Technician Licensing Class

Electrons Go With the Flow!

Presented by
ELEMENT 2 SUB-ELEMENTS
(Groupings)

- About Ham Radio
- Call Signs
- Control
- Mind the Rules
- Tech Frequencies
- Your First Radio
- Going On The Air!
- Repeaters
- Emergency!
- Weak Signal Propagation
ELEMENT 2 SUB-ELEMENTS (Groupings)

- Talk to Outer Space!
- Your Computer Goes Ham Digital!
- Multi-Mode Radio Excitement
- Run Some Interference Protection

Electrons - Go With the Flow!
- It’s the Law, per Mr. Ohm!
- Go Picture These!
- Antennas
- Feed Me with Some Good Coax!
- Safety First!
Electrons – Go With the Flow!

- **T5A5** Voltage is the electrical term for the electromotive force (EMF) that causes electron flow.
  - Think of voltage as water pressure in the pipes (not the flow)

- **T5A11** The volt is the basic unit of electromotive force.

- **T7D1** A voltmeter is an instrument you would use to measure electric potential or electromotive force.

- **T7D2** The correct way to connect a voltmeter to a circuit is in parallel with the circuit.
  - Car battery is measured in parallel
  - House wall sockets are measured in parallel
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Measure at the equipment to factor in any loss in cables from power source.

Power Supply

Voltmeter

Transceiver
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- **T6A10** 1.2 volts is the nominal voltage of a fully charged nickel-cadmium cell.

- **T6A11** A carbon-zinc battery type is not rechargeable.
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- **T5A6** A mobile transceiver usually requires about 12 volts.
- **T4A11** A mobile transceiver’s power negative connection should be made at the battery or engine block ground strap.
  - Ham radio power leads need to be connected directly at the battery source.
- **T5A3** Current is the name for the flow of electrons in an electric circuit.
  - Think of the flow of water in a pipe (not the force)
- **T7D4** An ammeter is an instrument used to measure electric current.

![Diagram](image)
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- **T7D3** An ammeter is connected to a circuit in series with the circuit.
- **T5A1** Electrical current is measured in amperes.
- **T5A7** Copper is a good electrical conductor.
- **T5A9** Alternating current is the name for a current that reverses direction on a regular basis.

![AC & DC voltages](image)
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- The term that describes the number of times per second that an alternating current reverses direction is frequency.
• **T6D1** Rectifier devices or circuits change an alternating current into a varying direct current signal.

Power supply contains: Transformer, rectifier (diodes), filter choke, capacitors, and regulators.

This circuitry converts the house 120 VAC to varying DC and that is filtered and smoothed out to produce DC current that we need for our ham radio equipment.
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- **Direct current** is the name for a current that flows only in one direction.
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- **T6B2** A diode is an electronic component that allows current to flow in only one direction.
  - Rectification is process of changing AC to pulsating DC
  - Diode stops current flow when it tries to go in the reverse direction

- **T6B9** Anode and cathode are the names of the two electrodes of a diode.

- **T6B6** A semiconductor diode’s cathode lead usually identified with a stripe.

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**Semiconductor Diode**

![Semiconductor Diode Diagram](image1)

**Zener Diode**

![Zener Diode Diagram](image2)

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Here is the schematic symbol of a diode. Current will only flow ONE WAY in a diode. You can remember this diode diagram as a one-way arrow (key words).

Here is the schematic symbol of a Zener diode. Since a diode only passes energy in one direction, look for that one-way arrow, plus a “Z” indicating it is a Zener diode. Doesn’t that vertical line look like a tiny “Z”?

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Current will only flow ONE WAY in a diode. You can remember this diode diagram as a one-way arrow (key words).

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Here is the schematic symbol of a Zener diode. Since a diode only passes energy in one direction, look for that one-way arrow, plus a “Z” indicating it is a Zener diode. Doesn’t that vertical line look like a tiny “Z”?
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• **T6A1** A resistor is the electrical component used to oppose the flow of current in a DC circuit.

• **T7D5** An ohmmeter is an instrument used to measure resistance.

