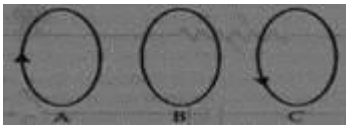
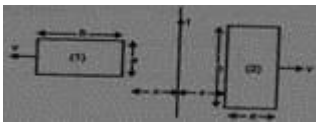
Physics : CBSE Class XII Important Questions
Physics EMI and AC

Q. 1. Three identical coil A, B and C are placed with their planes parallel to one another. Coils A and C carry



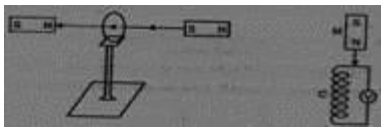
current as shown.Coil B and C are fixed. The coil A is moved towards B with uniform motion. Is there any induced current in B?

Q. 2. Two coils are being moved out of magnetic field- one coil is moved rapidly and the other slowly. In which



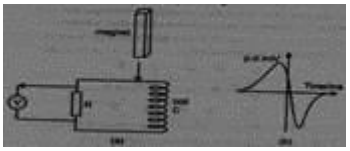
case is more work done and why?

Q. 3. The figure shows two identical rectangular loops (1) and (2), placed on a table along with a straight line current carrying conductor between them. (i) what will be the directions of the induced currents in the loops



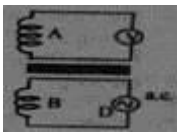
when they are pulled away from the conductor with same velocity? (ii) Will the e.m.f. induced in the two loops be equal? Justify your answer.

Q. 4. Give the direction in which the induced current flows in the coil mounted on an insulating stand when a



bar magnet is quickly moved along the axis of the coil from one side to the other as show

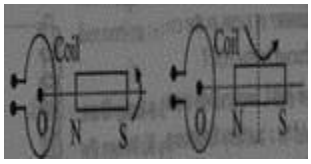
Q. 5. A bar magnet M is dropped so that it falls vertically through the coil C. The graph obtained for voltage



produced across the coil vs time is shown in figure (b).(i) Explain the shape of the graph. (ii) Why is the negative peak longer than the positive peak?

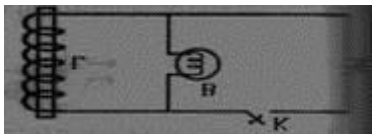
Q. 6. A coil A is connected to a voltmeter V and the other coil B to an alternating current source D. If a large copper sheet C is placed between the two coils, how does the induced e.m.f. in the coil A change due to current in coil B?

Q. 7. A cylindrical bar magnet is kept along the axis of along the axis of a circular coil, when the magnet is



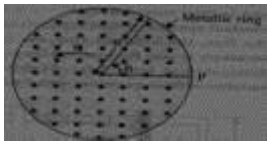
rotated (a) about its own axis, and (b) about an axis perpendicular to the length of the magnet?

Q. 8. Write the principle of an a.c. generator. An a.c. generator consists of a coil of 50 turns and area 2.5m2 rotating at an angular speed of 60 rads-1 in a uniform magnetic field B = 0.30 T between two fixed pole pieces. The resistance of the circuit including that of coil is 500Ω.(i) Find the maximum current drawn from the



generator(ii) What will be the orientation of the coil with respect to the magnetic field to have (a) maximum, (b) zero magnetic flux?(iii) Would the generator work if the coil were stationary and instead the pole pieces rotated together with same speed as above?

Q. 9. How does the self inductance of an air core coil change, when (i) the number of turns in the coil is

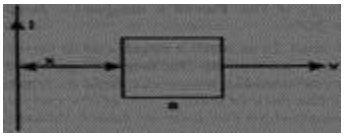


decreased, (ii) an iron rod is introduced in the coil?A copper coil L wound on a soft iron core and a lamp B are connected to a battery E through a tapping key K. When the key is suddenly opened, the lamp flashes for an instant to much greater brightness. Explain.

Q. 10. How is the mutual inductance of a pair of coils affected when:

i. separation between the coils is increased?
ii. the number of turns of each coil is increased?
iii. a thin iron sheet is placed between the two coils, other factors remaining the same? Explain your answer in each case.

Q. 11. A conducting rod 1 m in length is rotating with a frequency of 50 rev/s as shown in figure about an axis

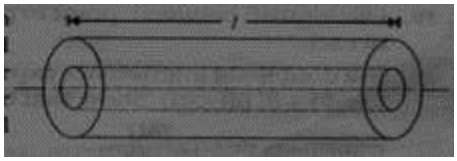


passing through the center of the coil perpendicular to the plane of the coil. A constant magnetic field parallel to the axis is present everywhere. What is the emf between the center and the metallic ring? Given that B = 1T.

Q. 12. Two circular coils, one of small radius r1 and the other of very large radius r2 are placed co-axially with centers coinciding. Obtain an expression for the mutual inductance of the arrangement.

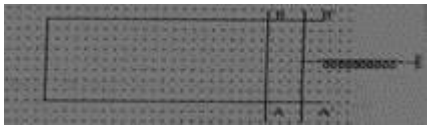
Q. 13. (a) Obtain an expression for the mutual inductance between a long straight wire and a square loop of side a as shown in figure.(b) Evaluate the induced emf in the loop if the wire carries a current of 50 A and the loop has an instanta-neous velocity v = 10m/s at the location x = 0.2 m as shown. Take a = 0.1 m and assume that the loop has a large resistance.

