



# CHEMISTRY

## BOOKS - BETTER CHOICE PUBLICATION

### ALTERNATING CURRENTS

#### Very Short Answer type Questions

1. Define power factor. Write its value for pure inductor.



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2. What do you mean by wattless current?



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3. Why high frequency current can pass easily through a capacitor ?



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4. Why high frequency ac can not pass easily through an inductor ?



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5. What do you mean by impedance of a circuit?



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6. Define root mean square value of an alternating current.



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7. What is the relationship between  $m$  and  $nm$  ?



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8. What do you mean by power factor of an ac circuit ?



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9. The variation of inductive reactance ( $X_L$ ) of an inductor with the frequency of the ac sources of 100 V and variable frequency is shown in the figure.

Calculate the self inductance of the inductor.



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**10. Define capacitance of a capacitor?**



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**11. What is an idle current ?**



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**12. What is the impedance of circuit at resonance ?**





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**13.** Define resonant frequency of LCR Series Circuit.



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## Short Answer type Questions

**1.** Discuss the behaviour of a capacitor in (i) DC  
(ii) high frequency ac circuits:



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**2. Discuss the behaviour of an inductor in**  
**(i) DC (ii) high frequency AC circuits.**

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**3. Can a.c. be used for electrolysis? Why?**

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4. Can one have an inductance without a resistance ? How about a resistance with an inductance ?



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5. Which is more dangerous in use : ac or d.c. ?  
Explain why ? .



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6. The frequency of a.c. is doubled, what happens to inductive reactance?



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7. Does the capacitance of a capacitor depend upon its shape?



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**8.** The variation of inductive reactance ( $X_L$ ) of an inductor with the frequency of the ac sources of 100 V and variable frequency is shown in the figure.

Calculate the self inductance of the inductor.



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**9.** An alternate e.m.f. is applied to pure capacitance. Investigate the phase

relationship between the current flowing through it and e.m.f. applied.



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**10.** Derive the relation between  $eV$  and  $J$ .



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**11.** An alternate e.m.f. is applied to pure capacitance. Investigate the phase

relationship between the current flowing through it and e.m.f. applied.



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**12.** Find a phase relation between current and voltage in an a.c. circuit containing a pure inductor. Why high frequency current can not passthrough a pure inductor easily ?



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**13.** Show mathematically that in an a.c. circuit containing only inductance, the current lags behind the e.m.f. by a phase of  $\frac{\pi}{2}$ .

An a.c. voltage  $E = E_0 \sin \omega t$  is applied across an inductor  $L$ . Obtain an expression for current  $I$ .



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**14.** An alternate e.m.f. is applied to pure capacitance. Investigate the phase

relationship between the current flowing through it and e.m.f. applied.



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**15.** Find a phase relation between current and voltage in an a.c. circuit containing a pure capacitance. A pure capacitor blocks direct current, why?



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**16.** What do you mean by the average value of a.c. ? Derive the expression for it.



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**17.** Derive the relation for mean value of alternating current.



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**18.** Define root mean square value of an alternating current.



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**19.** What is root mean square value of alternating current? Derive a relation between peak value and virtual value of alternating current.



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**20.** What is an ideal inductor?



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**21.** What is meant by mean or average value of alternating current ? Show that mean value of ac over a complete cycle is zero.



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**22.** Define impedance of an electric circuit. How it differs from ohmic resistance ? Find an expression for the impedance of an a.c. circuit containing L-C-R in series.



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**23.** Derive an expression for impedance of an a.c. circuit with an inductor L, capacitor C and a resistor R in series. What is condition of resonance?





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24. With the help of phasor diagram derive an expression for impedance in LCR circuit.



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25. Derive an expression for average power is an A.C. circuit containing resistor only.



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**26.** Derive an expression for average power of an AC (alternating current) circuit.



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**27.** What is meant by mean or average value of alternating current ? Show that mean value of ac over a complete cycle is zero.



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**Long Answertype Questions**

1. Derive an expression for average power is an A.C. circuit containing resistor only.



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2. Derive an expression for average power is an A.C. circuit containing resistor only.



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3. Derive an expression for average power in an A.C. circuit containing resistor only.



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4. What is meant by mean or average value of alternating current? Show that mean value of ac over a complete cycle is zero.



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5. Define root mean square value of an alternating current.



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6. Derive an expression for average power in an A.C. circuit containing resistor only.



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7. What is the difference between resistance and resistor?



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8. Find the expression for mass of earth.



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9. Using phasor diagram, derive an expression for the impedance of an a.c. circuit containing

inductance, capacitance and resistance in series. What do you mean by resonance ?



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**10.** Define resonant frequency of LCR series circuit.



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**11.** Define impedance of an electric circuit. How it differs from ohmic resistance ? Find an

expression for the impedance of an a.c. circuit containing L-C-R in series.



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**12.** Find a phase relation between current and voltage in an a.c. circuit containing a pure inductor. Why high frequency current can not passthrough a pure inductor easily ?



