



FIRST® at Home Electrical Circuits

PROBLEM STATEMENT

Ever had something electrical go wrong and need to fix it? For example, have you ever had the wrong type of charger, a flashlight quit working or you want to put a new stereo in your car? From the beat of our heart to flicker of the TV, circuits can be found all around us. How we understand circuits to troubleshoot them or build a circuit of our own safely and operating correctly. In your challenge, how can you create a simple circuit with household items.

CRITERIA & CONSTRAINTS

1. Design or fix an electrical circuit with supplies from you home.
 2. The circuit should be illustrated using flow that properly powers the circuit using Ohm's law.
 3. Use two power sources and two conductors.
 4. The circuit should be able to be open and closed.
 5. The circuit should use DC power only and be powered by no more than a 9-volt battery.
 6. The circuit should follow proper safety procedures and guidelines.
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ENGINEERING DESIGN PROCESS & FIRST® CORE VALUES

[FIRST Engineering Design Process](#) | [Explore FIRST Core Values](#)

BUILDING THE BACKGROUND & BRAINSTORMING

Check out these video resources find out more about electricity and circuits.

Video Links:

1. [Electrical Safety](#)
2. [Introduction to Simple Circuits](#)
3. [Ohm's Law](#)
4. [Electricity and Circuits](#)
5. [Schematics and Symbols](#)

In your home what types of power do you have and what is the source of that power?
What items in your house use electricity that meets the criteria and constraints above?
Are there any items in your house that may be a non-traditional power source, like a lemon or potato?
What items in your house indicate that electricity is flowing?
Do you have items that prevent electricity from flowing or allow the current to flow?
What are the properties of those different types of items?

Draw a simple circuit diagram

Using the items, you have found in your home and the knowledge you have gained about circuits Draw a circuit flow diagram labeling the power source, conductors, electrical components and switch using the correct symbols



Test Your Ideas

Test your circuit design and various materials, record which items work and which items did not work when creating a circuit. Why do you think those items didn't work? Reflect as you watch them go through the process how might you improve the directions?

SHARE AND COLLABORATE ON YOUR IDEAS

Using online collaboration or a parent, share your ideas with them.

Discuss with them how you might improve your design to create a series or parallel circuit.

REFLECTION QUESTIONS

1. What material work as conductors and why?
2. What materials work as power sources and why?
3. What happens when the circuit is open? What is happening to the electrons?
4. What is the difference between AC and DC power?

GO FURTHER!

Electrical engineers are not the only people fascinated with circuits!

The theory of power is fascinating to more than electrical engineers. Research the various areas of study that include circuits as part of the career pathway, what professional pathways are available to students, what credentials are needed, and what is the future forecast of need for these professionals.

Fill in the career pathway matrix below. One hint is to check out the [website O'net](#) used by professionals and career analyst or [career trend](#) to find out more about a variety of careers that use electricity.

CORE VALUES SELF-REFLECTION

| | Amazing Skill | Great Job | Making Progress | Could Be Better |
|-------------------|---|---|--|--|
| Discover | I approached the tasks looking for all possible answers independently and used perseverance to discover the answer on my own. | I approached the tasks and asked questions from one other person but persevered to discover the answer on my own. | I approached tasks but needed assistance multiple times to reach a point of discovery. | I depended on others to make the discovery for me. |
| Innovation | I used creativity and perseverance to solve problems on my own, coming up with unique solutions for the tasks I was given. | I used creativity and perseverance to solve problems on my own coming up with different solutions for the tasks I was given. | I used creativity but struggled with perseverance to solve problems on my own. | I struggled with being creative and only used the information given and needed a lot of encouragement from others to complete the task. |
| Impact | I approached the tasks applying understanding of the information with the impact it can have on me and my future as well as how I could help others. | I approached the tasks knowing and applying the information with impact it can have on me and my future. | I understand the tasks but struggle to apply how it will help me in my future or to influence others. | I understand the tasks but did not approach it with understanding the impact it can have on my future or others. |
| Inclusion | I approached all tasks with inclusion of others' ideas, I showed tremendous kindness by including others' views in my projects and work. I approached my solution thinking how all people would interact with the solution. | I approached most with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution mostly incorporates needs of others. | I approached some tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution meets only a few needs of others. | I did not approach tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution is not inclusive of different types of people. |
| Teamwork | I used collaboration, communication and project management to get all tasks accomplished for myself as well as the others. | I used collaboration, communication and project management to get most tasks accomplished for myself as well as the others. | I used collaboration, communication and project management to get some tasks accomplished for myself as well as the others. | I only sometimes used collaboration, communication and project management and accomplished a few tasks for myself as well as the others. |
| Fun | I kept a positive attitude throughout and found opportunities to have fun even through struggle. I looked for additional opportunities to have fun in my tasks. | I kept a positive attitude throughout and found opportunities to have fun even through struggle. | I saw the enjoyment and fun after the activity but struggled to see it during. | I only saw struggle in completing my tasks and did not look for times to have fun. |

FIRST is a global robotics community that prepares young people for the future.

www.firstinspires.org