A3.1 Parallel circuits

Mia has received a dollhouse from her grandfather. Every room in the dollhouse has lighting. Her grandfather connects the dollhouse to a battery and the lamps in all the rooms light up.

Figure 1: A lit-up dollhouse.

When one incandescent lamp in the dollhouse burns out, the remaining incandescent lamps should continue to light up. How do you have to build the electrical circuit?

Write down your ideas and guesses:

_____

_____

You need the following for the experiment:

- ☐ 6 batteries
- ☐ 2 battery holders
- ☐ 6 cables with alligator clips
- ☐ 3 incandescent lamps (3.5 volts)
- ☐ 3 incandescent lamp sockets

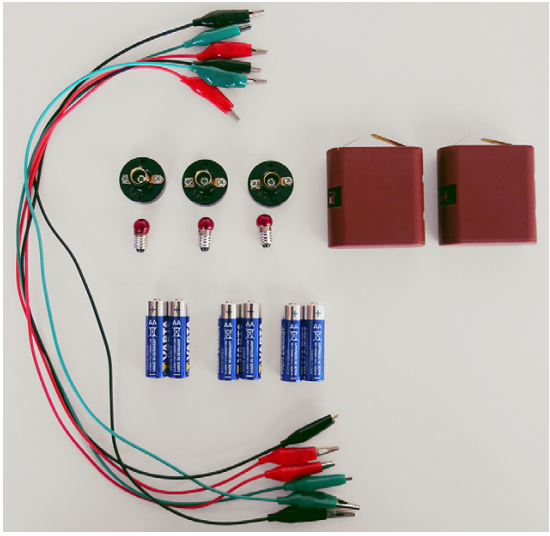

Figure 2: Required materials.

How to set up the experiment:

Lay out the materials as shown in the photo.

How to conduct the experiment:

Tip: If the lamps do not light up, go get the sheet "Do you need help?"

1. Build a simple electrical circuit with a lamp (see sketched circuit diagram). This electrical circuit will not change during the experiment. It is the comparison electrical circuit.

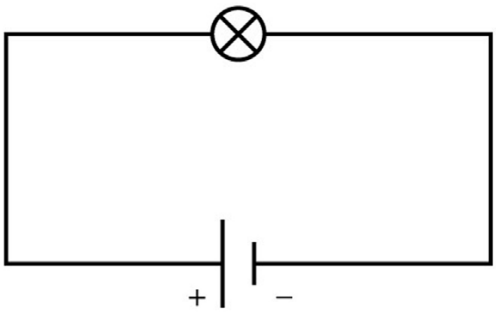

Figure 3: Sketched circuit diagram of the comparison electrical circuit.

2. Now build your experimentation electrical circuit with two incandescent lamps and a battery.
   You have different options for how you connect the lamps with the battery. They are called parallel circuit and series circuit.
3. Try out the different options and sketch a circuit diagram for each circuit that you build.

Sketched circuit diagrams:

4. Figure out a circuit in which one lamp continues to light up when you unscrew the other lamp (after all, the dollhouse shouldn't be completely dark if one lamp burns out, should it?). This circuit is the parallel circuit.
5. Observe how brightly the lamps in the experimentation electrical circuit with the parallel circuit shine and compare it with the lamp in the comparison electrical circuit. What do you notice?

Write down your observations.

The two lamps in the experimentation electrical circuit with the parallel circuit shine _____ the lamp in the comparison electrical circuit.

Here you see the sketched circuit diagram of the parallel circuit. Compare it with your circuit and with your sketched circuit diagrams to see whether you have built the parallel circuit in this way. If not, then re-create the circuit in exactly this way.

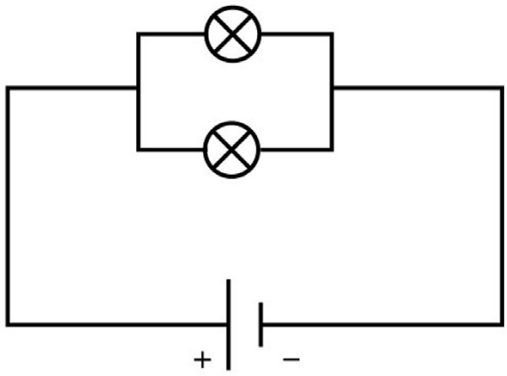

Figure 4: Sketched circuit diagram of a parallel circuit.

Evaluate your observations:

1. Trace your finger along the parallel circuit that you built.

   How many electrical circuits do you count? _____

2. Consider why the lamps behave as they do when you unscrew one of the two and write down your thoughts.
   Tip: Did it make a difference which lamp you unscrewed?

