(C) Current through R_2 at $t=0$	(R) Zero
(D) Current through R_2 at $t=\infty$	(S) Infinite

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156. Instantaneous voltage and instantaneoss current in an L-R circuit in AC is V=100sin (100)t and

$i = 10\sin(100t - \pi/4)$. Match the following table,

(A)	R	(P)	$\frac{1}{10\sqrt{2}}$ SI units
(B)	X_L	(Q)	$5\sqrt{2}$ SI unit
(C)	L	(R)	$10\sqrt{2}$ SI units
(D)	Average power in one cycle	(S)	None

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157. In the figure V_{ab} versus time graph along an inductor is shown. Match the following

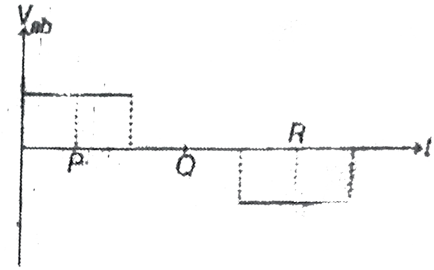

Table-1	Table-2
(A) At P, if current is from b to a it must be	(P) increasing
(B) At Q, if current is from a to b it must be	(Q) decreasing
(C) At R, if current is from a to b it must be	(R) constant

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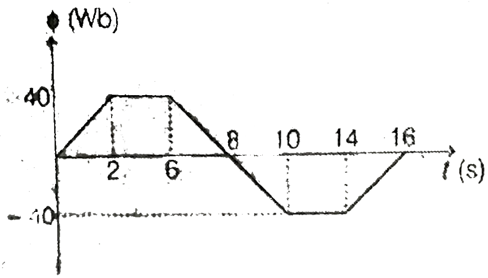
158. Magnetic flux in a circular coil of resistance 10Ω changes with time as shown in figure. $\otimes$ direction indicates a direction perpendicular to paper inwards.

Match the following table.



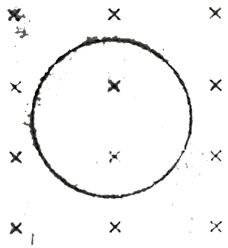


Table-1	Table-2
(A) At 1 s induced current is	(P) clockwise
(B) At 5 s induced current is	(Q) anticlockwise
(C) At 9 s induced current is	(R) zero
(D) At 15 s induced current is	(S) 2A
	(T) None

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159. In L-C-R series circuit suppose ω_r is resonance frequency, then match the following table,

	Table-1		Table-2
(A)	If $\omega > \omega_r$	(P)	Current will lead the voltage
(B)	If $\omega = \omega_r$	(Q)	Voltage will lead the current
(C)	If $\omega = 2\omega_r$	(R)	$X_L = 2X_C$
(D)	If $\omega < \omega_r$	(S)	Current and voltage are in phase
		(T)	None

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160. Three coils are placed infront of each other as shown currents in 1 and 2 are in same direction while that in 3 is in opposite direction. Match the following table

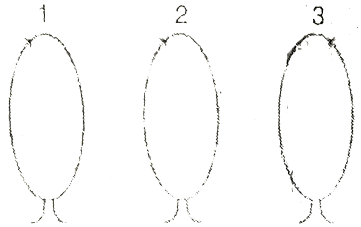

Table-1		Table-2	
(A)	When current in 1 is increased	(P)	current in 1 will increase
(B)	When current in 2 is increased	(Q)	current in 2 will increase
(C)	When current in 3 is increased	(R)	current in 3 will increase
		(S)	None

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161. A square loop is placed near a long straight current carrying wire as shown. Match the following table.

