PHYSICS 570 – Master's of Science Teaching

“Electricity”
Lecture 13 – Equivalent Resistance

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For Resistors in series

Voltages add as cross each resistor.
Current is the same everywhere in the circuit.
Equivalent resistance is sum of all resistances.

$$R_{equivalent} = R_1 + R_2 + R_3 + \ldots$$

For Resistors in parallel

Voltage is the same across each resistor.
Current divides between resistors.
Equivalent resistance comes from following formula.

$$\frac{1}{R_{equivalent}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

Examples

Given a 3, 4 and 5 Ohm resistor in series and a 6 V battery.

What is equivalent resistance?
What is current?
What is power consumed by resistors?

$$R_{equivalent} = R_1 + R_2 + R_3 + \ldots$$

Examples

Given a 3, 4 and 5 Ohm resistor in series and a 6 V battery.

R_eq=

I=

P=

Examples

Given a 10 Ohm a 20 Ohm and a 40 Ohm resistor in parallel and a 6 V battery.

What is equivalent resistance?
What is total current?
What is power consumed by each resistor?
What is total power consumed?

$$\frac{1}{R_{equivalent}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

Examples

Given a 10 Ohm a 20 Ohm and a 40 Ohm resistor in parallel and a 6 V battery.

R_{eq}

I_{total}

P_{total}

Homework is Lab 13

You will build one resistor in series with two resistors in parallel. The theory and experiment match beautifully!

$$R = \rho \frac{L}{A}$$