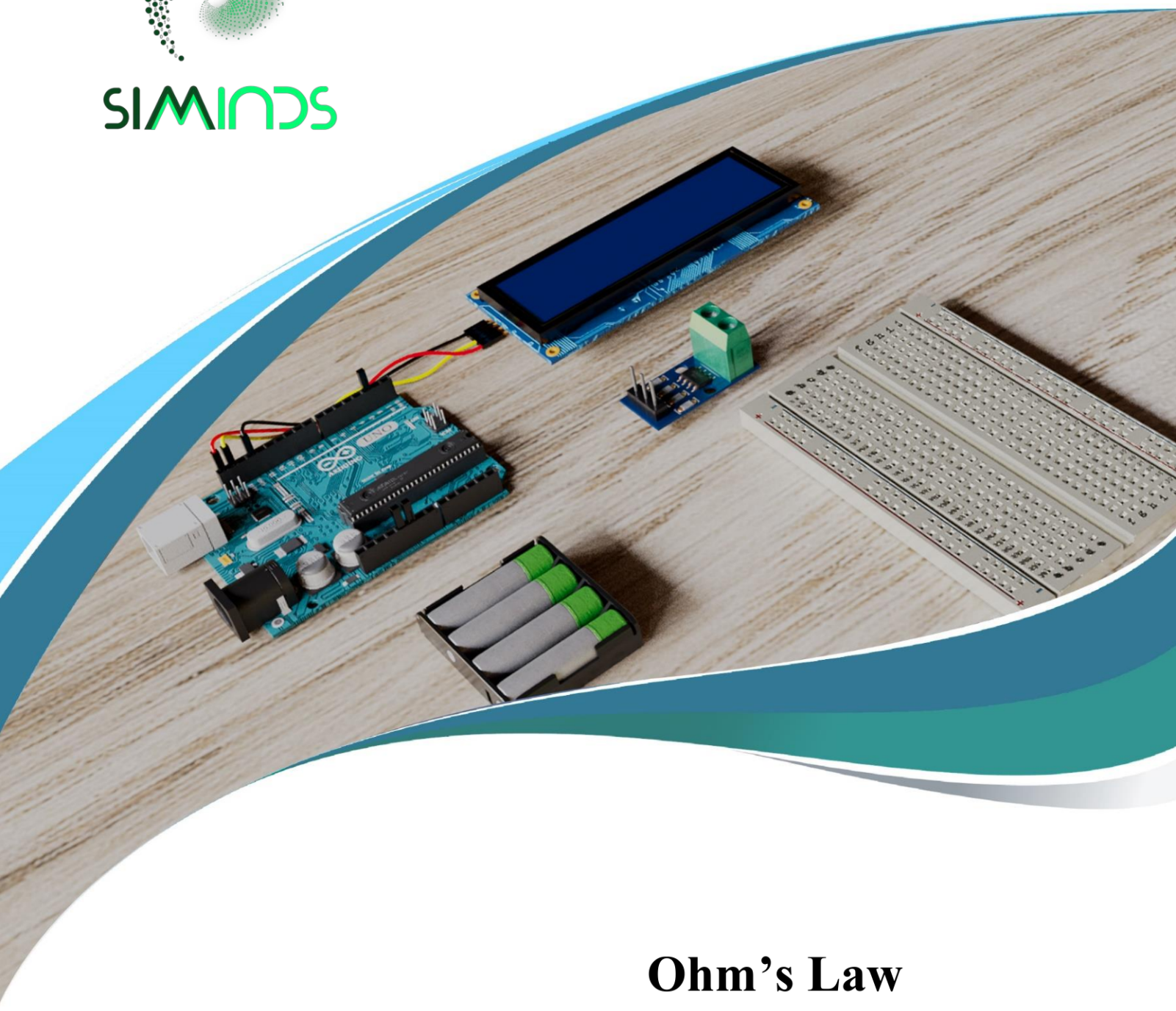
2022 – 2023



Ohm’s Law

Student version

STKS – Subject - V 1.0

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This experiment has been designed and developed as one component of the comprehensive vision of active learning programs presented by the ***Siminds***.

As the education system becomes more technology inclusive, it is important for students to keep up with recent digital trends while still gaining a deep understanding of course content. And from this concept, this experiment is intended to enhance the students' learning experience in their educational subjects by presenting the scientific materials in a simple and easy way, as well as promote students to use high-tech equipment as digital measuring sensors and microcontrollers.

Implementing technology into the curriculum provides teachers with an invaluable opportunity to enhance student engagement and academic success.

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⚠	Here are the basic safety rules that you might need while dealing with the lab kit. You should follow this safety guide in each experiment.

Basic Safety Rules

	Always wear safety glasses.
	Always wear the appropriate gloves.
	Always wear the lab coat
	After performing an experiment, always wash your hands with soap and water.
	During the experiment, make sure to keep your hands away from your body, mouth, eyes and face.

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Experimental Variables

In this experiment, we attempt to determine a cause-effect relationship between two or more variables, in other words, to determine if one variable has an effect on another variable. **Variables** are factors that can be manipulated, controlled for or measured in an experiment. The main variables in a science experiment are the independent, dependent and extraneous variables.

Independent Variable (IV):is a factor or condition that is manipulated, change in the experiment to measure its effect on the participant response (dependent variable).

