

# **Technician License Course**

## **Chapter 3.1**

# **Electricity, Components and Circuits**

Lesson Plan Module 5

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# Fundamentals of Electricity

- When dealing with electricity, what we are referring to is **the flow of electrons through a conductor**.
  - Electrons are **negatively charged** atomic particles.
    - The opposite charge is the positive charge (holes)
  - A conductor is a material that allows electrons to move with relative freedom within the material.

# Fundamentals of Electricity

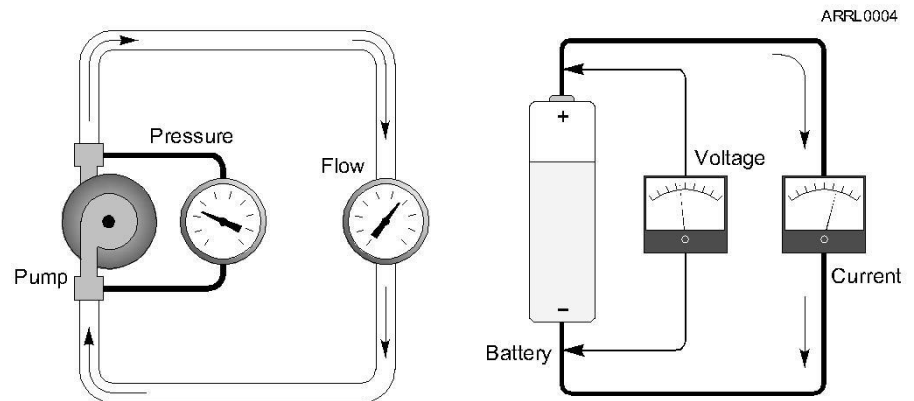
- In electronics and radio, **we control the flow of electrons** to make things happen.
- You need to have a basic understanding of how and why we control the flow of electrons so that you can better operate your radio.

# Basic Characteristics of Electricity

- There are three characteristics of electricity:
  - **Voltage**
  - **Current**
  - **Resistance**
- All three must be present for electrons to flow.

# Basic Characteristics of Electricity

- The **flow of water through a hose** is a good analogy to understand the three characteristics of electricity and how they are related.



# Characteristics of Electricity are Inter-related

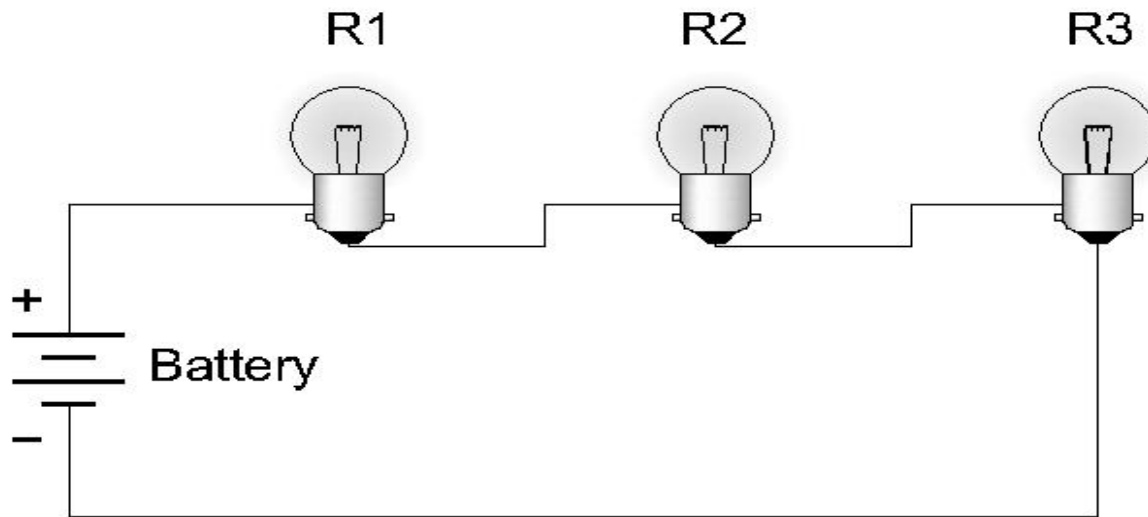
- **Voltage, current and resistance** must be present to have current flow.
- Just like water flowing through a hose, **changes in voltage, current and resistance affect each other.**
- That effect is mathematically expressed in **Ohm's Law.**

# The Electric Circuit: An Electronic Roadmap

- For current to flow, there must be a path from one side of the source of the current to the other side of the source – this **path is called a circuit**.
  - There must be a hose (conductive path) through which the water (current) can flow.
- The following are some vocabulary words that help describe an electronic circuit.

# Series Circuits

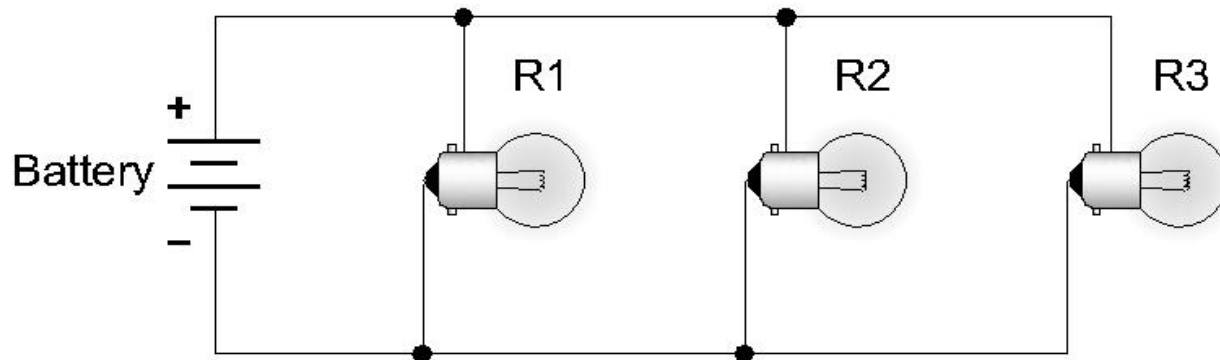
- **Series circuits** provide one and only one path for current flow.



