Answer on Question#61363 – Physics – Electromagnetism

11) An air-cored transformer is assumed to be 100% efficient. The ratio of the secondary turns to the primary turns is 1:20. A 240V ac supply is connected to the primary coil and a 6Ê load is connected to the secondary coil. what is the current in the primary coil?
a) 0.10A
b) 0.14A
c) 2.0A
d) 40.0A

Solution. According to the conditions of the problem $\frac{N_2}{N_1} = \frac{1}{20}$, $R_2 = 6\Omega$ where N_1, N_2 – turns in primary and secondary coil, R_2 – resistor secondary coil. Using formula for transformer $\frac{V_2}{V_1} = \frac{N_2}{N_1}$ (V_1, V_2 – voltage in primary and secondary coil.). Therefore $V_2 = V_1\frac{N_2}{N_1} \to V_2 = 240\frac{1}{20} = 12V$.
Using Ohm's law $I = \frac{V}{R}$ find current in secondary coil. $I_2 = \frac{12}{6} = 2A$.
From definition electric power $P = VI$. For secondary coil power $P_2 = 12 \cdot 2 = 24W$.
An air-cored transformer is assumed to be 100% efficient. Hence $P_1 = P_2$.
$V_1I_1 = V_2I_2 \to I_1 = \frac{V_2I_2}{V_1} = \frac{24}{240} = 0.1A$.

Answer. a) 0.1A.

12) A voltmeter connected across a 60Hz ac source reads 240V. Write down the expression of the instanteneous voltage as a function of time.
a) 240sin339.4t
b) 339.4sin377t
c) 377cos339.4t
d) 240cos339.4t

Solution. The General equation of the instantaneous voltage of the alternating current has the form $V = V_0 \sin \omega t = V_0 \sin 2\pi f t$, where V_0 – peak voltage, f – frequency. Using relationship between peak voltage and rms voltage $V = \frac{V_0}{\sqrt{2}}$. A voltmeter show rms voltage hence peak voltage $V_0 = V\sqrt{2} = 240\sqrt{2} \approx 339.4V$.
$2\pi f = 2\pi \cdot 60 \approx 377\frac{rad}{s}$. Therefore
$V = 339.4 \sin 377t$.

Answer. b) $339.4 \sin 377t$.