## Answer on Question\#79900 - Physics - Electric Circuits

What is the net resistance of a parallel circuit?

## Solution.

Consider an electrical circuit with two resistors connected in parallel. Find the total resistance of the resistors


Both resistors between points $A$ and $B$ and have the same potential difference. Hence, voltage $U_{A B}=U_{1}=U_{2}$. The sum of the currents $I_{1}+I_{2}$ flowing through both conductors is equal to the current in an unbranched circuit. $I_{A}=I_{1}+I_{2}=I_{B}$. Let $R$ is total resistance of the resistors. Using Ohm's law we get

$$
I_{A}=\frac{U_{A B}}{R} .
$$

Using the Ohm's law for each resistor separately we get

$$
I_{1}=\frac{U_{1}}{R_{1}} \text { and } I_{2}=\frac{U_{2}}{R_{2}} \text {. }
$$

From the formula $I_{A}=I_{1}+I_{2}$ substituting $I_{A}=\frac{U_{A B}}{R}, I_{1}=\frac{U_{1}}{R_{1}} I_{2}=\frac{U_{2}}{R_{2}}$ get

$$
\frac{U_{A B}}{R}=\frac{U_{1}}{R_{1}}+\frac{U_{2}}{R_{2}} .
$$

We divide the equation by $U_{A B}$

$$
\frac{1}{R}=\frac{1}{R_{1}}+\frac{1}{R_{2}} .
$$

We obtained a resistance formula for two resistors connected in parallel. In the same way, we can obtain a formula for net resistance of a parallel circuit (for $n$ elements)

$$
\frac{1}{R}=\frac{1}{R_{1}}+\frac{1}{R_{2}}+\cdots \frac{1}{R_{n}}
$$

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