Technician License Course

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Chapter 3

Lesson Plan Module - 4

Electricity

Fundamentals of Electricity

- Radios are powered by electricity and radio signals are a form of electrical energy.
- A basic understanding of how we control electricity allows you to better install and operate your radio.

Fundamentals of Electricity

- Electrical charge can be positive or negative.
  - Opposite charges attract each other
- Electrical current is the flow of *electrons*.
  - Electrons are negatively-charged atomic particles, usually surrounding an atom's positively-charged nucleus of protons (positive) and neutrons (neutral – no charge)
  - Electrons move in response to an *electromotive force* and can move independently of atoms

Basic Electrical Concepts

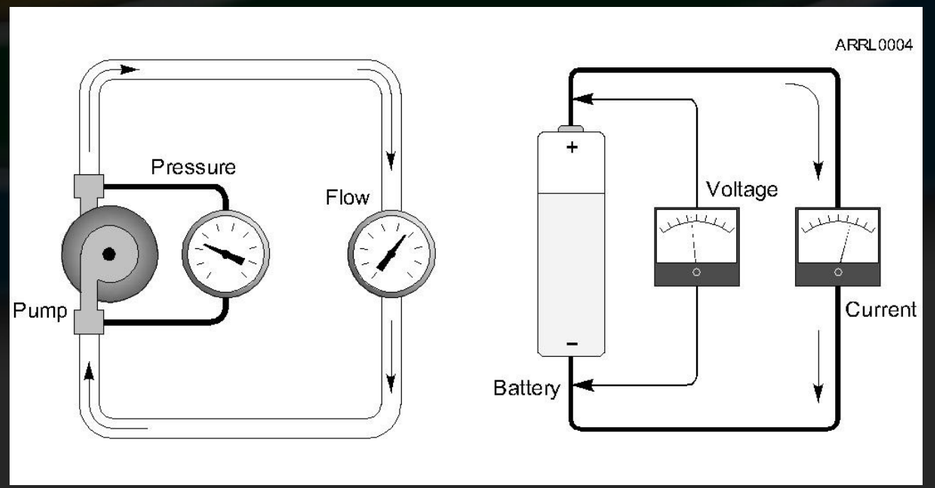
- Current: the movement of electrons, measured in *amperes* (A) by an *ammeter*, and represented by *I* in formulas
- Voltage: the amount of electromotive force (emf), also called *electrical potential*, measured in *volts* (V) by a *voltmeter*, represented by *E* or *V* in formulas

Basic Electrical Concepts

- Resistance: the opposition to the movement of electrons, measured in *ohms* (Ω) by an *ohmmeter* and represented by R in formulas.
- Resistance is like friction and turns electrical energy into heat when current flows.
- *Conductors* permit current flow (low resistance) and *insulators* block current flow (high resistance).

Basic Electrical Concepts

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

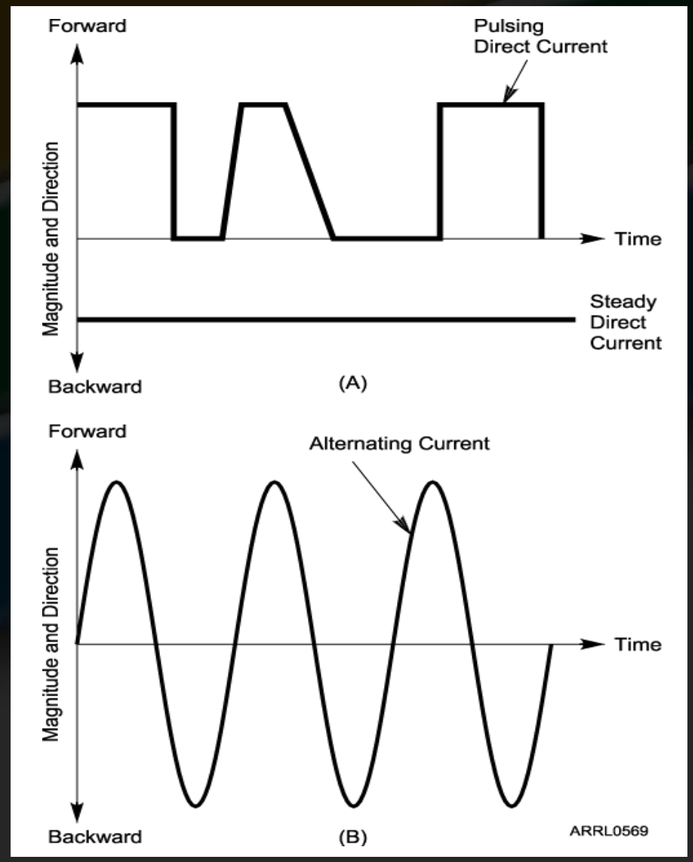


Basic Electrical Concepts

- Voltage from a *source* of electrical energy causes current to flow.
- Resistance is a material's opposition to the flow of current.
- Voltage, current and resistance affect each other. For example, higher voltage (bigger push) causes more current (more flow).

