Ohm's Law

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Name: _____

What if there were no circuits? How would you play your favorite gaming systems, use your cell phone, or turn the on the heat on a winter day? The answer is simple, you would not be able to. All of these electrical devices rely on circuits.

Circuits are the foundation of modern electrical systems, powering everything from household appliances to complex machines. A circuit is essentially a closed loop that allows electricity to flow, enabling various devices to operate. Understanding the basic components of a circuit—such as current, voltage, and resistance—is essential for grasping how electrical systems function.

Current (I) is defined as which is the rate at which a charge moves through a circuit and is measured in amperes (a)
Voltage (V) is defined as the measure of potential energy and is measured in volts (V)
Resistance (R) is defined as which is a measure of an object's opposition to the flow of an electrical current and is measured in ohms (Ω)

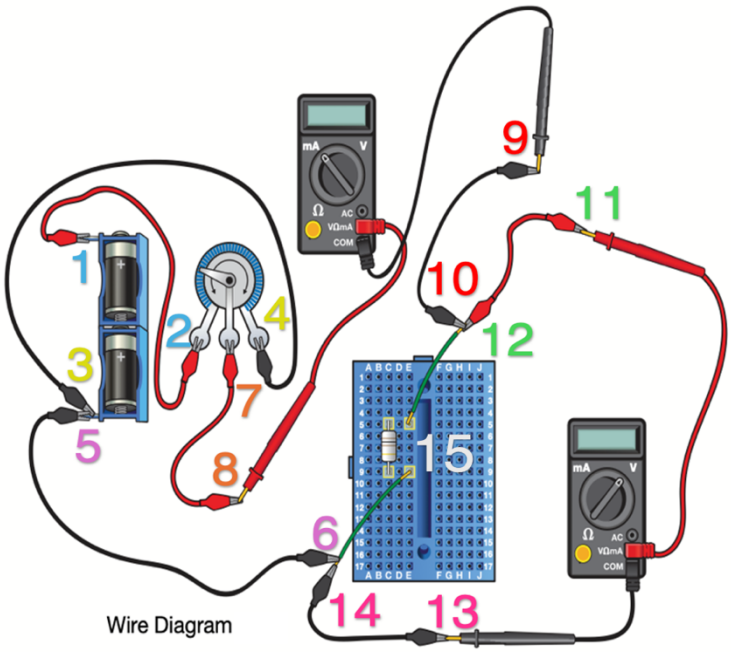
PART 1: SET UP

*In this activity, you will experimentally determine the relationship between voltage, current, and resistance. For this experiment, you will use a **potentiometer**, a type of variable resistor.*

Materials Per Group:

(1) Mini breadboard + resistor
(3) Red alligator clips
(4) Black alligator clips
(2) D-cell batteries
(2) D-cell battery holders
(1) Voltmeter
(1) Ammeter
(2) Hookup wires
(1) kΩ potentiometer

Follow the wire diagram to complete the circuit:



Wire Diagram

1. Take one red alligator clip and connect one end to the positive terminal of the D-cell battery holder.
2. Take the second end of the first alligator clip and connect it to the left terminal of the potentiometer.
3. Connect 1 black alligator clips to the negative terminal of the D-cell battery holder.
4. Take the other end of that black alligator clip and connect it to the right terminal of the potentiometer.
5. Take a second black alligator clip and connect it to the negative terminal of the D-cell Battery holder.
6. Take the other end of the second black alligator clip and connect it to the end of hookup wire #1.
7. Take a second red alligator clip and connect it to the middle terminal on the potentiometer.
8. Connect the other end of the second alligator clip to the positive (red) lead of the **ammeter**.
9. Take a third black alligator clip and connect it to the negative (black) lead of the **ammeter**.
10. Connect the other end the third black alligator clip to the end of hookup wire #2.
11. Take a third red alligator clip and connect it to the positive (red) lead of the **voltmeter**.
12. Take the other end of the third red alligator clip and connect it to the end of hookup wire #2.
13. Take a fourth black alligator clip and connect it to the negative (black) lead of the **voltmeter**.
14. Take the other end of the fourth black alligator clip and connect it to end of hookup wire #1.

PART 2: DATA COLLECTION

1. Set the voltmeter to 20 V DC and turn the device on.
2. Set the ammeter to 200 mA DC and turn the device on.
3. Put your batteries (2) D-cell batteries into the D-cell battery holder.
4. Record your resistor in ohms below.
    a. For the **100Ω resistor,** the color bands are brown, black, black, black, brown
    b. For the **150Ω resistor,** the color bands are brown, green, black, black, brown
    c. For the **220Ω resistor,** the color bands are red, red, black, black, brown
    d. For the **330Ω resistor,** the color bands are orange, orange, black, black, brown
5. Turn the knob on the potentiometer until the **voltmeter** displays the lowest reading. Record this in the table below along with the current reading from the ammeter.
6. Slowly adjust the knob on the potentiometer, until it reads 0.25 V. Record the voltage and current in the table below.
7. Continue increasing the voltage by increments of 0.25 V and record the voltage and current at each point until the voltage reaches the same value as that supplied by the batteries (3V).
8. When your table is complete, disconnect the circuit by removing the alligator clip lead from the positive terminal of the battery holder.
9. Create a graph of voltage vs. current. Make sure your graph is scaled for units of volts and amps.
    a. The ammeter gives readings in mA. To convert from mA to A, divide by 1,000.

Resistor: _____

Voltage (Volts)	Current (mA)	Current (A)