Dependent Variable (DV): is a factor that is observed or measured in the experiment (outcome of the experiment). It is called the DV because whether or not it will change and the way in which it changes is dependent on the IV. In the cause-effect relationship, the IV is the possible cause, while changes in the DV is the possible effect.

Controlled Variables (CV): are extra factors that may influence the outcome of the experiment, even though they are not the focus of the experiment. These variables assumed to be controlled during the experiment to make it a fair test; to ensure that the change in the dependent variable is due to the change in the independent variable. Here are some examples of different types of Controlled variables:

- **Aspects of the environment** where the data collection will take place, e.g., room temperature, background noise level, light levels.
- **Test operator, or experimenter behavior** during the test. e.g., their instructions to the test participants should be consistent.

In this experiment the:

1. Independent variable is Resistance
2. Dependent variable is Current
3. Controlled variables are Battery Voltage, Temperature of wires and environment, Wire Dimensions

Vocabulary

- **Electric Current:** A flow of any charged particles such as electrons, protons, ions through a conducting material is known as electric current. Electric current is measured in Amperes or Amps which denoted by the letter 'A'. Current is read by opening the circuit and connecting the Ammeter in series.
- **Direct Current (DC):** The unidirectional flow of electric charge. Direct current is generated by such sources as batteries, thermocouples, solar cells, and commutator-type dynamo electrical machine.
- **Ammeter / Current Sensor:** A device that measures current flowing through the circuit.
- **Voltage / Potential Difference:** The amount of potential energy between two points on a circuit. One point has more charge than another. This difference in charge between the two points is called voltage. Voltage drop is measured in Volts which denoted by 'V' letter. Voltage is read using the Voltmeter connected in parallel.
- **Voltmeter / Voltage Sensor:** A device that measures the amount of energy per charge between two points.
- **Resistance:** The opposition of a substance to current passing through it, resulting in a change of electrical energy into heat, light, or another form of energy. Resistance is measured in Ohms. The resistance of an ohmic device is constant.
- **Series Circuit:** Circuit that only has one path for the electrons to flow.
- **Parallel Circuit:** A circuit that has two or more branches for separate currents from one voltage source.

Objective(s):

Apply Ohm's law

Abstract:

This experiment aims to investigate the relation between resistance and current in a simple circuit. The independent variable of this experiment is the resistance, the dependent variable is the current, and the constant variables are as follows: Battery voltage, temperature of wire and environment and wire dimensions. First, connections between the Arduino and the LCD are established to be able to see the results from the sensors. Then, connections between the voltage and the current sensors to the Arduino Uno board are established. After that, the first resistor is connected to the breadboard. Then the resistor is connected in series with the current sensor and in parallel with the voltage sensor. Then the results are checked on the LCD and validated. After that the old resistor is removed and replaced with a new one. Then the results are checked on the LCD and validated. After that the old resistor is removed once again and replaced with a new one. Then the results are checked on the LCD and validated. Finally, with our results, a graph is to be drawn to see the relation between the value of the resistances and the values of the currents.

Materials/Equipment

Table 1:Experiment supplies for student		
i. Items provided in student's kit		
No.	**Item**	**Qty**
1	Arduino Controller	1
2	I2C Liquid Crystal Display (LCD) module	1
3	Power Supply - 6V Battery Holder	1
4	Breadboard	1
5	Color Coded Resistors	3
6	Voltage Sensor	1
7	Current Sensor	1
7	Jumper Wire (Male – Male)	4
	Jumper Wire (Male – Female)	6
ii. Items not provided in student's kit		
No.	**Item**	**Qty**
1	Calculator	1
2	AA Battery (1.5V)	4
3	Wire Stripper	1

Theory

Ohm's law states that the electrical current through a conductor is proportional to the potential difference across it. Furthermore, the electrical resistance of the conductor is constant. Figure (1) illustrates the I-V curve for a resistor of 1 Ω subjected to a current of 1 A has a voltage difference of 1 V across its terminals.

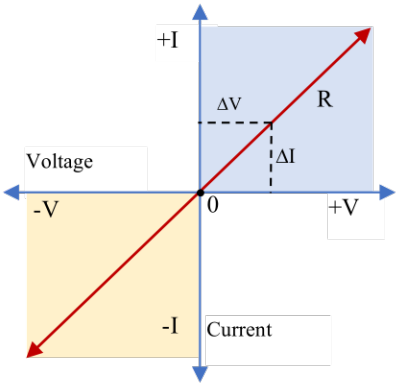

Figure 1:Relation Between Voltage And Current

$$R = \frac{V}{I} \quad (\Omega)$$

Ohm's formula can be used when two of three variables are known. The relation between resistance, current and voltage can be written in different ways.

Resistors are passive elements that introduce resistance to the flow of electric current in a circuit. A resistor that functions according to Ohm's law is called an Ohmic resistor. When a current passes through an Ohmic resistor, the voltage drop across the terminals is directly proportional to the magnitude of resistance. Ohm's formula is also valid for circuits with varying voltage or current, so it can be used for alternating current (AC) circuits as well. For capacitors and inductors, Ohm's law cannot used since their I-V curves are inherently not linear (Non-Ohmic).

Ohm's formula is valid for circuits with multiple resistors that can be connected in series, parallel or both. Groups of resistors in series or parallel can be simplified with an equivalent resistance.