

NCERT Physics 12.7 Q19

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Question: Suppose the circuit in Exercise 7.18 has a resistance of $15\ \Omega$. Obtain the average power transferred to each element of the circuit, and the total power absorbed.

$$I = \frac{V}{Z} = \frac{230}{31.728} \quad (5)$$

$$= 7.25\ \text{A} \quad (6)$$

Average power transferred to resistance is given by :

$$P_R = I^2 \cdot R = (7.25)^2 \times 15 \quad (7)$$

$$= 788.44\ \text{W} \quad (8)$$

Average power transferred to the capacitor, $P_C =$
Average power transferred to the inductor, $P_L = 0$

Total power absorbed by circuit:

$$= P_R + P_C + P_L \quad (9)$$

$$= 788.44 + 0 + 0 \quad (10)$$

$$= 788.44\ \text{W} \quad (11)$$

Solution: In Exercise 7.18, the following information is provided:

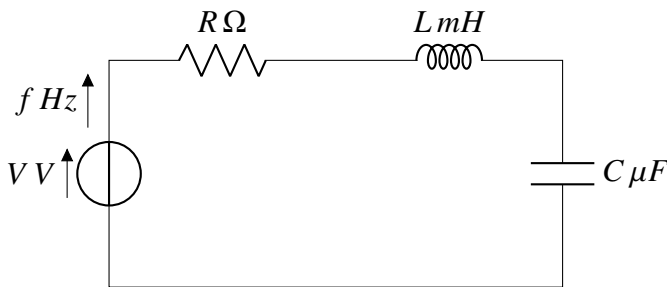
| Components | Values |
|-----------------------------|-------------------|
| Capacitance of capacitor | $60\ \mu\text{F}$ |
| Inductance of inductor | $80\ \text{mH}$ |
| Resistance of resistor | $15\ \Omega$ |
| Potential of voltage supply | $230\ \text{V}$ |
| Frequency of signal | $50\ \text{Hz}$ |

TABLE I

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Electrical Components and Values

Angular frequency of signal, $\omega = 2\pi f = 2\pi \cdot (50)$
 $= 100\pi$



The elements are connected in series to each other. Hence the impedance Z is given as :

$$Z = \sqrt{R^2 + \left(\omega \cdot L - \frac{1}{\omega \cdot C}\right)^2} \quad (1)$$

$$= \sqrt{15^2 + \left(100\pi \cdot (80 \times 10^{-3}) - \frac{1}{100\pi \times 60 \times 10^{-6}}\right)^2} \quad (2)$$

$$= \sqrt{15^2 + (25.12 - 53.08)^2} \quad (3)$$

$$= 31.728\ \Omega \quad (4)$$

Current flowing through the circuit I is :