

SI Physics - Full Discipline Demo

Ohm's Law

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Physics - Full Discipline Demo
Course	SI Physics - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Match each term with the best description.

Terms to match:

- Conducting material
- Current
- Digital multimeter
- Resistance
- Voltage

Descriptions to match:

1. A measure of the rate of flow of charges past a point in a circuit
2. A measure of the potential difference across a circuit component
3. A measure of the hindrance of flow for charges in a circuit
4. A device used to measure two or more electrical values
5. Provides a pathway for charges to travel in a circuit

Correct answers:

- 1 Current 2 Voltage 3 Resistance 4 Digital multimeter
5 Conducting material

Identify each statement as true or false.

True	False
1	2

Correct answers:

1

Ohm's law describes the relationship between current, potential difference, and resistance.

A digital multimeter can function as an ammeter and voltmeter.

2 Current in a circuit is directly proportional to resistance.

An ammeter is used to measure potential difference.

Exploration

Charges travel from low potential energy to high potential energy in the ____ of a closed circuit.

- ☒ energy supply
- ☐ conducting material
- ☐ load
- ☐ All of the above



A ____ is a source of load in a circuit.

- ☐ light bulb
- ☐ resistor
- ☐ rheostat
- ☒ All of the above

✓

Potential difference within a circuit is expressed in ____.

- ☐ amperes
- ☐ ohms
- ☒ volts
- ☐ All of the above

✓

Ohm's law is expressed using the equation ____.

- ☒ $V = I \times R$
- ☐ $I = V \times R$
- ☐ $R = I/V$
- ☐ All of the above

✓

When measuring current, a device with high internal resistance is connected in series within a circuit.

- ☐ True
- ☒ False

✓

Exercise 1

Explain Ohm's law including the relationship between potential difference, resistance, and current.

Ohm's law states the electric potential difference between two points on a circuit is equivalent to the product of the current between those two points and the total resistance of all electric devices present between those two points.

$$V = I \times R$$

The current in a circuit is directly proportional to the potential difference across the ends of the internal circuit and inversely proportional to the resistance of the external circuit. An increase in voltage results in an increase in current. Conversely, an increase in resistance results in a decrease in current.

The resistor used in the procedures has a manufacturer's stated tolerance (percent error) of 5%. Did your results from Data Table 1 agree with the manufacturer's statement? Explain your answer.

Yes. The measured resistance in **Data Table 1** was 100.3 Ω . The manufacturer's stated tolerance is 5% = 100 +/- 5 Ω , therefore the experimental measure agrees with the manufacturer's statement.

Was the current entering the battery equal to the current leaving the battery? Use your results in Data Table 2 and Photo 1 to explain your answer.

Yes. The current measured on the positive side of the battery was 13.4 mA as recorded in **Data Table 2** and the current measured on the negative side of the battery was 13.4 mA as recorded in **Photo 1**.

Did the jumper cables provide measurable resistance to the flow of current? Use your results in Data Table 2 and Photo 2 to explain your answer.

No. The potential difference measured across the battery and recorded in **Data Table 2** was 1.35 V, identical to the potential difference measured across the resistor and recorded in Photo 2. Therefore, the jumper cables provided no measurable resistance in the circuit.

Do your results in Data Table 2 support Ohm's law? Explain your answer.

Yes. Ohm's law states that an increase in voltage results in an increase in current throughout a circuit. The voltage differences between the three circuits were matched by current changes between the circuits. Furthermore, the calculated R values for each circuit were within the margin of error of the manufacturer's stated resistance and the measured resistance of the 100 Ω resistor used in each circuit.

How would the measurements for potential difference and current change if a 200 Ω resistor was used in Circuit 1 instead of the 100 Ω resistor? Explain your answer.

The potential difference measurement would remain constant since the battery determines this measurement. The potential difference across the 200 Ω resistor would be 1.35 V. The current would be reduced when using the 200 Ω resistor since current is inversely proportional to resistance: $I = V/R = 1.35 \text{ V}/200 \Omega = 0.00675 \text{ A}$.

Data Table 1: Measured Resistance
(SAMPLE ANSWER BELOW)

Resistor	Measured Resistance (Ω)
100 Ω	100.3

Data Table 2: Current and Potential Difference of Simple Circuits
(SAMPLE ANSWER BELOW)

Trial	Current (mA)	Current (A)	Potential Difference (V)	Calculated Resistance ($R=V/I$) Ω
1	13.4	0.0134	1.35	101
2	26.9	0.0269	2.69	100.
3	39.1	0.0391	3.92	100.

