

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 6Ω 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

We are given:

$$\frac{N_S}{N_P} = \frac{1}{20}$$

$$V_P = 240 \text{ V}$$

$$R_S = 6\Omega$$

For ideal transformer:

$$\frac{V_P}{V_S} = \frac{I_S}{I_P} = \frac{N_P}{N_S}$$

Voltage on secondary coil :

$$V_S = \frac{V_P N_S}{N_P}$$

Using Ohm's law for secondary coil :

$$I_S = \frac{V_S}{R_S} = \frac{V_P N_S}{N_P R_S}$$

Using expression for ideal transformer get current in the primary coil:

$$I_P = \frac{I_S N_S}{N_P} = \frac{V_P N_S N_S}{N_P R_S N_P} = \frac{V_P}{R_S} * \left(\frac{N_S}{N_P}\right)^2$$

Calculation:

$$I_P = \frac{240}{6} * \left(\frac{1}{20}\right)^2 = \mathbf{0.10 \text{ A}}$$

Answer: a, 0.10A