

Name: _____

Go With the Flow!

Part 1

Directions:

Follow along with the guided notes as your teacher presents them and fill in the activity sheet below.

Fundamentals of Electric Circuits

1. Circuit Terms

- a. _____: A complete circle of current flow. It consists of a source of electricity, one wire to carry the current from the source to where it will be used and another wire to carry it back, plus an object of rated resistance (for example, a lamp) to use the voltage.
- b. _____: Circuits beginning from the service entrance panel and branching out into a variety of places for a variety of purposes
- c. _____: Refers to a break in the circuit circle so that the current cannot flow through it
- d. _____: A current flow around the circuit resistance and back to the source so rapidly that fuses blow, wire insulation burns and batteries drain
- e. _____: The practice of providing an additional connection between a piece of electrical equipment and the earth with a conductor called a ground wire in case the current gets out of the circuit

2. Components of a Simple Two-Wire Circuit

- a. Wires: A simple circuit has a _____ wire and a _____ wire.
 - b. The white wire is known as the _____ or _____ wire because it is always connected to an underground water pipe or a ground rod through the service-entrance panel.
 - I. It must always run direct to every _____ outlet.
 - II. It must always be connected to a _____ terminal (silver-colored).
 - III. It never has a fuse or breaker.
 - IV. It never has a _____.
 - V. It must be electrically continuous.
- The _____ wire is referred to as the "hot" wire.
 - One black wire and one white wire must run to every _____.
 - Electrical potential always exists between the black wire and the white wire.
 - _____: These are boxes made of either metal or plastic, rectangular or octagonal in shape, which have the following functions:
 - I. They _____ the cable or conduit so stress cannot be placed on wire connections.
 - II. They are nailed, screwed or clamped to the building in order to support outlets, switches or fixtures.
 - III. They contain all wire connections made outside of _____.

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- _____: The most common outlet is the duplex receptacle wired so that both of its outlets are on the same circuit.
- Outlets are wired across the black wire and the white wire.
- The current enters the outlet on the black wire, flows from one screw through a metal strap to the other screw and continues on to the next _____.
- One outlet in a duplex receptacle may be switched by breaking the metal strap between the two screws, but they must be on the same _____.
- _____: They are bases or housings for light bulbs, fan motors and other such electrical devices.
- _____: They are electrical devices which provide a means to open a circuit to stop electron flow to outlets or lights and to close it again to allow current flow.
- The wire is usually black except in a _____.
- Their _____ and voltage ratings must match those of the circuit.
- Their number of poles indicates how many _____ wires feed through the switch.
- Their number of throws indicates from how many locations a switch can be operated.
- _____: Fuses and breakers are always wired to the black (hot) wire.
- _____: It is a switch placed ahead of the fuse in the hot wire where electricity enters the building.

3. Colors of Wires and Terminals in Structural Wiring

a. Colors of Wires

- _____ (sometimes natural gray) colored wire must be used only for the ground wire.
- Additional grounding conductors may be _____, green with one or more yellow stripes or a bare wire.
- Wiring for the "hot" wires may be any other color, but it is most frequently _____.
- The color schemes most often used for structural wiring are:
 - _____ -wire circuit: white and black
 - Three-wire circuit: _____, _____, _____
 - _____ -wire circuit: white, black, red and blue
 - Five-wire circuit: _____, _____, _____, _____, _____

b. Colors of Terminals on Electrical Equipment

- Natural copper or _____ terminals are for "hot" wires only.
 - Terminals of a whitish color (such as nickel, tin or zinc-plated) are for _____ wires only.
 - Terminals of a _____ color are for grounding wires only.
- Grounding wires are those connected to the surface or shell of an appliance or tool to supply a continuous low-resistance path to ground should the surface of the tool or appliance accidentally become energized.

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Part 2

Directions:

Watch the video and follow the instructions available at <https://www.sciencebuddies.org/stem-activities/paper-circuit?from=Blog> to create your paper circuit. Then, complete the questions below.

1. Lay down two smooth strips of copper tape, about a 1/2 inch apart.
What will these strips do in your circuit?

2. Attach your LED so the long leg (positive) is on the outer strip and the short leg (negative) is on the inner strip.
Why is leg direction important?

3. Tape down the LED legs securely to the copper strips.
How do you know the connection is solid?

4. Place the battery with the '+' side facing up on the inner tape strip.
What happens when you press the outer tape to the battery top?

5. Secure with a binder clip or paper clip to hold the connection in place.
Does your LED light up? What might you need to adjust?

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6. Draw your final paper circuit below. Label the following parts clearly:

- Battery (Source)
- Copper Tape (Path)
- LED (Load)
- Open/Closed Switch (if included)

Reflection Questions

1. What made your circuit successful or unsuccessful?

2. Describe the role of the battery, copper tape and LED in your circuit.

3. What would you change if you built another paper circuit?

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Part 3

Directions:

Using your notes from Part 1 and the paper circuits activity, complete the questions below.

1. Which three parts are required to complete a simple circuit?
 - a. Source, path and plug
 - b. Source, path and load
 - c. Battery, LED and glue
 - d. Wire, tape and multimeter

2. What is the purpose of the source in a circuit?
 - a. To stop current from flowing
 - b. To physically connect wires
 - c. To provide electrical energy
 - d. To protect the circuit from overload

3. Which of the following would most likely be considered a load in a simple circuit?
 - a. A wire
 - b. A switch
 - c. A copper strip
 - d. A light bulb

4. What is the role of the path in an electrical circuit?
 - a. To generate power
 - b. To prevent short circuits
 - c. To carry electricity from source to load
 - d. To support the battery

5. What does a closed circuit allow that an open circuit does not?
 - a. Voltage to increase
 - b. Heat to escape
 - c. Electricity to flow
 - d. Battery life to extend

6. What happens when a circuit is open?
 - a. The light shines brighter.
 - b. Current flows more quickly.
 - c. No current flows through the circuit.
 - d. The battery explodes.

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7. Why is it important to match wire gauge with ampere rating?
 - a. To make the circuit look neat
 - b. To improve energy storage
 - c. To prevent overheating or fires
 - d. To save electricity

8. What type of wire is commonly used for grounding?
 - a. Black
 - b. Red
 - c. White
 - d. Green

9. To which screw is the black (hot) wire attached on a 110V duplex outlet?
 - a. Silver
 - b. Brass/Gold
 - c. Green
 - d. White

10. Which wire carries current back to the panel in a typical household circuit?
 - a. Black
 - b. Green
 - c. White
 - d. Bare copper

11. How does understanding the path electricity takes help you troubleshoot real-life electrical problems?

12. Why do you think it is important to have a basic understanding of circuits, even if you're not planning to become an electrician?