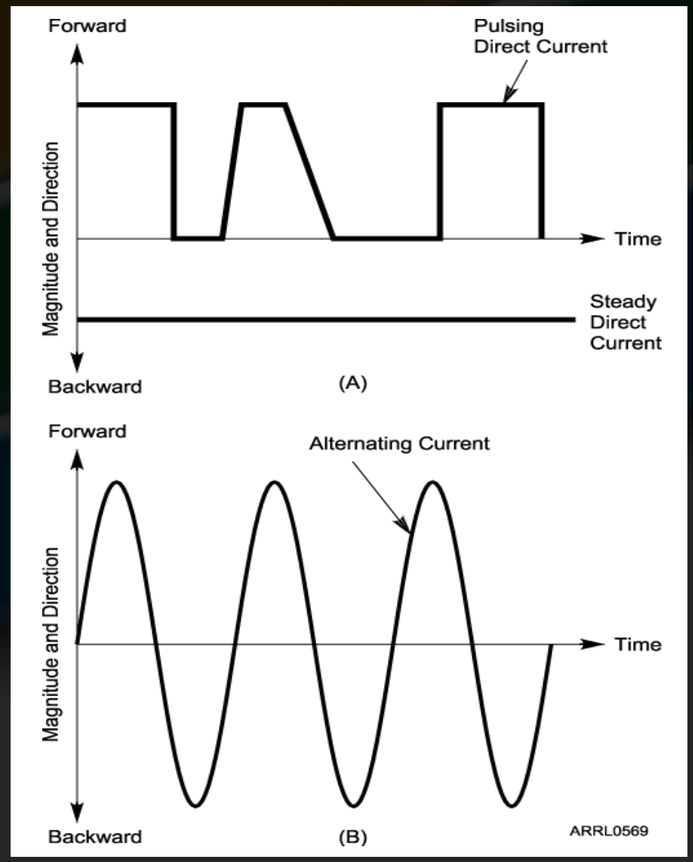
The Two Kinds of Current

- Current that flows in only one direction, is called direct current (DC).
  - Batteries are a common source of DC.
- Current that flows in one direction then in the opposite direction is called alternating current (AC).
  - Household current is AC



The Two Kinds of Current

- AC current reverses direction on a regular basis
  - –Each process of reversing is a *cycle*.
  - –The number of cycles per second is *frequency*, measured in hertz (Hz).
- 1 Hz = 1 cycle per second



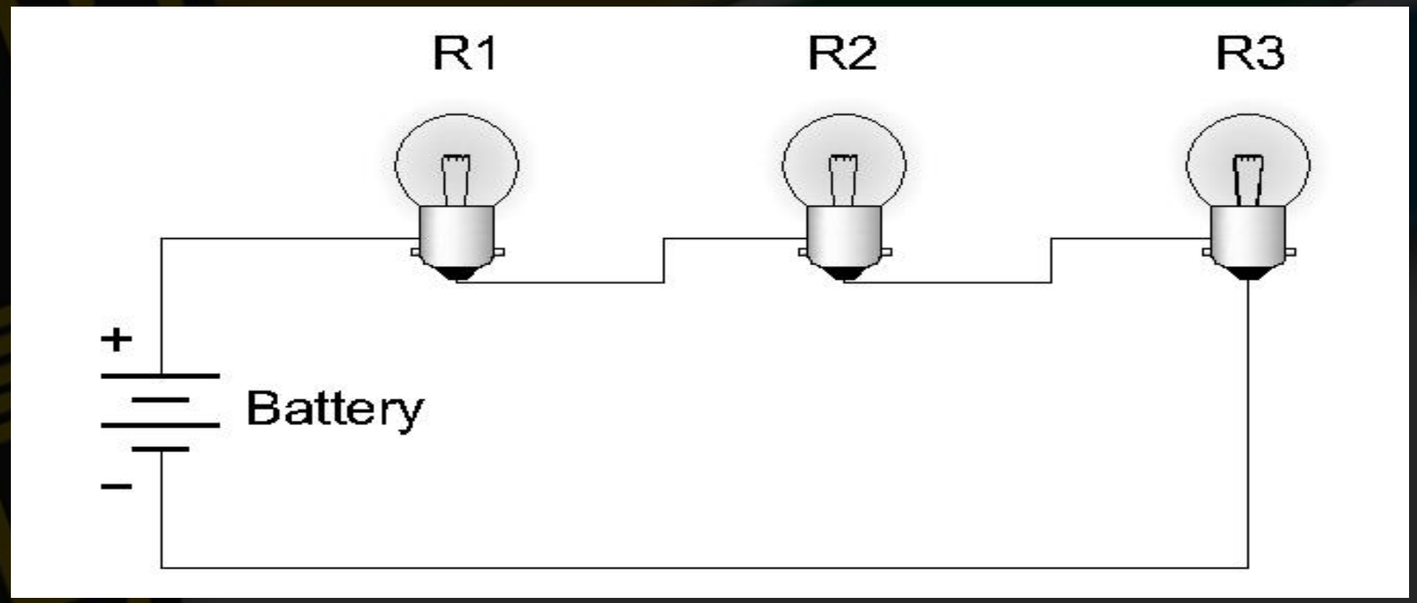
The Electric Circuit:
An Electronic Roadmap

