

Ohms Law

In a conductor where a electric field is established electrons are free to move. The electrons move from a place where their electrical potential is high to a place where they have less electrical potential, the electrons are said to flow at this time. This is analogous to water flowing through a pipe or hose. The water will flow from a place of higher potential energy to a place of lower potential energy.

The flow of electrons is called the **electric current**. Current is represented by , **I**, and has units of **amps**. Current is the amount of electric charge which flows in a second.

Other terms to become familiar with are **volts and voltage**, which are terms associated with **electric potential difference** and represented by **V** the units are called volts and uses the term v. A battery is a voltage source, when a wire is connected across the two terminals of the battery a current is established and flows in one direction. The common convention is to say that current flows from the positive terminal to the negative terminal.

How much current can flow in a wire is determined by the **resistance** the electrons encounter in that wire. Resistance which is represented by **R** and has units called **ohms** which uses the term Ω . Different type of wires have different resistances. Generally a wire with small resistance per foot are used to minimize the wire resistance to the flow of current.

An element known as a resistor is used to restrict the flow of current generally to do some specific function. The heating elements in a hair dryer or on the cooking range are types of resistors. The amount of current allowed to flow through the resistor is determined by the voltage across the resistor and the resistance of the resistor. The formula to determine the current is known as **Ohms Law** and is

$$I = V/R$$

Power is the amount of current which flows through a potential difference(voltage). Power uses the term .P and has units of **Watts** which uses the term W. To determine the power used by a device multiply the current the device draws by the voltage across the device

$$P = I * V$$

Terms	represented by	Units	represented by
Current	I	amps	a
Voltage	V or E	volts	v
Resistance	R	ohms	Ω
Power	P	Watts	W

In this lab we will measure the voltage and current across and through different unknown resistors to determine the resistance and then calculate the power dissipated across each resistor. Lastly we will devise equations to determine Power using resistance and current and voltage and resistance.

When resistors are connected in series, as in Figure 1, an equivalent total resistance, R_{ser} can be found

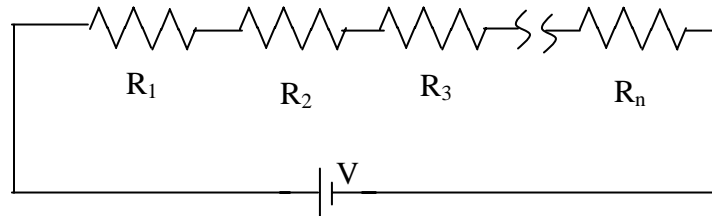


Figure 1

where $R_{ser} = R_1 + R_2 + R_3 + \dots + R_n$

Also when resistors are connected in parallel as in Figure 2 an equivalent total resistance, R_{par} can be found

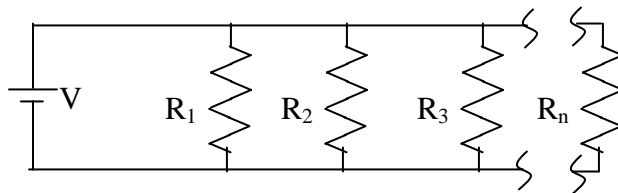


Figure 2

where

$$\frac{1}{R_{par}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots + \frac{1}{R_n}$$

Equipment:

Voltmeter
Power Supply

current meter (digital Wavtek Model 15XL)
Unknown resistors box

Procedure

1. Connect a wire from the + (Red) power supply to R_1 of the black box and connect a wire from the (3) terminal on the voltmeter to this same point. Connect a wire from the – terminal of the voltmeter to the other terminal of R_1 and place the red probe of the current meter to this terminal.
2. Place the black probe of the current meter to the negative terminal of the power supply (black). Turn the dial on the power supply completely counter clockwise to the zero position. Turn on the power supply.
3. Adjust the knob on the power supply until the voltmeter displays one volt. **(Use the scale on the bottom)**. Read the current and record onto the data table. Calculate the resistance and the power. Complete the data table for R_1 .

4. Repeat the steps 1 through 3 for each resistor of the unknown resistance box.
5. Connect R_1 and R_2 in series determine the series resistance. Measure and record the current at 2VDC.
Repeat for R_1 , R_2 and R_3 connected in series.
Repeat for R_1 , R_2 , R_3 and R_4 connected in series
6. Repeat step 5 for the resistors connected in parallel.

Data Sheet

Box # _____

	voltage setting	measured current	calculated resistance	calculated power
R ₁	1			
	2			
	3			
R ₂	1			
	2			
	3			
R ₃	1			
	2			
	3			
R ₄	1			
	2			
	3			

Resistors in series and parallel.
at 2 V DC

Resistor combination	Calculated Series Resistance	Measured Current I	Calculated Current I	Calculated Parallel Resistance	Measured Current I	Calculated Current I
R ₁ and R ₂						
R ₁ , R ₂ and R ₃						
R ₁ , R ₂ , R ₃ and R ₄						

What relationship can be seen between the voltage and current for any given resistor?

As resistors are connected in series what happens to the current in the circuit?

As resistors are connected in parallel what happen to the current in the circuit?