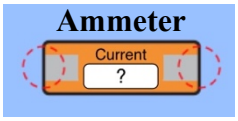
DC Circuit Builder – Series Circuit **Name:**_____

Goal: To analyze mathematical relationships between quantities for series & paralell circuits.

Getting Ready: Navigate to the DC Circuit Builder Interactive at Tigerphysics.org → Unit 12 Electricity and Circuits

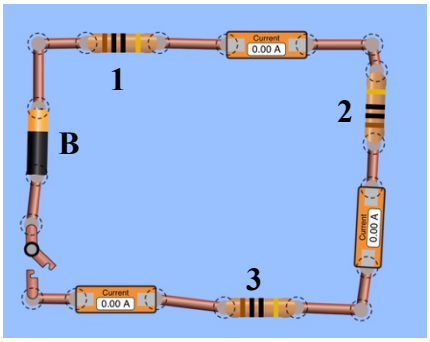


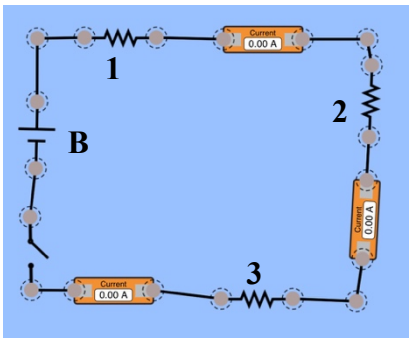
Once opened, click on Lab, build a circuit. Simply select a bulb, resistor, wire or ammeter (the rectangular box) and drag it into the workspace where you wish it to be located. You'll get the hang of it quite quickly.

Note to measure the electric potential values you will need a Voltmeter. Place the red probe on one side of a circuit element and the black probe on the other side. Current values are listed on the ammeters. The ammeter has to be in Series with the other elements to measure the current in that part of the circuit. To change a battery voltage or a resistor value, click on the item.

Build, Measure, Analyze:

Build the circuit shown with three resistors, four ammeters, a switch, and a battery. Click on the resistors and set Resistor 1 to any value greater than 5 Ω. Make sure the value you use is different from people working near you. Make Resistor 2 to be 2X Resistor 1, and Resistor 3 to be 3X Resistor 1. Set your Batteries Electric Potential (Voltage) to be value 9 V or greater. Again be different from the people working near you.





Teacher Initials:
_____

1. For resistors 1, 2, and 3 and for the battery (B), measure the electric potential difference and fill in the table below.

Element	Electric Potential Difference (ΔV)	Current (I)	Resistance (R)
B			--
1			
2			
3			

2. How does the current in each resistor (I_1, I_2, I_3) compare to one another and to the current in the battery (I_B)?

3. How does the electric potential difference across the battery (ΔV_B) compare to the *summative* electric potential differences of the three resistors ($\Delta V_1 + \Delta V_2 + \Delta V_3$)?

4. Write the above relationship as an equation: _____

5. Calculate the ratio of electric potential difference to current for the battery.
   $\Delta V_B / I_B =$ _____

   How does this ratio compare to the resistance values of the resistor? Attempt to write an equation relating the $\Delta V_B / I_B$ ratio to R_1, R_2, and R_3 values.

6. Alter the values of the battery voltage and the resistance of the resistors so that each resistor has a different value. Then make measurements and complete the table.

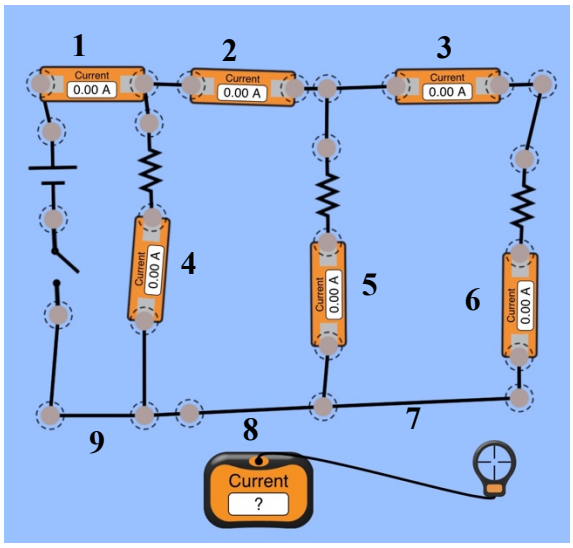
Element	Electric Potential Difference (ΔV)	Current (I)	Resistance (R)
B			--
1			
2			
3			

Teacher Initials:
_____

7. Using values from the circuit analyzed in Question #6, identify as many mathematical equations as you can that relate ΔV, I and R for individual circuit elements or for the circuit as a whole. For each equation that you write, demonstrate its validity by substituting in values from the table above.

Equation	Demonstration of Equation's Validity
a.	
b.	
c.	
d.	
e.	

8. Now build the following Parallel Circuit:



9. Close the switch and record the value for the current at each labelled spot in Table 1.

Table 1	
#	I (amps)
1	
2	
3	
4	
5	
6	
7	
8	
9	

Teacher Initials: _____

10. Record the Electric Potential across the battery and each branch of the circuit using the Voltmeter. Record in Table 2.

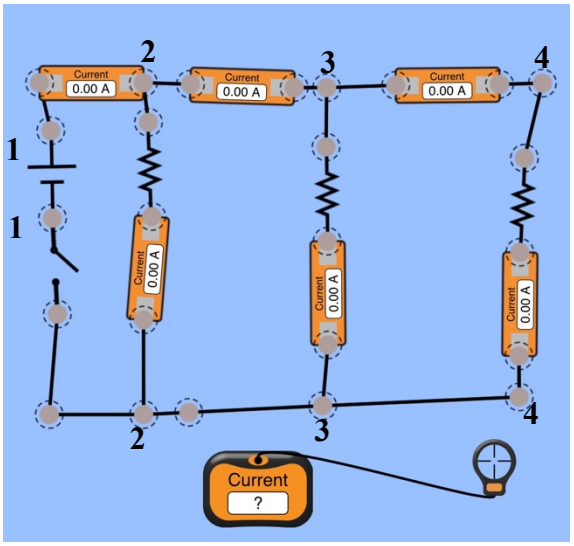


Table 2	
#	ΔV (Volts)
1	
2	
3	
4	

11. Observe all the current values in the circuit. Describe a rule that could be used to relate the current values at a "junction" (location where a path divides into two paths or a location where two paths come together to form one path).

12. Observe all the Electric Potential values in the circuit. Describe a rule that could be used to relate the Electric Potential values for a "branch" (location where a path divides into two paths or a location where two paths come together to form one path).

13. Now place a switch between #2 & #3 and between #3 & #4 on the bottom of the circuit.

Teacher Initials: _____

14. What happens to the current out of the battery and electric potential when switch #2-3 and #3-4 is open.

15. What happens to the current out of the battery and electric potential when switch #2-3 is closed and #3-4 is open.

16. What is generalized rule you can make for when there is branch added across the battery (you closed the switch making that branch part of the circuit)?

Summarize what you learned in this simulation: _____