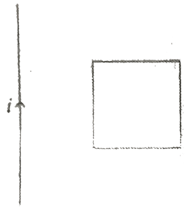

Table-1		Table-2	
(A)	If current is increased	(P)	Induced current in loop is clockwise
(B)	If current is decreased	(Q)	Induced current in loop is anticlockwise
(C)	If loop is moved away from the wire	(R)	Wire will attract the loop
(D)	If loop is moved towards the wire	(S)	Wire will repel the loop

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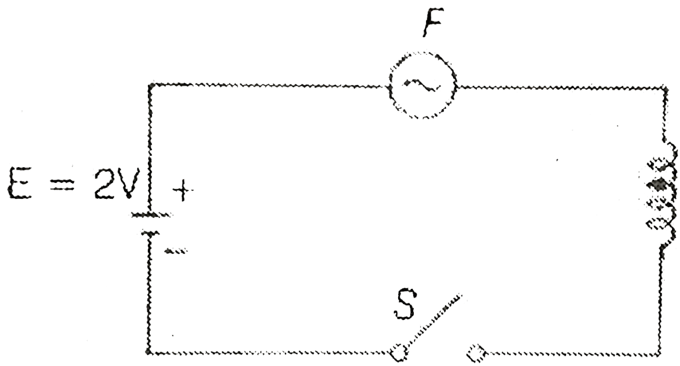
162. In the circuit shown the cell is ideal. The codil has an inductance of 2H and will blow when the current through it reaches 5a. The switch is closed at t=0. Find the time (in second)n when fuse will blow.



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163. A coil =of inductance $L = 50 \mu H$ and resistance $= 0.5 \Omega$ is connected to a battery of emf=5A. A resistance of 10Ω is connected parallel to the coil. Now at some instant the connection of the battery is switched off. Then the amount of heat generated in the coil after switching off the battery is (0.02)x in mJ. Find valuie of x.

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164. An L-C circuit contains a 0.60 H inductor and a $25\mu F$ capacitor is $3.0 \times 10^{-5} C$?

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165. A capacitor of capacity $2\mu F$ is changed to a potential different of $12V$. It is then connected across an inductor of inductance $0.6mH$ What is the current in the circuit at a time when the potential difference across the capacitor is $6.0V$?

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166. When an AC voltage, of variable frequency is applied to series L-C-R circuit, the current in the cirucit is the same at 4kHz. The current in the ciruit is maximum at (x)kHz. Find the value of x

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167. An ideal choke takes a current of 8A when connectd to an AC source of 100V and 50 Hz. A pure resistor under the same condition strikes a current of 10A. If two are connected in series to an AC supply of 100V and 40Hz, then the current in the series combination of above resistor and inductor $\sqrt{10x}$A. Find value of x

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168. An AC circuit consists of a resistance and a choke coil in series . The resistance is of 220 Ω and choke coils is of 0.7 H . The power abosorbed from 220 V and 50 Hz , source connected with the circuit , is

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169. Two coils have a mutual inductance 0.005H. The current changes in the first coil according to the equation $I = I_0 \sin \omega t \text{where} I_0 = 10A$ and $\omega = 100\pi rad/s$. The maximum value of emf wiin second coil is (pi//x)` volts. Find the value of x.

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170. In a certain circuit current changes with time accroding to $i = 2\sqrt{t}$. r.m.s. value of current between $t = 2$ to $t = 4s$ will be

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171. An $L - C - R$ series circuit with 100Ω resistance is connected to an AC source of $200V$ and angular frequency $300rad/s$. When only the capacitance is removed, the current lags behind the voltage by 60°. When only the inductance is removed the current leads the voltage by 60°. Calculate the current and the power dissipated in the $L - C - R$ circuit