Photo 1: Current Reading on Negative Side of Battery
(SAMPLE ANSWER BELOW)



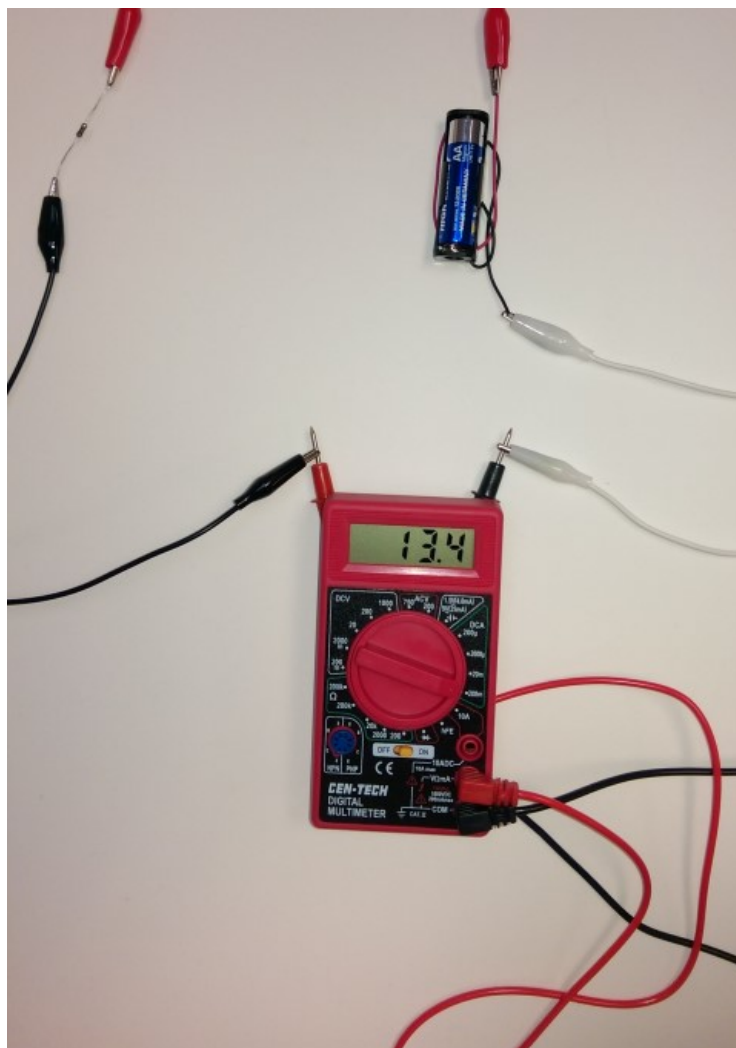
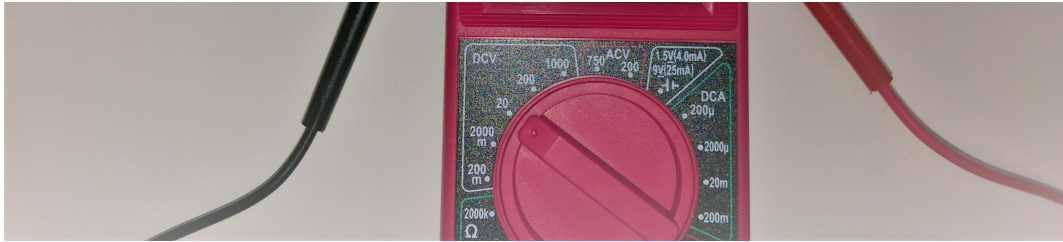


Photo 2: Potential Difference Across Resistor
(SAMPLE ANSWER BELOW)





Competency Review

An electrical circuit is a closed loop containing a(n) ____.

- ☐ conducting material
- ☐ energy supply
- ☐ load
- ☐ All of the above



The measurement of current in a circuit is expressed in ____.

- ☐ amperes ✓
 - ☐ ohms
 - ☐ voltage
 - ☐ All of the above
-

Ohm's law states that current and potential difference are directly proportional in a circuit.

- ☐ True ✓
 - ☐ False
-

Ohm's law can calculate the ____ of a circuit.

- ☐ current
 - ☐ potential difference
 - ☐ resistance
 - ☐ All of the above ✓
-

Ohm's law can be demonstrated by ____ of a simple circuit.

- ☐ measuring the current
 - ☐ measuring the potential difference
 - ☐ varying the energy source
 - ☐ All of the above ✓
-

A digital multimeter measures ____.

- ☐ current
 - ☐ voltage
 - ☐ resistance
 - ☐ All of the above ✓
-

Jumper cables function as a(n) ____ in a simple circuit.

- ☒ conducting pathway ✓
- ☐ energy source
- ☐ load source
- ☐ All of the above

____ is measured by touching the leads of a multimeter to each side of a battery in a simple circuit.

- ☐ Current
- ☐ Resistance
- ☒ Voltage ✓
- ☐ All of the above

Adding batteries to a simple circuit increases the resistance of the circuit.

- ☐ True
- ☒ False ✓

A circuit has a potential difference of 2.50 V and a current of 0.050 A. The resistance of the circuit is ____ Ω .

- ☐ 0.020
- ☐ 0.125
- ☐ 2.550
- ☒ 50.0 ✓

Extension Questions

A current of 0.001 A can be felt by the human body. 0.005 A can produce a pain response. 0.015 A can cause a loss of muscle control. In the procedures of this lesson, over 0.030 A of current traveled in the three-battery circuit. Why was this circuit safe to handle with dry hands? Include the resistance of human skin in your answer. (SAMPLE ANSWER BELOW)

The resistance of dry human skin is approximately $100,000\ \Omega$. Applying Ohm's law, this would reduce the current entering the body by a factor of 100,000 since current is inversely proportional to resistance. If 0.030 A were present in the touched circuit, only 0.00000030 A could potentially enter the body.