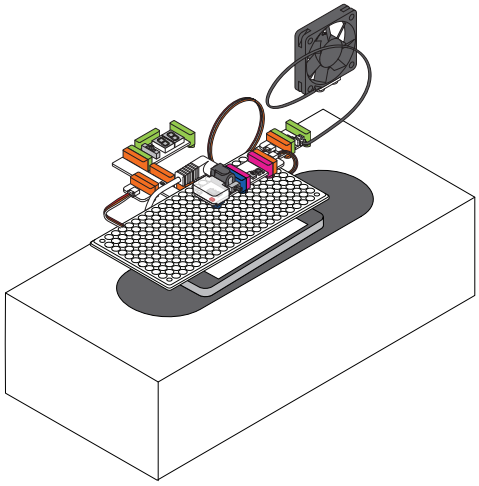
littleBits

KEEP IT COOL



GUIDED

DESIGN CHALLENGE
Design a littleBits thermometer and cooling system to experiment with data-center cooling design.

EXPLORE

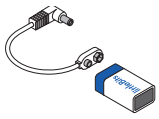
- Discuss with your group if the following statements are True or False:
  - When your phone is running high-powered activities, like streaming music or video, it is better to have it plugged in and charging while you watch.
  - When it comes to overheating, your phone case plays a big part.

CREATE

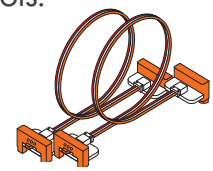
CREATE

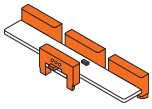
Let's design our cooling device

1. Gather your invention tools.

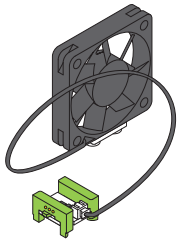

a1 battery & cable


p4 power

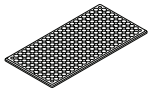

w1 wire (x2)


w7 fork


i12 temperature sensor


o13 fan


o21 number

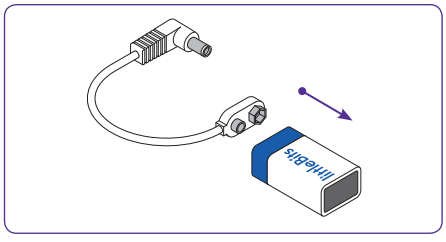

a30 mounting board

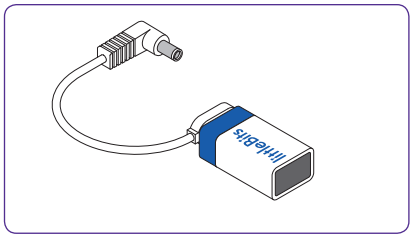

a31 battery clip

Other materials:

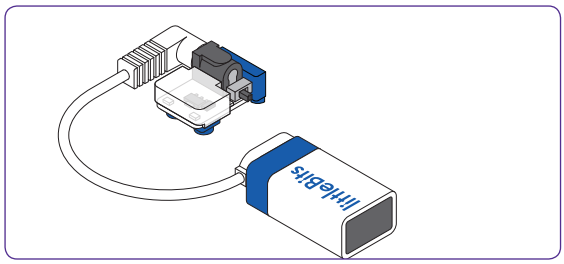
- Stopwatch or timer for trials
- 2 or more smartphones or tablets that can fit inside the box, queued for mapping directions or streaming music (on mute)
- Empty rectangular boxes (tissue box or a similarly-shaped box, but you will need to cut a hole in the top)
- Different insulation material, such as foil, napkins, fabric, etc.
- Optional: If using ice, place the cubes in a plastic sandwich bag to keep your littleBits dry.

