

## Some Properties of Electric Circuits (Uses CCK only )

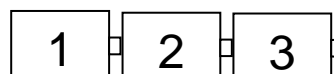
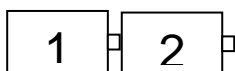
Learning Goals: Students will be able to

- Discuss basic electricity relationships
- Build circuits from schematic drawings
- Use an ammeter and voltmeter to take readings in circuits.
- Provide reasoning to explain the measurements and relationships in circuits.

### I. Observing voltage relationships

Go to the PHeT web site and use the Circuit Construction Kit simulation (CCK). Drag out three batteries. Measure the voltage of each using the voltmeter and record the voltage in a table like the one shown. Then move the batteries end to end as below to measure combined voltage.

Battery	Voltage (V)
1	
2	
3	
1+2	
1+2+3	



- a. Describe the relationship between the number of batteries and the voltage and explain what you think might be happening.
- b. What could you vary to test your description about the relationship? (Right click on the batteries to change characteristics ) Run several tests recording your data in an organized table.
- c. Talk to another group about their description, tests and results. Rewrite your description to include the more broad tests.

### II. Using voltage

Use the Circuit Construction Kit simulation to build a circuit with a battery and a light bulb in the *Lifelike* visual mode.

- a. Draw what your circuit looks like.
- b. How does the voltage of the battery compare to the light bulb voltage? Explain what you think is happening.
- c. Vary the voltage of the battery and write observations about how the brightness is affected by voltage.
- d. Think about a real light bulb and battery; explain what you think is happening that causes the changes in brightness.

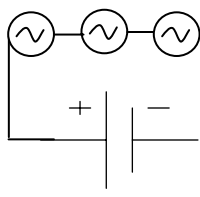
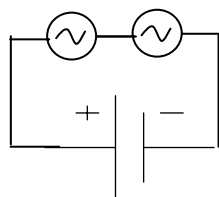
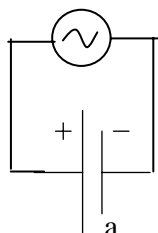
### III. Using voltage in series circuits

Use CCK to build the circuits below with a battery at about 12 volts and light bulbs. Turn on the voltmeter and ammeter to measure voltage of the battery and current into it. Record bulb brightness with descriptive language.

Figure 1

Figure 2

Figure 3



# of bulbs	Battery voltage (v)	Current into battery(A)	Brightness of bulbs
1			
2			
3			

- a. Summarize the relationships you observed and explain what you think is happening.
- b. Test to see if changing the battery voltage causes you to modify any of your conclusions. Explain what you measured and any conclusions you draw from your tests.
- c. What happens when you take a wire out of a circuit? Explain what you think is happening
- d. Test using the voltmeter or ammeter in different ways. For example: Does it matter if you take the reading on the left or right of the battery? Switch the meter ends? Describe your tests and results.

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### IV. Using voltage in parallel circuits

Redo Part III but use figures 4-6 for the circuits. Make a new table and answer the questions.

Figure 4

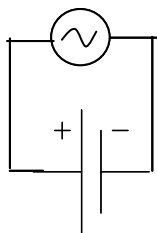


Figure 5

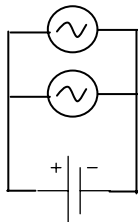
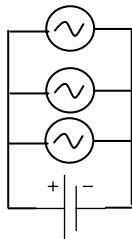
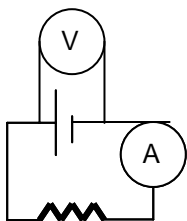


Figure 6



### V. Observing voltage and current relationships with resistors

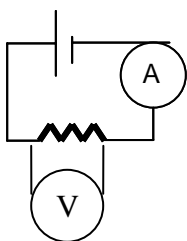
Use CCK to build the circuit below. Vary the voltage of the battery. Record the battery voltage and the current in the circuit in a table.



- Explain what might be happening to cause the change in current.
- How are current and battery voltage related? What is the shape of the graph?
- Describe how you could use the simulation to verify the relationship. Test your ideas and make modifications to your original answers if necessary. Be sure to explain your reasoning.

### VI. Observing voltage and current relationships for variable resistors.

Build the circuit below. Vary the value of resistor at least ten times. Record in a data table: resistance, current and voltage for each trial.



- Chart and determine the algebraic relationship for resistance and current.
- Chart and determine the algebraic relationship for resistance and voltage.
- Explain the relationships in terms what you think is happening in the circuit. Include how this experiment is like the one where you added light bulbs.