A D’Arsonval-type meter uses a mechanical needle to indicate the test results. Both use internal batteries.

Caution: NEVER measure voltage or current in the Ohm position.
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- T6A2 The potentiometer is the type of component often used as an adjustable volume control.

- T6A3 Resistance is the electrical parameter controlled by a potentiometer.

- T5A8 Glass is a good electrical insulator.
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- **T6A6** An inductor is the type of electrical component that stores energy in a magnetic field.
- **T6A7** The inductor is an electrical component usually composed of a coil of wire.

- **T5C3** The ability to store energy in a magnetic field is called inductance.
- **T5C4** The basic unit of inductance is the henry.
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- T5C1 The ability to store energy in an electric field is called capacitance.
- T5C2 The basic unit of capacitance is the farad.
- T6A4 A capacitor is the electrical component that stores energy in an electric field.

Typical construction and schematic symbol for capacitors.

Various types of capacitors.
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- **T6A5** The capacitor is the type of electrical component consisting of two or more conductive surfaces separated by an insulator.
  - Paper, glass, air, etc...

- **T6A8** A switch is an electrical component that is used to connect or disconnect electrical circuits.

- **T6A9** A fuse is an electrical component used to protect other circuit components from current overloads.

Toggle Switch  
Slide Switch  
Rocker Switch  
Slow Blow Fuse  
Automobile Fuse  
Schematic Symbol
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• **T6B3** A transistor is a component that can be used as an electronic switch or amplifier.

• **T6B1** Transistors are a class of electronic components capable of using a voltage or current signal to control current flow.
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Transistor Basics
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- **T6B5** The transistor is an electronic components that can amplify signals.
- **T6B12** Gain is the term that describes a transistor's ability to amplify a signal.
- **T6B10** The bipolar transistor semiconductor component has an emitter electrode.
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- **T6B4** The bipolar junction transistor is a component that is made of three layers of semiconductor material.

- **T6B8** The abbreviation "FET" stands for Field Effect Transistor.

- **T6B11** The field effect transistor semiconductor component has a gate electrode.
Element 2 Technician Class
Question Pool

Electrons Go With the Flow!

Valid July 1, 2010
Through
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What is the electrical term for the electromotive force (EMF) that causes electron flow?

A. Voltage
B. Ampere-hours
C. Capacitance
D. Inductance
What is the basic unit of electromotive force?

A. The volt
B. The watt
C. The ampere
D. The ohm
T7D01  Which instrument would you use to measure electric potential or electromotive force?

A. An ammeter
B. A voltmeter
C. A wavemeter
D. An ohmmeter
What is the correct way to connect a voltmeter to a circuit?

A. In series with the circuit
B. In parallel with the circuit
C. In quadrature with the circuit
D. In phase with the circuit
What is the nominal voltage of a fully charged nickel-cadmium cell?

A. 1.0 volts
B. 1.2 volts
C. 1.5 volts
D. 2.2 volts
T6A11  Which battery type is not rechargeable?

A. Nickel-cadmium
B. Carbon-zinc
C. Lead-acid
D. Lithium-ion
How much voltage does a mobile transceiver usually require?

A. About 12 volts  
B. About 30 volts  
C. About 120 volts  
D. About 240 volts
Where should a mobile transceiver’s power negative connection be made?

A. At the battery or engine block ground strap
B. At the antenna mount
C. To any metal part of the vehicle
D. Through the transceiver’s mounting bracket
What is the name for the flow of electrons in an electric circuit?

A. Voltage
B. Resistance
C. Capacitance
D. Current
Which instrument is used to measure electric current?

A. An ohmmeter  
B. A wavemeter  
C. A voltmeter  
D. An ammeter
How is an ammeter usually connected to a circuit?

A. In series with the circuit
B. In parallel with the circuit
C. In quadrature with the circuit
D. In phase with the circuit
Electrical current is measured in which of the following units?