The Electric Circuit: An Electronic Roadmap

- For current to flow, there must be a path from one side of the energy source to the other side of the source – this path is called a *circuit*.
  - There must be a pipe (conductive path) through which the water (current) can flow.
- There are two types of electric circuits.
  - Series and parallel

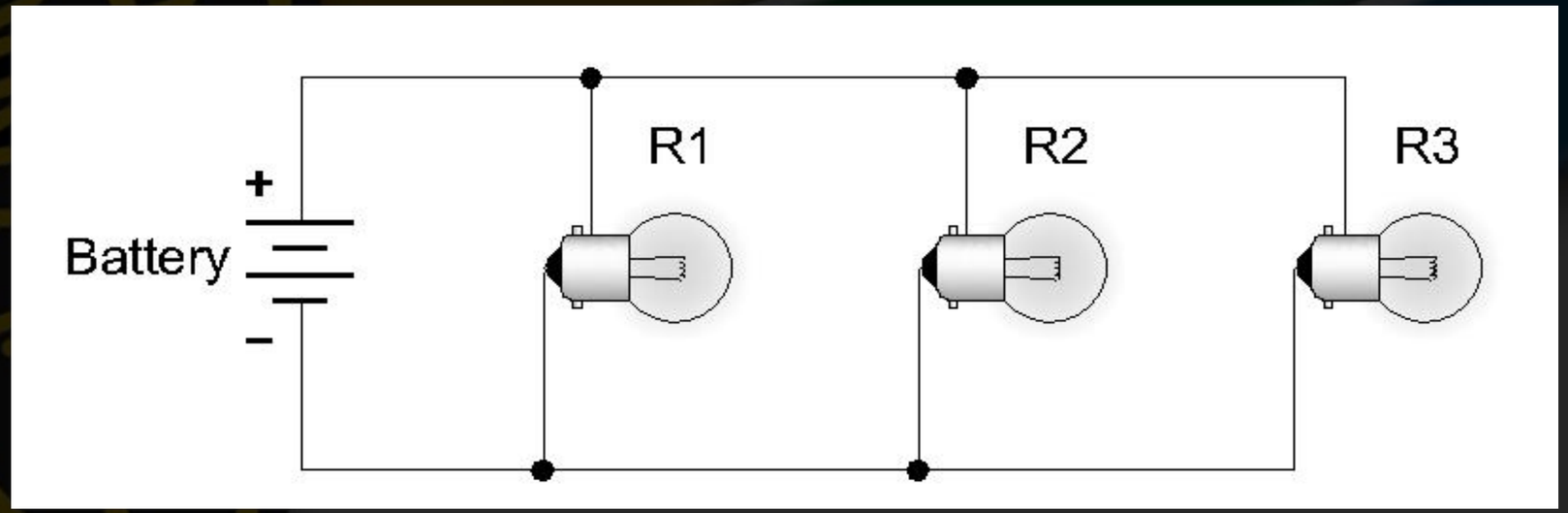
Series Circuits

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



Parallel Circuits

- Parallel circuits provide multiple paths for current flow.



Practice Questions

Electrical current is measured in what unit?

Electrical current is measured in what unit?

Amperes

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

What is the name for the flow of electrons in an electric circuit

Amperes

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

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

Direct current

What is the electrical term for the electromotive force (EMF) that causes electron flow?

What is the electrical term for the electromotive force (EMF) that causes electron flow?

Voltage

What is a good electrical conductor?

What is a good electrical conductor?

Copper

What is a good electrical insulator?

What is a good electrical insulator?

Glass

What is the name for a current that reverses direction on a regular basis?

What is the name for a current that reverses direction on a regular basis?

Alternating current

What is the basic unit of electromotive force?

What is the basic unit of electromotive force?

The volt

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

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

Frequency

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

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

A voltmeter

What is the correct way to connect a voltmeter to a circuit?

What is the correct way to connect a voltmeter to a circuit?

In parallel with the circuit

How is an ammeter usually connected to a circuit?

How is an ammeter usually connected to a circuit?

In series with the circuit

Which instrument is used to measure electric current?

Which instrument is used to measure electric current?

An am[p]meter

What instrument is used to measure resistance?

What instrument is used to measure resistance?

An ohmmeter

What might damage a multimeter?

What might damage a multimeter?

Attempting to measure voltage when using the resistance setting

What measurements are commonly made using a multimeter?

What measurements are commonly made using a multimeter?

Voltage and resistance

What precautions should be taken when measuring circuit resistance with an ohmmeter?

What precautions should be taken when measuring circuit resistance with an ohmmeter?

Ensure that the circuit is not powered

What precaution should be taken when measuring high voltages with a voltmeter?

What precaution should be taken when measuring high voltages with a voltmeter?

Ensure that the circuit is grounded through the voltmeter

End of Module 4