Doing further research:

1. Take a switch and install it in your experimentation electrical circuit with the parallel circuit.
2. What happens? Write down your observations.
3. Install the switch at other positions in the electrical circuit and observe what happens.
4. What do you think? Is the wiring of the lighting in your home or at school the same as in the dollhouse? Find out with your teacher's help.

Tracking down technology

You are certainly familiar with a technical application of the experiment from everyday life: a string of lights. People really like to use these strings of lights during the Christmas season, for example, to make their Christmas trees sparkle or to decorate the front of their homes. However, a string of lights consists of many more lamps than you used in the experiment.

1. Look closely at the photo. How many cables lead to the lamp and how many lead away from it?
2. Guess why this is the case.
3. Sketch a circuit diagram for this string of lights with a parallel circuit of ten lamps. NOTE: For the lamp, use the graphic symbol for an incandescent lamp.

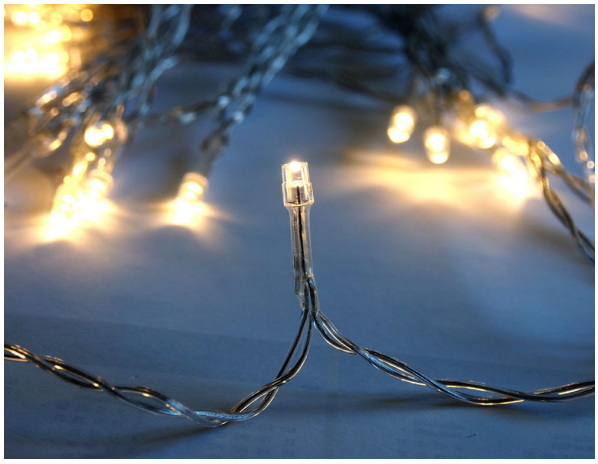

Figure 5: String of lights with LEDs.

4. Some strings of lights turn completely off when just one lamp burns out. How can that be? What is different in this case?

You may be familiar with the device circled in the photo below from home or perhaps even from the classroom.

5. Describe what you can use a power strip for in everyday life.
6. What do you think the power strip has to do with the experiment on parallel circuits that you just conducted?

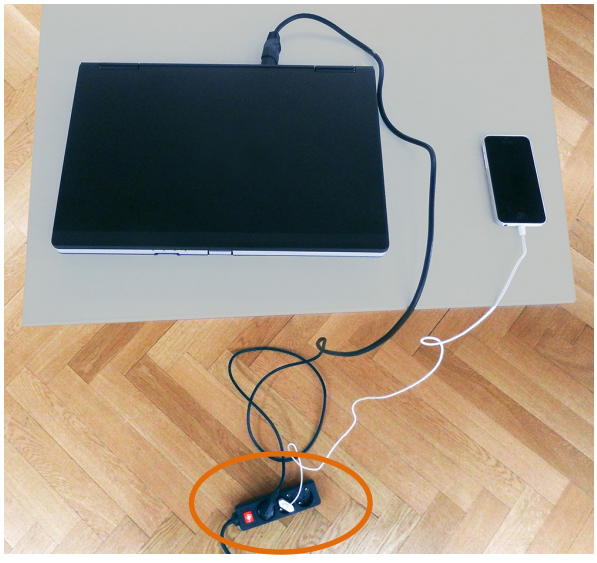

Figure 6: Power strip.

7. Think about what the wiring in the power strip might look like and complete the following sketched circuit diagram. Connect the individual sockets with both cables and draw in the switch

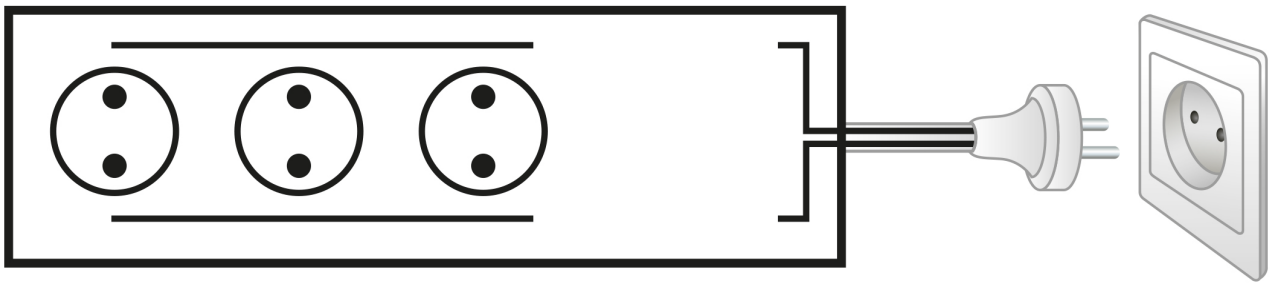

Figure 7: Sketched circuit diagram of a power strip with a switch. Complete it!