LESSON PLAN

Title: *Exploring Electricity, DC Electric Circuits I*

Lesson Level: *Beginner to Intermediate*

Time Frame: *One hour*

Objectives: *The student will explore the basics of Direct Current electricity, with supervision and instruction, and accompanying slide presentation from CD Rom, "Electrifying Experiments".*

Supplies: *See supply list on slide four of accompanying CD Rom, "Electrifying Experiments". (Note* Each section of this lesson builds on the previous section. Do not allow students to dismantle their circuit until the end of the lesson.)*

Beginning Narrative: **Today we are going to build a simple circuit. Then we are going to wire our circuit in SERIES and then in PARALLEL. We will see how specific wiring can change the performance of the load consuming objects on the circuit.**

Electricity Kit Lesson Plan for use with CD Rom, Electrifying Experiments, Lesson Two, Exploring Electricity, Direct Current.

Remember to pay close attention because there are lots of steps and we need to work together on each step. Try as hard as you can to stay with the class and don't work ahead of everyone else.

Slide	*Step by Step Guide / (**Narrative in bold**)*	*What You Do or Show*	*What Participants Do*
1.	This is the title slide		
2.	Visual representation of a series circuit with all components labeled.	Display slide	View the slide
3.	Material list for instructor/student reference	Display visual	View visual/slide 3
4-9	Definition of basic terms	Review terms	Review terms
10.	Visual display of a basic circuit **"Here is a picture of what a basic circuit looks like."**	There is no hands on action on this slide- simply an introduction	View slide- no action
11.	Visual display of pertinent symbols	Review symbols with students- going over each one	Review symbols
12.	Build a basic circuit **"Now we are ready to build a basic circuit! We are going to complete an unbroken path for electricity to travel on- from the source, or battery, to the conductors, or the wires, to the object that needs the power, or light bulb."** **"Lets take the black wire and attach one end to the negative terminal on the battery- then attach the opposite end of the black wire to the brass screw on the lamp holder."** **"Then attach one end of the white wire to the silver screw of the lamp holder, then attach the opposite end of the white wire to the positive terminal on the battery."** **"We are ready to see if this works- take your light bulb and carefully screw it into the lamp holder. If it lights up, congratulations! You have built a basic circuit. If you light bulb doesn't light raise your hand for help."**	Demonstrate attachment of black wire to lamp holder and battery. Demonstrate attachment of white wire to lamp holder and battery. Demonstrate placement of light bulb into lamp holder (GENTLY-NOT TIGHTLY- BULB IS BREAKABLE) Trouble shoot if needed	Connect one end of black wire to brass screw on lamp holder and connect opposite end of black wire to negative terminal on battery. Connect one end of white wire to the silver screw on lamp holder and connect opposite end of white wire to positive terminal on battery. GENTLY screw light bulb into lamp holder.

13.	Visual of what the basic circuit should look like once it is competed	Show visual	Review visual
14.	Breaking the circuit "we wouldn't want our light bulb on all the time, so sometimes we need to break the circuit to shut the lamp off. One way to break a circuit is to install a switch."	Show visual	Review visual
15.	Diagram of a simple switch that is open (light bulb off) **"First- open the single pole switch. Remove the black wire from the lamp holder and attach it to one of the terminals on the single pole switch. Then take one end of the red wire and attach it to the opposite terminal on the single pole switch. Then attach the opposite end of the red wire to the brass screw on the lamp holder. Now, close the switch."**	Show visual— Have the students follow the directions in concert (do each step together) and when completed have them visually trace the path of the electricity.	Review visual-- Open the single pole switch. Remove the black wire from the lamp holder and attach it to one of the terminals on the single pole switch. Then take one end of the red wire and attach it to the opposite terminal on the single pole switch. Then attach the opposite end of the red wire to the brass screw on the lamp holder. Close the switch
16.	Diagram of a simple switch that is closed (light bulb on) Shows pattern that the kids should have visually traced.	Show visual	Review visual
17.	Visual demonstration of basic circuit with switch, in the on position.	Show visual	Review to make sure project looks like picture
18.	Detail visual of fan stock clips- not included in kit.	Forward through slide	N/A
19.	Building a series circuit. **"Lets look at a picture of a series circuit. A series circuit is a circuit with more than one load (or energy using object) on it, in a straight line. First, open your single pull switch to break the flow of electricity to the light bulb. You will use another black wire and another lamp holder and light bulb from our supplies. Disconnect the red wire from the terminal on the singe pull switch. Take one end of the new black wire and attach it to the single pull switch where the red wire was removed. The opposite end of the new black wire should be attached to the brass screw on the new lamp holder. The red wire that was removed from the single pole switch should be attached the silver screw on the new**	Show visual and demonstrate the addition of another light bulb into the circuit.	open your single pull switch to break the flow of electricity to the light bulb. You will use another black wire and another lamp holder and light bulb from our supplies. Disconnect the red wire from the terminal on the singe pull switch. Take one end of the new black wire and

