Answer on Question 71070, Physics, Other

Question:

A 2 Ω resistor is connected in a series with a 20.0 V battery and a three-branch parallel network with branches whose resistance are 8 Ω each. Ignoring the battery's internal resistance, what is the current in the battery?

Solution:

Let's first find the equivalent resistance of the three-branch parallel network:

$$\frac{1}{R_{eq\ parallel}} = \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} = \frac{1}{8\ \Omega} + \frac{1}{8\ \Omega} + \frac{1}{8\ \Omega} = \frac{3}{8}\ \Omega.$$

$$R_{eq\ parallel} = \frac{8}{3}\ \Omega.$$

This three-branch parallel network of resistors is connected in series with the 2.0-ohm resistor. So, the equivalent resistance of the circuit is equal:

$$R_{eq} = R_1 + R_{eq\ parallel} = 2\ \Omega + \frac{8}{3}\ \Omega = \frac{14}{3}\ \Omega.$$

Finally, we can find the current in the battery from the Ohm's law:

$$I = \frac{V}{R_{eq}} = \frac{20\ V}{\frac{14}{3}\ \Omega} = 4.28\ A.$$

Answer:

$I = 4.28\ A.$