A. Volts
B. Watts
C. Ohms
D. Amperes
Which of the following is a good electrical conductor?

A. Glass
B. Wood
C. Copper
D. Rubber
What is the name for a current that reverses direction on a regular basis?

A. Alternating current
B. Direct current
C. Circular current
D. Vertical current
What term describes the number of times per second an alternating current reverses direction?

A. Pulse rate  
B. Speed  
C. Wavelength  
D. Frequency
Which of the following devices or circuits changes an alternating current into a varying direct current signal?

A. Transformer  
B. Rectifier  
C. Amplifier  
D. Reflector
What is the name for a current that flows only in one direction?

A. Alternating current
B. Direct current
C. Normal current
D. Smooth current
What electronic component allows current to flow in only one direction?

A. Resistor  
B. Fuse  
C. Diode  
D. Driven element
What are the names of the two electrodes of a diode?

A. Plus and minus
B. Source and drain
C. Anode and cathode
D. Gate and base
How is a semiconductor diode’s cathode lead usually identified?

A. With the word “cathode”
B. With a stripe
C. With the letter “C”
D. All of these choices are correct
What electrical component is used to oppose the flow of current in a DC circuit?

A. Inductor
B. Resistor
C. Voltmeter
D. Transformer
What instrument is used to measure resistance?

A. An oscilloscope
B. A spectrum analyzer
C. A noise bridge
D. An ohmmeter
What type of component is often used as an adjustable volume control?

A. Fixed resistor
B. Power resistor
C. Potentiometer
D. Transformer
T6A03  What electrical parameter is controlled by a potentiometer?

A. Inductance
B. Resistance
C. Capacitance
D. Field strength
Which of the following is a good electrical insulator?

A. Copper
B. Glass
C. Aluminum
D. Mercury
What type of electrical component stores energy in a magnetic field?

A. Resistor
B. Capacitor
C. Inductor
D. Diode
What electrical component is usually composed of a coil of wire?

A. Switch  
B. Capacitor  
C. Diode  
D. Inductor
What is the ability to store energy in a magnetic field called?

A. Admittance
B. Capacitance
C. Resistance
D. Inductance
What is the basic unit of inductance?

A. The coulomb  
B. The farad  
C. The henry  
D. The ohm
What is the ability to store energy in an electric field called?

A. Inductance  
B. Resistance  
C. Tolerance  
D. Capacitance
What is the basic unit of capacitance?

A. The farad
B. The ohm
C. The volt
D. The henry
What electrical component stores energy in an electric field?

A. Resistor
B. Capacitor
C. Inductor
D. Diode
What type of electrical component consists of two or more conductive surfaces separated by an insulator?

A. Resistor  
B. Potentiometer  
C. Oscillator  
D. Capacitor
What electrical component is used to connect or disconnect electrical circuits?

A. Zener diode
B. Switch
C. Inductor
D. Variable resistor
What electrical component is used to protect other circuit components from current overloads?

A. Fuse  
B. Capacitor  
C. Shield  
D. Inductor
Which of these components can be used as an electronic switch or amplifier?

A. Oscillator
B. Potentiometer
C. Transistor
D. Voltmeter
What class of electronic components is capable of using a voltage or current signal to control current flow?

A. Capacitors
B. Inductors
C. Resistors
D. Transistors
Which of the following electronic components can amplify signals?

A. Transistor
B. Variable resistor
C. Electrolytic capacitor
D. Multi-cell battery
What is the term that describes a transistor's ability to amplify a signal?

A. Gain
B. Forward resistance
C. Forward voltage drop
D. On resistance
Which semiconductor component has an emitter electrode?

A. Bipolar transistor  
B. Field effect transistor  
C. Silicon diode  
D. Bridge rectifier
Which of these components is made of three layers of semiconductor material?

A. Alternator
B. Bipolar junction transistor
C. Triode
D. Pentagrid converter
What does the abbreviation "FET" stand for?

A. Field Effect Transistor
B. Fast Electron Transistor
C. Free Electron Transition
D. Field Emission Thickness
T6B11 Which semiconductor component has a gate electrode?

A. Bipolar transistor
B. Field effect transistor
C. Silicon diode
D. Bridge rectifier