| Science 30 | Unit C: Physics |
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| Lesson 4 - Electric Circuits | 84 mins |

## AC vs DC

| Direct Current (DC) | "direct" because the electricity only flows one way |
| :---: | :---: |
| Cells/Batteries/USB | Draw a Volts per time Grath |
| Alternating Current (AC) Plug-ins | "Alternating" because is flows back and forth 60 times per second |
| Pass Around My Plug | Many Plug-in devices need DC current so they have converters to change the 120V AC to a DC current needed. |
| Transformers |  |
| Used to change the strength of voltage from a source | Draw Pg. 329 |
|  | Long Distances high Voltage is better Transferred at 500, 000V <br> Less Power lost as heat |
|  | Homes only need 120V |
| Generating Electricity |  |
| Moving a magnet through a coil of wire generates an electrical current. | Mechanical to Electrical |
| Turning a motor manually creates a generator |  |

## Electric Circuits

Use electricity to do a job

- Need:
- Load (something to do work)
- Conductors (wire)
- Switch (turn on/off control)
- Power Source (Batteries/wall outlet)



## Building Simple Circuits

## https://www.physicsclassroom.com/Physics-Interactives/ <br> Electric-Circuits/Circuit-Builder/Circuit-Builder-Interactive <br> Series

- Loads in series (list positives and drawbacks)

- Sources (cells) in Series
- (list positives and drawbacks)



## Measuring Electricity

Voltage: The amount of energy in a single charged
particle $($ Volt $=V)$

Current: The rate at which electrons flow (1)
Amperes (Amp = A) )

Resistance: the ability of a substance to allow electrons to pass through (Ohms ( $\Omega$ ))

Ohm's Law

| Ohm's Law |  |  |  |  |
| :--- | :---: | :--- | :--- | :--- |
| Quantity | Symbol | Unit | Formula | Measured <br> With |
| Voltage | V | Volts $(\mathrm{V})$ | $\mathrm{V}=\mathrm{IR}$ | Voltmeter |
| Current | I | Amperes <br> $(\mathrm{A})$ | $\mathrm{I}=\mathrm{V} / \mathrm{R}$ | Ammeter |
| Resistance | R | $\operatorname{Ohms}(\Omega)$ | $\mathrm{R}=\mathrm{V} / \mathrm{I}$ | Ohmmeter |

## Ohm's Law

## Using Ohm's Law

Electric Stove is connected to a $240-\mathrm{V}$ outlet. The current is 20A, What is the resistance of the heating element?

| Steps to solving the <br> Problem | Information and Solution |
| :--- | :--- |
| 1. Identify known | Current $(\mathrm{I})=20 \mathrm{~A}$ <br> Voltage $(\mathrm{V})=240 \mathrm{~V}$ <br> Resistance (R) |
| 2. Identify unknown | $\mathrm{R}=\mathrm{V} / \mathrm{I}$ |
| 3. | Use Correct formula |
| 4. | Solve |
|  | $\mathrm{R}=\mathrm{V} / \mathrm{I}=240 \mathrm{~V} / 20 \mathrm{~A}$ <br> $\mathrm{R}=12 \Omega$ |

## Science 30 - Lesson 28 - Unit C - Electric Circuits

Name: $\qquad$

1. A headlight in an automobile draws a current of 5.0 A from the car's $12.0-\mathrm{V}$ battery.
a. Is the current passing through the headlight AC or DC? $\qquad$
b. Determine the resistance of the headlight while it is operating.
2. A low-intensity light bulb illuminates the numbers on the outside of a house. The bulb is operated by one of the $120-\mathrm{V}$ household circuits and draws 0.25 A .
a. Is the current passing through the bulb AC or DC? $\qquad$
b. Determine the resistance of the bulb while it is operating.
3. The four cells in a flashlight form a battery with a total voltage of 6.0 V . When the flashlight is switched on, the resistance of the bulb is $8.0 \Omega$.
a. Is the current passing through the bulb AC or DC? $\qquad$
b. Determine the value of the current passing through the bulb.
4. Electric service to your home is transmitted through cables that contain three wires. Two of the wires each possess voltages of 120 V , while the third wire is the neutral return wire required to complete the circuit.
a. To operate appliances that demand 120 V , describe the circuit that is required.
b. To operate appliances, like the stove and dryer, that demand 240 V , describe the circuit that is required.
$\qquad$
5. Laptop computers often need battery packs that have both high-energy output and long life. The solution is to combine groups of cells in combination series/parallel arrangements.


Four 3.6-V lithium-ion cells are connected in series to form a four-cell combination. This is then connected in parallel to another four-cell combination to form the laptop's battery pack. This configuration is called 4S2P: four cells in series to form one combination, connected in parallel to a second combination that is identical to the first.
a. If the four cells in each series combination are rated at 3.6 V , determine the total voltage of each set of four cells.
b. Use your answer to a. to determine the total voltage of the laptop's battery pack.
6. In an electric circuit, how is the value of the current affected in the following circumstances?
a. The voltage is doubled.
b. The resistance in the external circuit is doubled.
7. A resistor of $100 \Omega$ is connected to a $9.00-\mathrm{V}$ DC battery. Determine the current that flows through the resistor.
8. An electrical component with a resistance of $50.0 \Omega$ is connected to an AC power supply with a voltage of 45.0 V .
a. Determine the current that flows through the component.
9. Two 12.0-V DC batteries are connected to an external circuit. Determine the voltage if the two batteries are connected in series.
a. Determine the voltage if the same two batteries are connected in parallel.

