

a 60 ohm resistor in parallel with a resistor of unknown value when 120V is applied to the circuit the current is 3A. Calculate a) unknown resistance b) total equivalent resistance

Solution:

$R_1 = 60 \text{ ohm}$ – known resistance;

R_2 – unknown resistance;

R_{total} – total equivalent resistance of the circuit;

$I_{\text{total}} = 3\text{A}$ – current flowing through the circuit;

$U_{\text{total}} = 120\text{V}$ – voltage of the circuit;

Ohm's law for the circuit:

$$I_{\text{total}} = \frac{U_{\text{total}}}{R_{\text{total}}} \Rightarrow R_{\text{total}} = \frac{U_{\text{total}}}{I_{\text{total}}} = \frac{120\text{V}}{3\text{A}} = 40 \text{ Ohm}$$

Formula for the total resistance of the parallel circuit:

$$\begin{aligned} \frac{1}{R_{\text{total}}} &= \frac{1}{R_1} + \frac{1}{R_2} \\ \frac{1}{R_2} &= \frac{R_1 - R_{\text{total}}}{R_{\text{total}} \cdot R_1} \\ R_2 &= \frac{60 \text{ Ohm} \cdot 40 \text{ Ohm}}{60 \text{ Ohm} - 40 \text{ Ohm}} = 120 \text{ Ohm} \end{aligned}$$

Answer: a) $R_2 = 120 \text{ Ohm}$;

b) $R_{\text{total}} = 40 \text{ Ohm}$.