

Circuit Design Challenge

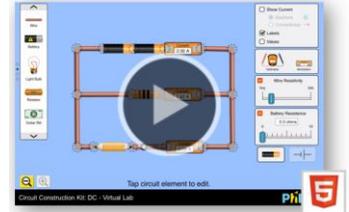
https://phet.colorado.edu/sims/html/circuit-construction-kit-dc/latest/circuit-construction-kit-dc_en.html

LAB REPORT: Type or hand write the answers to the observations and questions in this lab report in a separate document. Convert your final document to a PDF and submit into your Google Drive Chemistry Shared Folder.

- Include the number of the question and then the answer, image, Data Table, etc.
- Save your final work as a PDF and save it to your Google Drive Chemistry Shared Folder.

TO BEGIN: Click the link above or go to the PhET site (<http://phet.colorado.edu>) and launch *Circuit Construction Kit: DC Only, Virtual Lab*

Circuit Construction Kit: DC - Virtual Lab



PART A: INVESTIGATING CIRCUITS

- Select INTRO
- Explore. Click and drag to add parts to the blue lab space. *(Click on the bottom arrow in the parts window to expand your options.)* Other operating instructions:
 - You can stretch the wires to different lengths.
 - You can rotate parts BEFORE you connect them.
 - Click on a connection to cut/break it.
 - Double click on a part to select and delete it.
- Reset the simulation
- Use the parts to construct a circuit to light up a light bulb using only wires and one battery. Use as FEW supplies as possible.
 - 1) Take a screen shot and paste your image as your answer – or draw it. *(Reduce the size of your image to no more than 3 inches in height.)*
- Click on the battery and change the voltage.
 - 2) What happens to the electrons in the wire?
 - 3) What happens to the light? Why?
- Add a switch to your circuit.
 - 4) What happens when you open and close the switch? Why?
- Make a gap in your circuit.
 - 5) Use the following items to close the gap in your circuit, then fill in the chart below. *(For your answer, you can also write Conductor or Insulator beside each item in a list.)*

Item	Does allow electricity to flow (conductor)	Doesn't allow electricity to flow (insulator)
a. Paper clip		
b. Eraser		
c. Dollar bill		
d. Coin		
e. Pencil		

- 6) What properties did the conductors have in common?
- 7) What properties did the insulators have in common?

PART B: SERIES & PARALLEL CIRCUITS

- For the next few activities, you need to light 3 bulbs at the same time, using just one 9.0 V battery.
- **First circuit:** find a way to hook up 3 bulbs so that if you break the connection at one bulb, ALL bulbs go out.
 - 8) Attach the image of your circuit for your answer (or draw it)
 - 9) Why did the rest of the bulbs go out if you break the connection at one bulb?
 - 10) This circuit is called a **series circuit** because the bulbs are hooked up in one long "series" or line. Name somewhere you have seen a string of lights that are also a series circuit.
- **Second circuit:** find a way to hook up 3 bulbs so that if you break the connection at one bulb, ONLY that bulb goes out. (*Hint: instead of a single circle, think multiple joined loops. If you're still stuck and need an extra hint, look at #13 and Google it!*)
 - 11) Attach the image of your circuit for your answer (or draw it)
 - 12) Why do the rest of the bulbs stay lit if you break the connection at one bulb?
 - 13) This circuit is called a **parallel circuit**, which has 2 or more single loops connected to the same battery. When 1 bulb goes out in these circuits, the rest of the lights stay on! Name somewhere you have seen many bulbs hooked up to one power source, where one bulb can go out without affecting the others.
 - 14) You design toys for a toy company. Your boss wants you to hook up the lights in the toy car you are working on in the cheapest way possible, without consideration of the quality of the toy. Which circuit should you use? Why use this circuit?
 - 15) You are an electrician working on a house. What type of circuit should you use for the house so that the owners don't call to complain about their wiring? Why use this circuit?

PART C: CIRCUIT DESIGN CHALLENGE

- Using just one 9.0 V battery (click the battery to adjust the voltage), light a single light bulb that measures at 0.90 A. Drag the current meter over each bulb to measure the current. (*The diagram at the right is just an example.*)
- Challenge 1: Using just one 9.0 V battery, light 3 light bulbs with all 3 measuring at 0.90 A. Drag the current meter over each bulb to measure the current.



16) Attach the image of your circuit for your answer (or draw it)

- Challenge 2: Using the setup in Challenge 1, add a switch that turns on/off all 3 lights.
 - 17) Attach the image of your circuit for your answer (or draw it)
- Challenge 3: Using the setup in Challenge 1, add a switch that turns on/off just **one** of the 3 lights.
 - 18) Attach the image of your circuit for your answer (or draw it)
- Challenge 4: Using the setup in Challenge 1, add a switch that turns on/off **two** of the 3 lights.
 - 19) Attach the image of your circuit for your answer (or draw it)