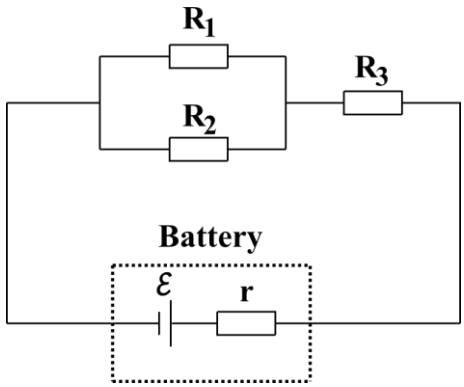
Answer on Question 59058, Physics, Electric Circuits

Question:

A $2\ \Omega$ and a $3\ \Omega$ resistors in parallel are connected in series to a $4\ \Omega$ resistor. The combination is then connected across a $12\ V$ battery having internal resistance of $1\ \Omega$. What is the equivalent resistance of the circuit?

Solution:

Here's the sketch of our task:



We have a parallel combination of $R_1 = 2\ \Omega$ and $R_2 = 3\ \Omega$ resistors that are connected in series to a $R_3 = 4\ \Omega$ resistor. The combination is then connected across a $12\ V$ battery having internal resistance of $r = 1\ \Omega$. Our task is to find the equivalent resistance of the circuit.

Let's first find the equivalent resistance of combination of resistors $R_1 = 2\ \Omega$ and $R_2 = 3\ \Omega$ that connected in parallel:

$$R_{12(||)} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}} = \frac{R_1 R_2}{R_1 + R_2} = \frac{2\ \Omega \cdot 3\ \Omega}{2\ \Omega + 3\ \Omega} = 1.2\ \Omega.$$

Then, from our sketch we can see that $R_{12(||)}$, R_3 and r are connected in series. Therefore, the equivalent resistance of the circuit will be:

$$R_{eq} = R_{12(||)} + R_3 + r = 1.2\ \Omega + 4\ \Omega + 1\ \Omega = 6.2\ \Omega.$$

Answer: $R_{eq} = 6.2\ \Omega.$