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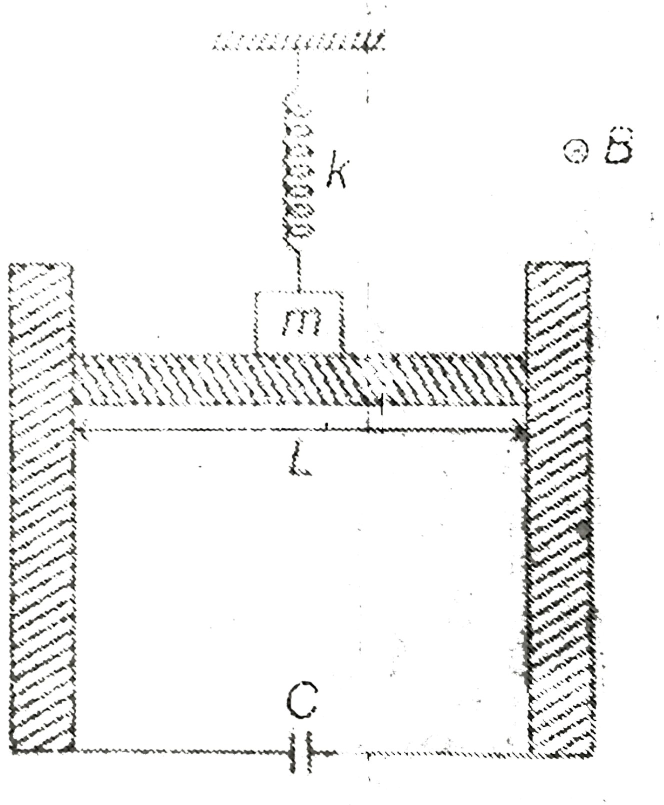
172. A block of mass 300g is attached to the ceiling by spring that has a force constant k=200N/m conducting massless rod is rigidly attached to the block and can slide without friction alon vertical parallel rails which are a distance L=1cm apart. A capacitor of known C=$500\mu F$ attached to the rails by the wire and the entire system is kept in magnetic field B=20cm perpendicular to plane of paper inwards. Neglect the self inductance to plane of paper inwards. Negect self inductance and electrical resistance of all wire and rod. In $'\omega'$ is angular frequency (in rad/sec) vertical oscillaitons of block i then $\frac{\omega}{10}$ is equal to



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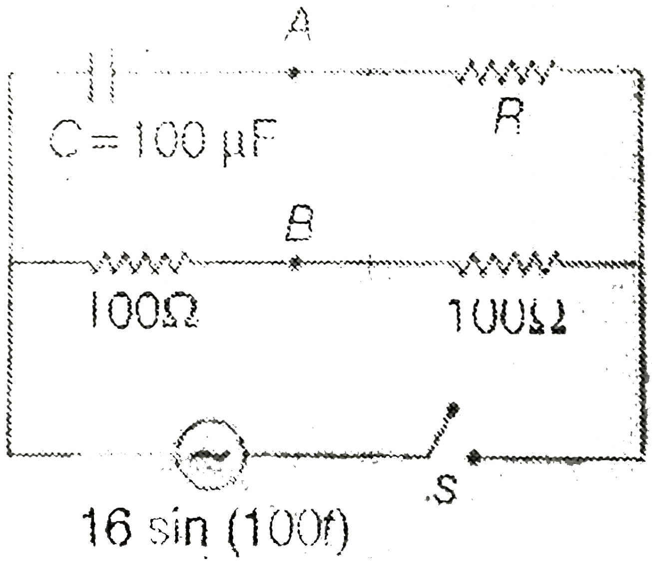
173. An uncharged capacity ER C=$100\mu F$ with a resistor is connected with AC source as shown in the figure If R= is 50Ω and switch S is closed at t=0 maximum value of

