CE9.2

Analyze the relationships that exist among voltage, current, and resistance in series and parallel circuits.

Indicators for this outcome

(a) Demonstrate the importance of using precise language in science and technology by formulating operational definitions for voltage, resistance, and current.

(b) Demonstrate the role of switches and variable resistors in series and parallel circuits and identify practical examples of switches and variable resistors in daily life.

(d) Use an ammeter, voltmeter, and/or multimeter safely and accurately to measure current and voltage of a variety of student-constructed series and parallel circuits, and identify potential sources of error in instrument readings.

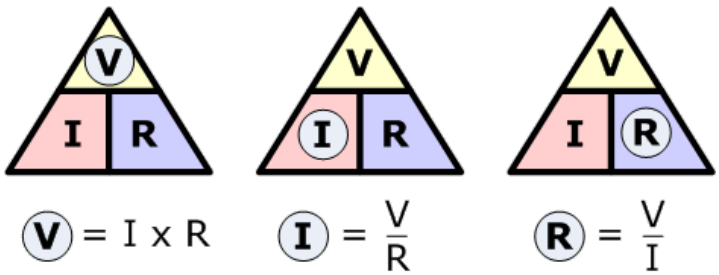
(f) Calculate values of unknown quantities in electric circuits using Ohm's Law.

Ohm's Law

The voltage (V) in a circuit is equal to the
current (I) multiplied by the resistance (R).

$$V=IR$$

Voltage (V) is measured in Volts (V)
Current (I) is measured in Amperes (A)
Resistance (R) is measured in Ohms (Ω)



Define Electrical Current.

What device measures electrical current?

Describe electrical voltage in simple terminology.

What device measures voltage?

Describe electrical resistance in simple terminology.

Ohm's Law Calculations

Practice Problem One:

A current of 1.5 A flows through a 30 Ω resistor in a circuit. Calculate the voltage.

Practice Problem Two:

A 30 V battery generates a current through a 15 Ω resistor. How much current does the battery generate?

Practice Problem Three:

An electric stove is connected to a 240 V outlet. If the current flowing through the stove is 20 A, what is the resistance of the heating element?

Online Circuit Construction Kit

https://phet.colorado.edu/sims/html/circuit-construction-kit-dc/latest/circuit-construction-kit-dc_en.html

Using the online circuit construction kit, construct a simple series circuit for each of the following scenarios. You will use the simple circuit to measure current and voltage.

Scenario One:

The series circuit contains one source, one 10 Ω resistor and conductors. Set the source to 6 volts. Use Ohm's Law to calculate the current generated by the battery. Use the ammeter provided with the simulation to check your answer.

Scenario Two:

The series circuit contains one source, one resistor and conductors. Set the source to 24 volts. Using Ohm's Law, calculate the value needed at the resistor to provide a current of 2 A running through the load. Use the ammeter provided with the simulation to check your answer.

Scenario Three:

The series circuit contains one source, one bulb and conductors. Set the source to 9 volts. Use the ammeter provided with the simulation to measure the current. Use Ohm's Law to calculate the resistance provided by the bulb.

Scenario Four:

The series circuit contains two sources, two bulbs and conductors. Set each source to 1.5 volts. Set the resistance of each bulb to 5 Ω Use Ohm's Law to calculate the current in the circuit. Use the ammeter provided with the simulation to confirm your answer.

Scenario Five:

The series circuit contains one source, three bulbs and conductors. Set the resistance of each bulb to 10 Ω. Use Ohm's Law to calculate the voltage needed to produce 3.0 A of current. Use the ammeter provided with the simulation to confirm your answer.

Scenario Six:

The series circuit contains sources totaling 15 volts, five bulbs and conductors. Assuming each bulb is of equal resistance, use Ohm's Law to calculate the resistance of each bulb if the circuit contains 0.5 A of current. Use the ammeter provided with the simulation to confirm your answer.