	lamp holder. Screw a light bulb into your new lamp holder. This should compete our circuit."		attach it to the single pull switch where the red wire was removed. The opposite end of the new black wire should be attached to the brass screw on the new lamp holder. The red wire should be attached the silver side of the new lamp holder.
20.	Close the switch **"What happens when you close your switch? Are the lights dimmer or brighter than the original light bulb."** (answer=dimmer) **They are dimmer because we have two load objects (light bulbs) on the same voltage battery. In a series circuit the voltage is reduced with each additional load-consuming object. So, with two light bulbs, we have half the voltage for each bulb- creating a dimmer light."** **"What happens if we gently unscrew on of the light bulbs?** (answer- both bulbs go out) **Right! Both bulbs go out because we have broken the circuit. Now, screw the light bulb back in gently."**	Show the visual Ask the students for an example of a series circuit- example: old Christmas tree lights- when one goes out they all go out.	Open and close switch to see the light bulb is dimmer than when there was only one bulb in the circuit. Gently remove and them replace one bulb.
21.	Detail of what student projects should look like.	Show visual	Review project to make sure it looks like the picture
22.	Detail of the lamp holder wiring if fanstock clips were used- not included in kit.	Forward through slide	N/A
23.	Wiring a circuit in parallel. **"Now that we have wired two light bulbs in SERIES- we are going to experiment with wiring our two light bulbs in PARALLEL. All we need to make this work is one additional white wire from our supplies. Open the single pole switch. Remove the red wire from the silver screw on the lamp holder that has the black wire attached to the brass screw. Place the red wire you just removed onto the brass screw with the black wire. YOU SHOULD HAVE TWO WIRES ON THE BRASS SCREW NOW- BLACK AND RED. Take the new white wire and attach each end underneath the silver screw on each of the lamp holders. Now the lamp holder**	Demonstrate each step as spoken. Open the single pole switch. Remove the red wire from the silver screw on the lamp holder that has the black wire attached to the brass screw. Place the red wire you just removed onto the brass screw with the black	Open the single pole switch. Remove the red wire from the silver screw on the lamp holder that has the black wire attached to the brass screw. Place the red wire you just removed onto the brass screw with the black wire. YOU SHOULD

	closest to the battery will have two wires on the silver screw.	wire. YOU SHOULD HAVE TWO WIRES ON THE BRASS SCREW NOW- BLACK AND RED. Take the new white wire and attach each end underneath the silver screw on each of the lamp holders.	HAVE TWO WIRES ON THE BRASS SCREW NOW- BLACK AND RED. Take the new white wire and attach each end underneath the silver screw on each of the lamp holders.
24.	Close the switch**. "Are the lights dimmer or brighter- or do they remain the same?** (answer- they remain the same) **"The lights remain the same brightness because the load is not being divided in half like a series circuit. Each bulb is receiving maximum voltage because of the Parallel circuit. What happens when you remove on light bulb**? (answer=the other bulb remains lit) **Right! The other bulb stays lit because we have not broke the circuit, since there is more than path for the electric current to travel."**	Have students close switch and see what happens. Have student gently remove one bulb and see what happens. Ask the students for examples of parallel circuits—examples- pretty much everything in your home. You can have one light bulb go out and all other electrical items in your home can remain on.	Close switch Gently remove one bulb- then replace.
25.	Visual of the parallel circuit. (NOTE- we used 2 red wires in photo- does not correspond to given directions- disregard slide for demonstration purposes.	Forward through slide	N/A

Summary: **We have learned today that there is a difference between objects that are wired in a series circuit and objects that are wired in parallel circuits. How our electrical household items are wired changes how they can operate.**