$(v_A - V_9B)$ is k volt. Calculate K



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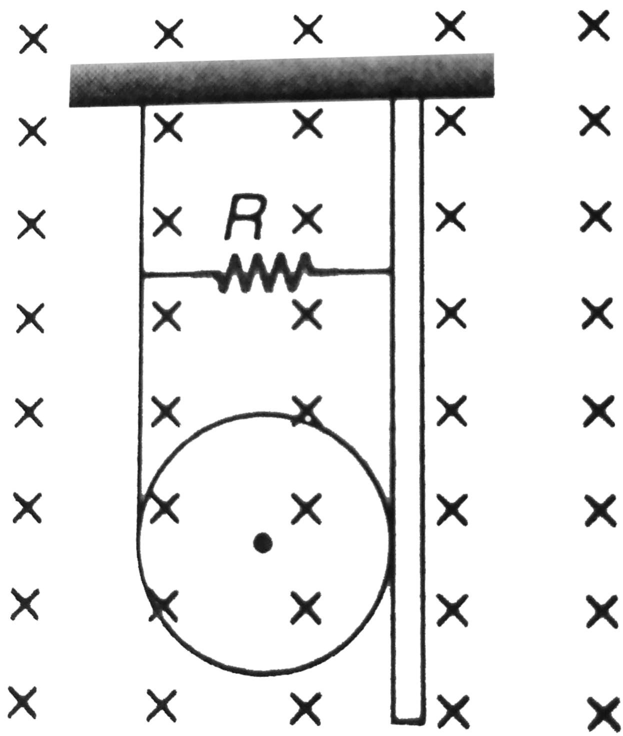
174. A conducting light string is wound on the rim of a metal ring of radius r and mass m. The free end of the string is fixed to the ceiling. A vertical infinite smooth conducting plane is always tangent to the ring as shown in the figure. A uniform magnetic field Bis applied perpendicular to the plane of the ring. The ring is always inside the magnetic field. The plane and the strip are connected by a resistance R. When the ring is released, find



a. the curent in the resistance R as as function of time.

b. the terminal velocity of the ring.

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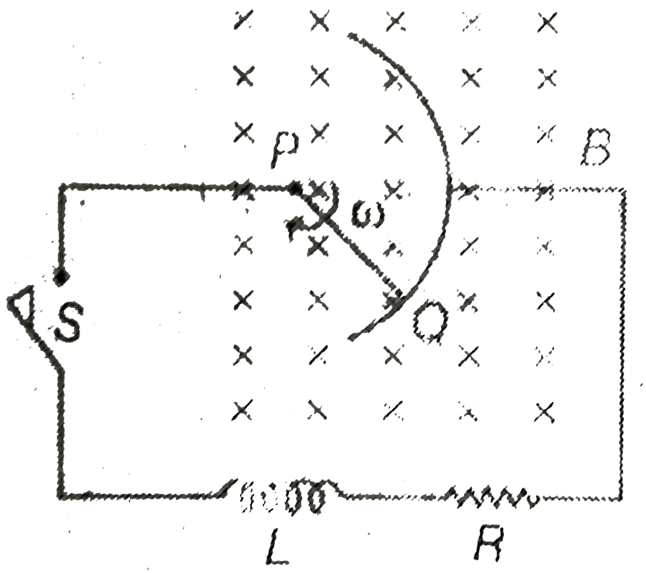
175. The circuit shows a resistance, $R = 0.01\Omega$ and inductance L=3mH connected to a conducting rod PQ of length l=wm which can slide on a perfectly conducting circular arc of radius l with its center at P. Assume that friction and gravity are absent and a constant uniform magnetic field b=0.1T exists as shown in the figure. At t=0, the circuit is seitched on a simultaneously an external torque is applied on the rod so that it rotates about P with a constant angular velocity $\omega 2rad/\sec$. Find the magnitude of this torque (inN-m) at t=(0.3In 2) second.



