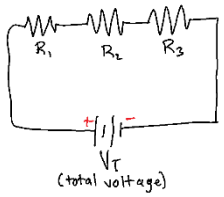
Circuits and Series Resistance NOTES

Remember: $V = IR \qquad P = VI = I^2R = \frac{V^2}{R}$

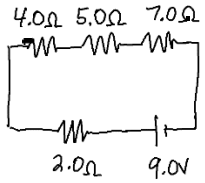
Series Circuits are said to be connected in series when resistors/bulbs/loads are connected to one another where all the charges must follow the same conducting path.

- Resistors in series carry the same current, but the voltage (potential difference) drops across the resistor based on its resistance.
- The total current in a series circuit depends on how many resistors are presented and how much resistance each offers. To find the total current, we need to find the total resistance or the effective/equivalent resistance.
- $R_{Total} = R_1 + R_2 + R_3 + \ldots$
- **Kirchoff's Loop Rule**: sum of the voltage drops across each device in a circuit equals the total voltage.

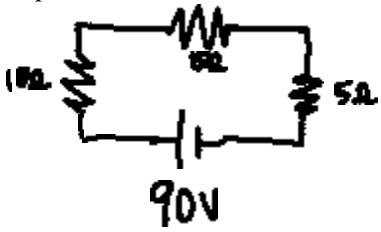


Examples/Practice:

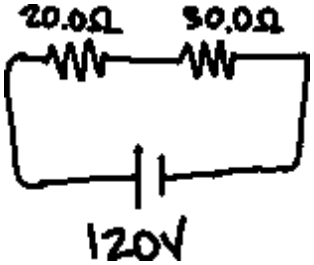
1. A 9.0V battery is connected to four light bulbs, as shown at below. Find the equivalent resistance for the circuit and the current in the circuit.



2. A 10Ω resistor, a 15Ω resistor, and a 5Ω resistor are connected in series across a 90V battery. Draw the circuit. What is the equivalent resistance and current in the circuit?



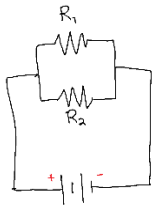
3. A 20.0Ω resistor and a 30.0Ω are connected to in series and placed across a 120V potential difference. Draw the circuit. What is the effective resistance of the circuit? What is the current through the circuit? What is the voltage drop across each resistor? What is the total power generated in this circuit?



Circuits and Parallel Resistance-Notes

Parallel Circuits have a wiring arrangement that provides alternative pathways for the movement of a charge.

- Resistors in parallel have the same potential difference across them, but the current traveling through each resistor will differ depending on its resistance.
- Total current is the sum of all individual currents.
- Total/Effective/Equivalent resistance is the reciprocal sum of resistances: $\frac{1}{R_{Total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$



- Parallel circuits do not require all elements to conduct. Household circuits are arranged in parallel so that appliances can produce devices that all operate at the standard potential difference (120V), making sure the current is neither too high or too low.
- Equivalent resistance of several parallel resistors is less than the resistance of any of the individual resistors. A low equivalent resistance can be created with a group of resistors of higher resistance.

Practice Examples:

1. A 9.0V battery is connected to four resistors in parallel. Their resistances are 7.0Ω, 5.0 Ω, 4.0 Ω, and 2.0 Ω. Draw the circuit. Find the equivalent resistance for the circuit and the total current in the circuit.

2. Three 15 Ω resistors are connected in parallel and placed across a 30V potential difference. Draw the circuit. Find the equivalent resistance and total current of the circuit. Find the current through each resistor.