Answer on Question #40550, Physics, Electric Circuits

A 10Ω and a 20Ω resistances are connected in parallel, another resistance of 5Ω is connected in series with the two. If the supply voltage is 48V, what is the current through the 10Ω resistance?

Solution

Total resistance is

$$R = \frac{R_1 R_2}{R_1 + R_2} + R_3,$$

where $R_1 = 10\Omega$, $R_2 = 20\Omega$ and $R_3 = 5\Omega$. So

$$R = \frac{10 \cdot 20}{10 + 20} + 5 = 11.7\Omega.$$

Total current is

$$I = \frac{U}{R} = \frac{48V}{\frac{35}{3}\Omega} = 4.1A.$$

But the total current is equal the sum of currents through a 10Ω and a 20Ω resistances:

$$I = I_1 + I_2.$$

In consequence of parallel connection of 10Ω and a 20Ω resistances the voltages across them are equal each other:

$$I_1 R_1 = I_2 R_2.$$

Thus

$$I = I_1 + \frac{I_1 R_1}{R_2}.$$

The current through the 10Ω resistance:

$$I_1 = \frac{I}{1 + \frac{R_1}{R_2}} = \frac{4.1}{1 + \frac{10}{20}} = 2.7A.$$

Answer: $2.7A$.