Current Electricity

Current electricity refers to electric charges ______ in a circuit through a conductor in a controlled way

An Electric Circuit is a _____ path for electricity to flow through

Flow of electricity

• Electricity flows along a conductor from an energy source, such as a battery, to a device that uses the energy

Battery

- _____: A connection of _____ or more electrochemical cells
- Example: Several electrochemical cells can be packaged together to make a battery

Chemical energy separates electrical charges in cells.

Electrochemical cell:

- Transforms ______ energy into ______ energy
- Example: An AA "battery" is an electrochemical cell (even though it is commonly known as a "battery")

How an Electrochemical Cell Works

- Chemical reactions of ______ different metals or metal compounds occur on the surface of electrodes
- The chemical reactions cause one electrode to become ______ charged, and the other to become charged
- The electrodes are in contact with terminals in the cell
- When the terminals are connected to an electrical pathway, charges ______ through

Source

- Source: anything that supplies ______ energy
 - Electrochemical cells
 - Batteries
 - Outlets





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Electrical Potential Difference

• A unit of charge gains electrical potential energy when it passes through a ______ (such as a battery)

Electrical potential difference: A quantity that provides a measure of the electrical potential energy a unit of charge______when passing through a source

- Often called ______
- Symbol: _____
- Units: volts (V)

Why is electrical potential difference called a *difference*?

 It measures the difference in electrical potential energy per unit of charge ______ the positive terminal and the negative terminal in an electrochemical cell

Electrical potential difference is often called the voltage

1.5V cell: It took 1.5 units of energy to ______ the last unit of charge

Discussion Questions

1. Why is the electrical potential different of a source referred to as a difference?

Charges can flow through conductors, but not insulators.

When two different solid materials are rubbed together, electrons can be transferred from one material to the other

- Electrons with either stay on the surface of the new material or travel through it
- _____: A material charges cannot travel through
- _____: A material charges can travel through

Conductivity: How Easily Charges Travel Through a Material

Conductivity: An indication of how_____ charges travel through a material

- Electrons can move through almost all _____ (conductors); can move through some metals more easily than others
- The higher the conductivity of a material, the more easily electrons can ______ through





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Discussion Questions

1. Explain why electrical wires are covered by an insulator.

Moving electrical charges form an electric current.

- Chemical energy from a source (cell or battery) causes charges to move through a conductor (wires), carrying energy to an electrical device (cellphone)
 - The moving charges are called an electric______
 - Symbol for current: _____
 - Current is measured in amperes: _____

Discussion Questions

1. Describe the relationship between moving charges and electric current.

A load resists the flow of current.

_____: A device that converts electrical energy into another form of energy

- As electrons pass through a load, they lose energy as electrical energy is converted to another type of energy
- Light bulb: A load that transforms electrical energy into ______
- Radio: A load that transforms electrical energy into ______

A load resists (hinders) the flow of current

- Electrons in the current collide with atoms that make up the load, or with each other
- Collisions interfere with the flow of current
- Resistance Describes The Amount of Current Hindered By a Load

Resistance: Describes the amount that current is hindered by a_____

- Symbol: _____
- Units: _____

• Example of Resistance: Filament in a Light Bulb



- Charges move from a large wire (electrical cord) into a very thin wire (filament)
- Since the charges have ______ in the filament (the filament *resists* the movement of charges), they collide with atoms so hard that the filament gets very hot
- The heat makes the filament glow ("light up")

Discussion Questions

1. Use the terms source, current, and load to describe how you think a flashlight works.

Conductors must form a ______ to allow current to flow.

Electrical circuit: A source, a load, and wires in a closed loop that allow current to flow

Example: Figure 3.19

- Source (electrochemical cell)
- Load (lightbulb)
- Wires

Short Circuits

_____: A circuit with a resistance that is too low, making the current so high that it is

dangerous

• Example: If there wasn't a load (light bulb) to resist the flow of current, the current would be so large that the conductor would get very hot and start a fire

Modelling the Flow of Current (Part A)

- Negative terminal ______ the negative charges already in the conductor
- Positive terminal attracts the negative charges already in the conductor
- Electrons move along the conducting_____; electrons from the electrochemical cell move into the conductor
- As the electrons pass through the load, they transfer some of their energy to the ______
- The electrons then leave the load and return to the electrochemical cell
- Electrons enter the electrochemical cell; combine with positive ions to become
- Over time: fewer electrons at negative terminal; fewer positive ions at positive terminal
- The worker (______) can carry more electrons up the ladder, keeping the number of separated charges equal

Controlling the Flow of Current

In a typical circuit, a _____ controls current in a circuit

Example: Figure 3.21

- A. The switch is _____. The circuit is open so the current cannot flow.
- B. The switch is ______. The circuit is closed so the current can flow and the light is on.





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Using Circuit Diagrams

Ammeter	Voltmeter	Light bulb	
-A-		-@-	
Connection point	Resistor	On/off switch	
o		-\$ <u></u>	
Wire	Dry cell		
	<u>+</u>		

Component		Symbol	Quantity	Unit of Measurement
Source	Cell		Electrical Potential Difference	Volt (V)
	Battery		(V)	
Conducting Wire			Current (/)	Ampere (A)
Load			Resistance (<i>R</i>)	Ohm (Ω)
Switch	Open	•		
	Closed	• • •		

Note: The long line in the symbols for cells or batteries represents the positive terminal and the short line represents the negative terminal.

• Lets Try out a circuit

Comparison: Water Circuit and Electrical Circuit

- Water circuit: A pump lifts the water to a higher level against the pull of gravity
- Electrical circuit: The cell or battery is similar to the pump



Discussion Questions

- **1.** Explain what "short circuit" means.
- 2. Describe the role of a switch in an electrical circuit.
- 3. Draw a circuit diagram for the circuit shown in Figure 3.21B.

Table 3.1 Symbols for Circuit Diagrams