Q. 14.Figure shows two long coaxial solenoids, each of length 'L'. The outer solenoid has an area of cross-



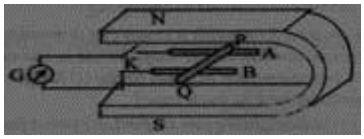
section A and number of turns/length n1. The corresponding values for the inner solenoid are A_2 and n_2. Write the expression for the inner solenoid are A_2 and n_2. Write the expression for self inductance L_1, L_2 of the two coils and their mutual inductance M. Hence show that $M < \sqrt{L_1 L_2}$.

Q. 15. A rectangular wire frame, shown below, is placed in a uniform magnetic field directed upward and normal to the plane of the paper. The part AB is connected to a spring. The spring is stretched and released



when the wire AB has come to the position A'B' (t = 0). How would the induced emf vary with time? Neglect damping.

Q. 16. Figure shows a metal rod PQ resting on the rails AB and positioned between the poles of a permanent magnet. The rails, the rod, and the magnetic field are in three mutual perpendicular direction A galvanometer G

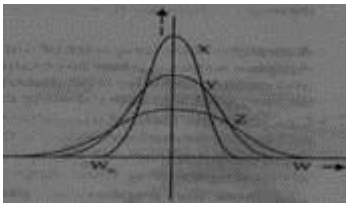


connects the rails through a switch K. Length of the rod = 15 cm, B = 0.50 T, resistance of the closed loop containing the rod = 9.0mΩ.

Q. 17. An armature coil consists of 20 turns of wire, each of area A = 0.09 m2 and total resistance 15.0Ω. It rotates in a magnetic field of 0.5T at a constant frequency of 150/π Hz. Calculate value of (i) maximum (ii) average induced emf produced in coil.

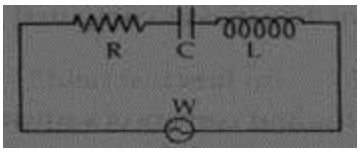
Q. 18. Why does metallic piece become every hot when it is surrounded by coil carrying high frequency alternating current?

Q. 19. Three students X, Y, and Z performed an experiment for studying the variation of alternating current with angular frequency in a series LCR circuit and obtained the graphs shown below. They all used a.c. sources of



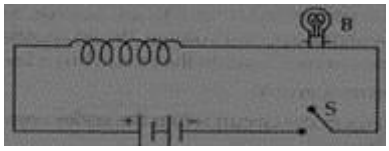
the same r.m.s. value and inductances of the same value.What can we (qualitatively) conclude about the (i) capacitance value (ii) resistance values Used by them? In which case will the quality factor be maximum? What can we conclude about nature of the impedance of the set up at frequency wo?

Q. 20. In the circuit shown below, R represents an electric bulb. If the frequency of the supply is doubled, how



should the values of C and L be changed so that glow in the bulb remains unchanged?

Q. 21. An air cored coil L and a bulb B are connected in series to the mains as shows in the given figure:The

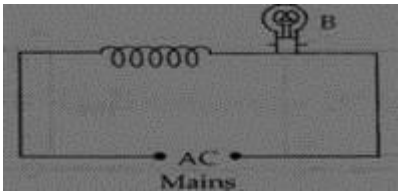


bulb glows with some brightness. How would the glow of the bulb change if an iron rod were inserted in the coil? Give reasons in support of your answer.

Q. 22. When a circuit element 'X' is connected across an a.c. source, a current of $\sqrt{2}$A flows through it and this current is in phase with the applied voltage. When another element 'Y' is connected across the same a.c. source, the same current flows in the circuit but it leads the voltage by $\pi/2$ radians.(i) Name the circuit elements X and Y. (ii) Find the current that flows in the circuit when the series combination of X and Y is connected across the same a.c. voltage. (iii) Plot a graph showing variation of the net impedance of

Q. 23. Fig shows a light bulb (B) and iron cored inductor connected to a DC battery through a switch (S). (i) What will one observe when switch (S) is closed? (ii) How will the glow of the bulb change when the battery is replaced by an ac source of rms voltage equal to the voltage of DC battery? Justify your answer in each case.

Q. 24. A circuit containing a 80 mH inductor and a 60 μF capacitor in series is connected to a 230 V, 50 Hz supply. The resistance of the circuit is negligible. (a) Obtain the current amplitude and rms values. (b) Obtain



the rms values of potential drops across each element. (c) What is the average power transferred to the inductor? (d) What is the average power transferred to the capacitor? (e) What is the total average power absorbed by the circuit? **Ans**
(a)8.24A,11.7A(b)VL=207V,VC=437V (c)zero (d)zero (e)zero.

Q. 25. A series LCR-circuit with L = 0.12 H, C = 480 nF, R = 23 **Ω** is connected to a 230 V variable frequency supply. (a) What is the source frequency for which current amplitude is maximum? Obtain this maximum value. (b) What is the source frequency for which average power absorbed by the circuit is maximum? Obtain the value of this maximum power. (c) For which frequencies of the source is the power transferred to the circuit half the power at resonant frequency? What is the current amplitude at these frequencies? (d) What is the Q-factor of the given circuit?

Ans (a) 4167 rad s-1 , 1.41A (b) 2300 W (c) 648Hz, 678Hz, I0=10A(d)21.7

Q. 26. An LC-circuit contains a 20 mH inductor and a 50 μF 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(a) what is the total energy stored initially. Is it conserved during the LC-oscillations? (b) What is the natural frequency of the circuit? (c) At what times is the energy stored? (i) completely electrical (i.e., stored in the capacitor)? (d) At what times is the total energy shared equally between the inductor and the capacitor? (e) If a resistor is inserted in the circuit, how much energy is eventually dissipated as heat?

Ans (a)1 J,(b)159Hz (c)electrical at t =