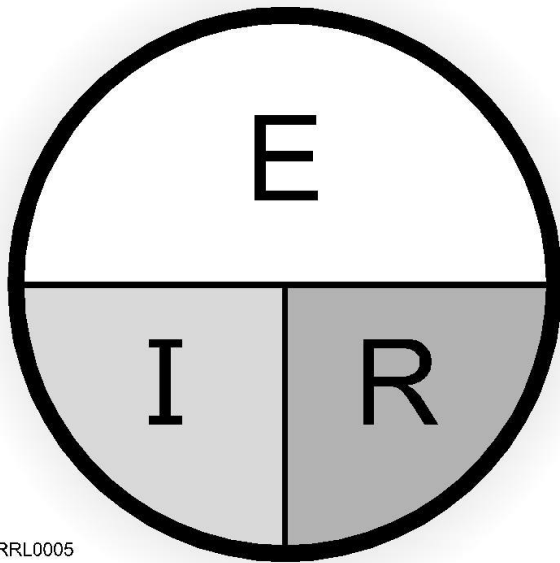


# Parallel Circuits

- **Parallel circuits** provide alternative paths for current flow.



# Ohm's Law



- E is voltage
  - Units - volts
- I is current
  - Units - amperes
- R is resistance
  - Units - ohms
  
- $R = E/I$
- $I = E/R$
- $E = I \times R$
- **$E / (I \times R) = 1$**

# Moving Electrons Doing Something Useful

- Any time energy is expended to do something, work is performed.
- When moving electrons do some work, power is consumed.
- **Power** is measured in the units of **watts (W)**.

# Power Formula

- Power is defined as the amount of current that is being pushed through a conductor or device to do work.
  - $P = E \times I$
  - $E = P/I$
  - $I = P/E$
  - **$P / (E \times I) = 1$**

# Two Basic Kinds of Current

- When **current flows in only one direction**, it is called **direct current (dc)**.
  - Batteries are a common source of dc.
  - Most electronic devices are powered by dc.
- When **current flows alternatively** in one direction then in the opposite direction, it is called **alternating current (ac)**.
  - Your household current is ac.

What term describes the number of times per second that an alternating current reverses direction? (T3B02)

- \* A. Pulse rate
- \* B. Speed
- \* C. Wavelength
- \* D. Frequency

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Electrical current is measured in which of the following units? (T5A01)

- \* A. Volts
- \* B. Watts
- \* C. Ohms
- \* D. Amperes



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What is the name for the flow of electrons in an electric circuit? (T5A03)

- \* A. Voltage
- \* B. Resistance
- \* C. Capacitance
- \* D. Current

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What is the name for a current that flows only in one direction? (T5A04)

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Which of the following is a good electrical conductor? (T5A07)

- \* A. Glass
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What is the name for a current that reverses direction on a regular basis? (T5A09)

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- \* D. Voltage



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# What is the basic unit of electromotive force? (T5A11)

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# What is the formula used to calculate electrical power in a DC circuit? (T5C08)

- \* A. Power (P) equals voltage (E) multiplied by current (I)
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# What formula is used to calculate voltage in a circuit? (T5D02)

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# What formula is used to calculate resistance in a circuit? (T5D03)

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Which instrument would you use to measure electric potential or electromotive force?  
(T7D01)

- \* A. An ammeter
- \* B. A voltmeter
- \* C. A wavemeter
- \* D. An ohmmeter

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# What is the correct way to connect a voltmeter to a circuit? (T7D02)

- \* A. In series with the circuit
- \* B. In parallel with the circuit
- \* C. In quadrature with the circuit
- \* D. In phase with the circuit

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# How is an ammeter usually connected to a circuit? (T7D03)

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# Which instrument is used to measure electric current? (T7D04)

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- \* A. An oscilloscope
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- \* C. A noise bridge
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# Which of the following might damage a multimeter? (T7D06)

- \* A. Measuring a voltage too small for the chosen scale
- \* B. Leaving the meter in the milliamps position overnight
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Which of the following measurements are commonly made using a multimeter? (T7D07)

- \* A. SWR and RF power
- \* B. Signal strength and noise
- \* C. Impedance and reactance
- \* D. Voltage and resistance



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What is probably happening when an ohmmeter, connected across a circuit, initially indicates a low resistance and then shows increasing resistance with time? (T7D10)

- \* A. The ohmmeter is defective
- \* B. The circuit contains a large capacitor
- \* C. The circuit contains a large inductor
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Which of the following precautions should be taken when measuring circuit resistance with an ohmmeter? (T7D11)

- \* A. Ensure that the applied voltages are correct
- \* B. Ensure that the circuit is not powered
- \* C. Ensure that the circuit is grounded
- \* D. Ensure that the circuit is operating at the correct frequency

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