

## A1.2 Switching on and off



You're helping with the housecleaning. When you turn on the new vacuum cleaner, it doesn't work. "What's going on here?" you ask your father. He explains to you that there are two switches on this vacuum cleaner: a main switch on the vacuum cleaner itself and one on the handle. The vacuum cleaner runs only when both switches are turned on.



**How do the switches in an electrical circuit work, such as with the vacuum cleaner here?**



**Write down your ideas and guesses:**

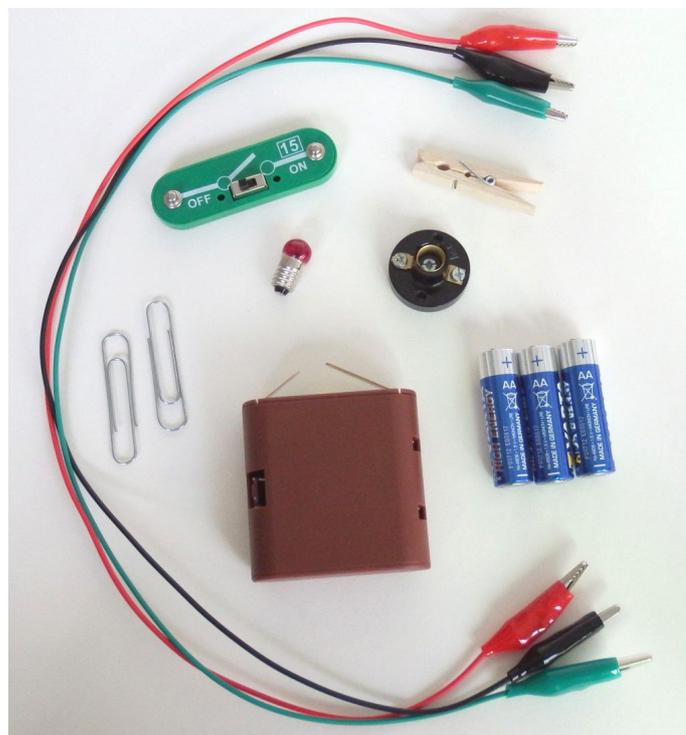
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**You need the following for the experiment:**

- 3 batteries
- 1 battery holder
- 3 cables with alligator clips
- 1 clothespin
- 1 incandescent lamp (3.5 volts)
- 1 incandescent lamp socket
- 2 paper clips
- 1 slide switch



Required materials.

**How to set up the experiment:**

Lay out the materials as shown in the photo.

**How to conduct the experiment:**

Tip: If you are having trouble getting the lamp to light up, go get the sheet “Do you need help?”

1. Build a simple circuit with the battery holder, two cables, and the lamp. When you have done everything correctly, the lamp will light up.
2. Find out where you must install the switch in the circuit so that you can turn the lamp on and off. Write down what you find out.
3. Install the switch in the circuit and operate it.  
What do you notice? Write down what you observe.
4. Think about how you can build a switch with a clothespin and two paper clips.
5. Build the switch.
6. Replace the switch in the circuit with your home-made switch.  
What do you notice? Write down what you find out.

**Write down your observations:**

Where in the circuit do you have to install the switch so that it functions as it should?

The switch does what it is supposed to do when \_\_\_\_\_  
\_\_\_\_\_

If I operate the slide switch, then \_\_\_\_\_  
\_\_\_\_\_

If I operate the clothespin switch, then \_\_\_\_\_  
\_\_\_\_\_

**Evaluate your observations:**

1. How does a switch do what it is supposed to do in a circuit? Fill in the blanks.  
closed – interrupted – lights up – does not light up.

When I turn the switch on, the circuit is \_\_\_\_\_.

The lamp \_\_\_\_\_.

When I turn the switch off, the circuit is \_\_\_\_\_.

The lamp \_\_\_\_\_.

2. Do you now know why you need to turn on both switches for the vacuum cleaner to work? Write down your explanation for this.

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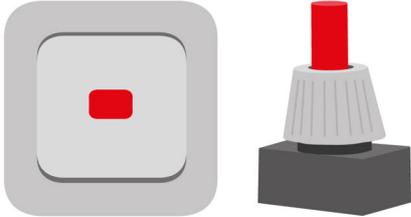
**Doing further research:**

1. Invent another switch and build it.  
Tips:
  - You can use the following materials, for example: paper clips, pins, brass fasteners, aluminum foil, cardboard, adhesive tape.
  - Use a cork tile or a piece of cardboard as a base.
2. Write down which materials you use and how you assemble them.
3. In what position does the switch close the circuit? When does it interrupt the circuit?



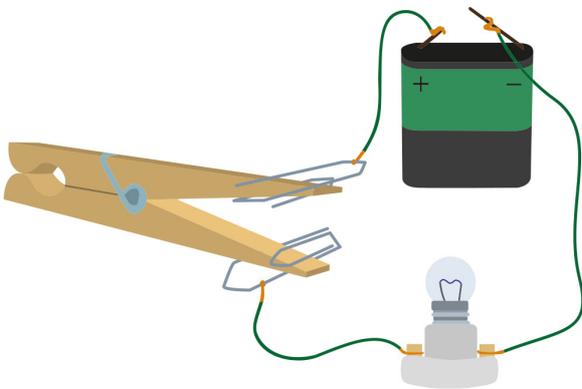
**Sketch a diagram of your circuit with the switch.**

1. First look at the graphic symbol that a technician uses for a switch.

Switch element	Graphic symbol	Description
		<p>The graphic symbol for a switch.</p>

Tips:

2. Draw the cables only as straight lines with square corners (no curves).
3. You do not need to draw how your cables are attached to the terminals.
4. Also, do not draw any other details that are not important to whether the circuit works (for example, the color of the cable).



What the circuit looks like.



What the sketched circuit diagram looks like.

Consider the following: What could you change in your real circuit without having to sketch a new circuit diagram?



### What is your opinion?

It's Sunday and your parents are still sleeping. You want to surprise them by making them breakfast. You have already arranged everything on a tray. All that's missing is the toast, which is your father's favorite thing to eat. When you turn on the toaster, the fuse blows.

### Think about it: What would you do?

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