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**13.** Find a phase relation between current and voltage in an a.c. circuit containing a pure capacitance. A pure capacitor blocks direct current, why ?



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**14.** What is meant by mean or average value of alternating current ? Show that mean value of ac over a complete cycle is zero.



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## Numericals Problems

1. What is the unit of frequency ?



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



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3. A capacitor of  $100\mu F$ , a resistor of  $20\Omega$  and an inductor of inductance  $L$  are connected in series with an a.c. source of frequency  $50\text{ Hz}$ . Calculate the value of inductance  $L$  of the inductor, if phase angle between current and voltage is zero.



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4. A coil of inductance  $0.50\text{ H}$  and resistance  $100\Omega$  is connected to a  $240\text{ V}$ ,  $50\text{ Hz}$  ac supply.

What is the maximum current in the coil?



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5. A coil of inductance  $0.50\text{ H}$  and resistance  $100\Omega$  is connected to a  $240\text{ V}$ ,  $50\text{ Hz}$  ac supply.

What is the maximum current in the coil?



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6. A coil of inductance  $0.50\text{ H}$  and resistance  $100\Omega$  is connected to a  $240\text{ V}$ ,  $50\text{ Hz}$  ac supply.

What is the maximum current in the coil?



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7. The instantaneous current from a.c. source is given by  $I=5 \sin 314 t$ . What is the peak value of current?



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8. The instantaneous current from a.c. source is given by  $I=5 \sin 314 t$ . What is the peak value



of current?



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9. What is the impedance of a circuit ?



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10. A  $40\Omega$  resistor,  $3\text{m H}$  inductor and  $2\mu\text{F}$  capacitor are connected in series to  $110\text{V}$ ,  $5000\text{ Hz}$  AC source. Calculate Impedence of the circuit and value of current in the circuit.



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11. A  $40\Omega$  resistor,  $3\text{m H}$  inductor and  $2\mu\text{F}$  capacitor are connected in series to  $110\text{V}$ ,  $5000\text{ Hz}$  AC source. Calculate Impedence of the circuit and value of current in the circuit.



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12. When an inductor  $L$  and a resistor  $R$  in series are connected across a  $12\text{V}$ ,  $50\text{Hz}$  supply

of current of 0.5 A flows in a circuit. The current differs in phase from applied voltage to  $\frac{\pi}{3}$  radian calculate the value of R.



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**13.** A 12V resistance and an inductance of  $\frac{0.05}{\pi} H$  are connected in series. Across the end of this circuit an alternating voltage of 130 V and frequency 50 Hz is connected. Calculate the current in the circuit and the potential difference across the inductance.



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**14.** Obtain an expression for the power in a.c. circuit containing a resistance and capacitance in series.



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**15.** A capacitor of  $100\mu F$ , a resistor of  $20\Omega$  and an inductor of inductance  $L$  are connected in series with an a.c. source of frequency 50 Hz. Calculate the value of inductance  $L$  of the

inductor, if phase angle between current and voltage is zero.



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**16.** An a.c. source of 200 V, 50 Hz is connected across a  $400\Omega$  resistor and capacitor of 25pF in series. Calculate reactance



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**17.** An a.c. source of 200 V, 50 Hz is connected across a  $400\Omega$  resistor and capacitor of 25pF in series. Calculate reactance



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**18.** A capacitor of  $100\mu F$ , a resistor of  $20\Omega$  and an inductor of inductance L are connected in series with an a.c. source of frequency 50 Hz. Calculate the value of inductance L of the

inductor, if phase angle between current and voltage is zero.



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**19.** A series circuit with  $L = 0.12\text{H}$ ,  $C = 0.48\text{ mF}$  and  $R = 25\text{ ohm}$ , is connected to a  $220\text{V}$  variable frequency power supply. At what frequency is the circuit current maximum ?



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20. A capacitor of unknown value and an inductor of  $0.1\text{H}$  and a resistor of  $10\Omega$  are connected in series to a  $220\text{V}$ ,  $50\text{Hz}$  ac source. It is found that the power factor of circuit is unity. Calculate the capacitance of capacitor and maximum amplitude of current



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**Most Expected Questions**



1. What is a measure ?



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2. In a series LCR circuit,  $V_L = V_C = V_R$

what is the value of power factor?



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3. Why do d.c. voltmeter and d.c. ammeter cannot read a.c.?



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4. Phase difference between voltage and current in a.c. circuit having resistor only is:



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5. Why do d.c. voltmeter and d.c. ammeter cannot read a.c.?



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6. Peak value of an a.c. source is  $E_0$ . What is its r.m.s. value?



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7. The division marked on the scale of an a.c. ammeter is not equally spaced. Why?



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8. What do you mean by cladding?





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**9.** An air coil solenoid is connected to an a.c. sources and a bulb. If an iron core is inserted in the solenoid, how does the brightness of the bulb change? Give reason for your answer.



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**10.** A lamp is connected in series with a capacitor. What will happen if d.c.or a.c. is connected to current?



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**11. Which of the best method of reducing current in an a.c. circuit and why?**



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