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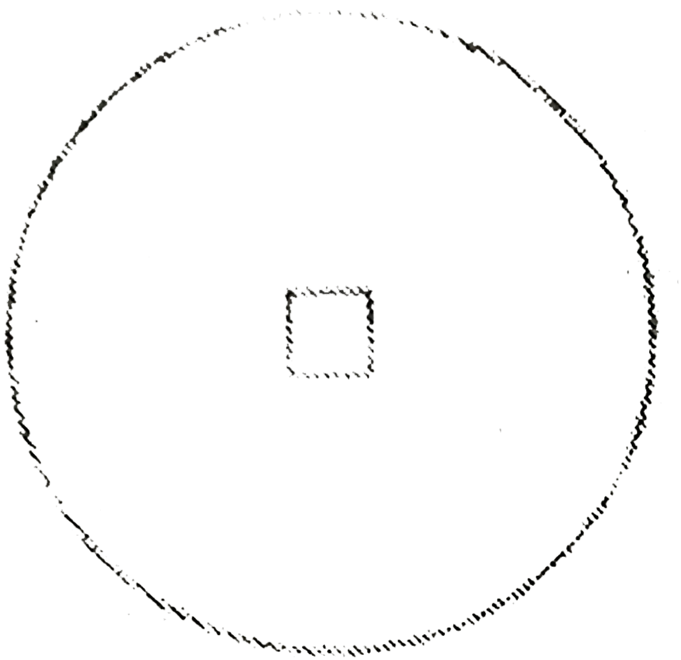
176. The circuit shows a resistance, $R = 0.01\Omega$ and inductance L=3mH connected toa conducting rod PQ of length l=wm which can slide on a perfectly conducting circular arc of radius l with its center at P. Assume that friction and gravity are absent and a constant uniform magnetic field b=0.1T exists as shown in the figure. At t=0, the circuitt ois seitched on a simultaneously an external torque is applied on the rod so that it rotates about P with a constant angular velocity $\omega 2rad/\sec$. Find the magnitude of this torque (inN-m) at t=(0.3In 2) second.



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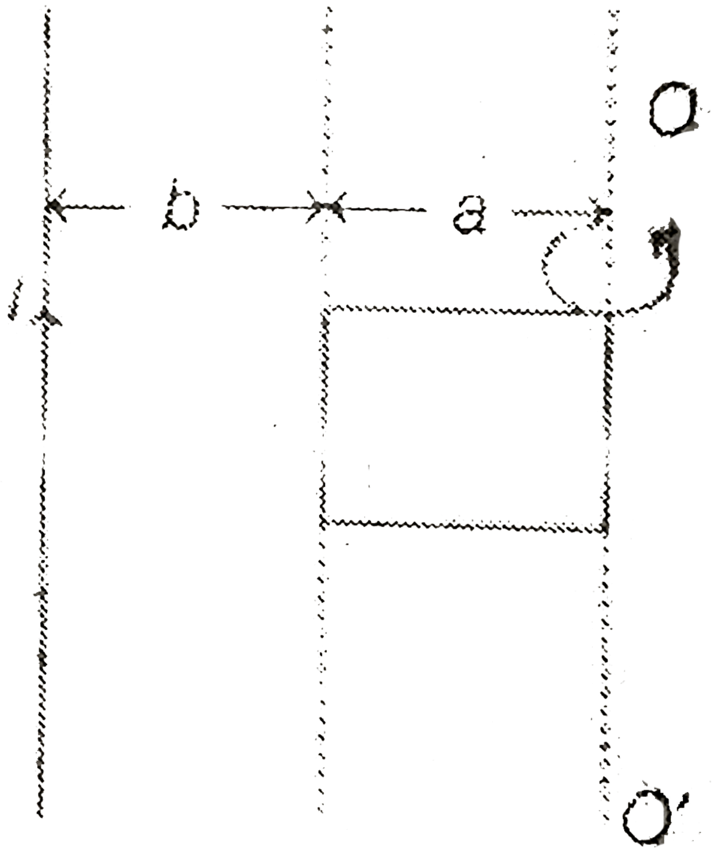
177. A square loop of side and a straight infinity conducor are placed in the same plane with two sides of the squre parallel to the conductor. The resistance of the loop is R. The loop is turned through 180° about the axis . The electric charge that flows in the square loop is

$\frac{\mu_0 I_a}{2\pi R} 1m \left| \frac{na+b}{b} \right|$. Find the value of n.



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178. In a series LCR circuit the frequency of a $10V$, AC voltage soure is adjusted in such a fashion that the reactance of the inductor meausers 15Ω and that of the capacitor 11Ω. If $R = 3\Omega$, the potentail difference across the series combination of L and Cwill be:

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