2. Attach the battery cable to the battery.

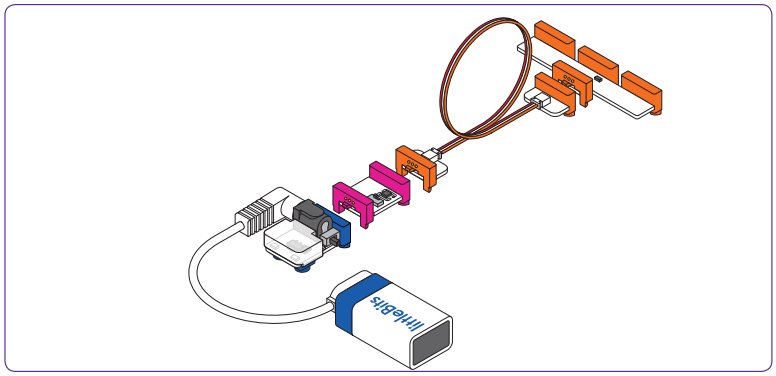




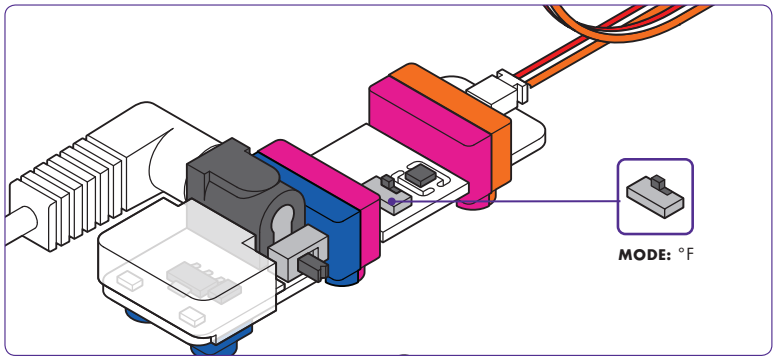
3. Attach the power Bit to the battery cable assembly.



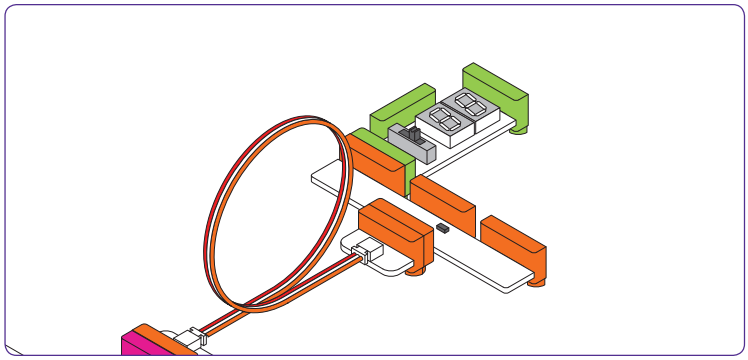
4. Snap this circuit together.



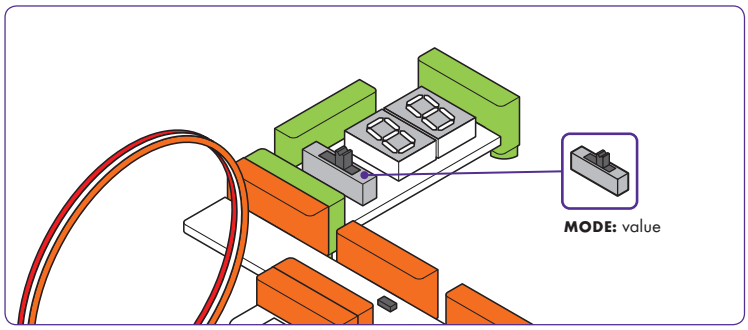
5. Make sure your temperature Bit is switched to °F (Fehrenheit) mode.



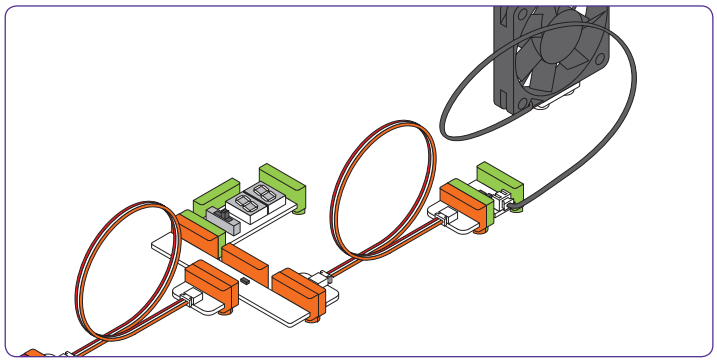
6. Attach the number Bit to the first bitSnap of the fork.



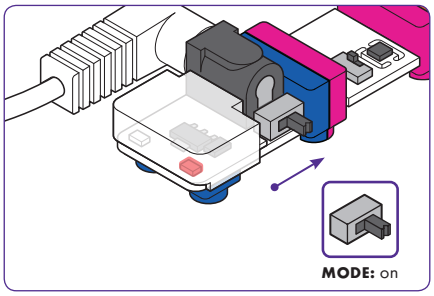
7. Toggle the switch to "value" mode.



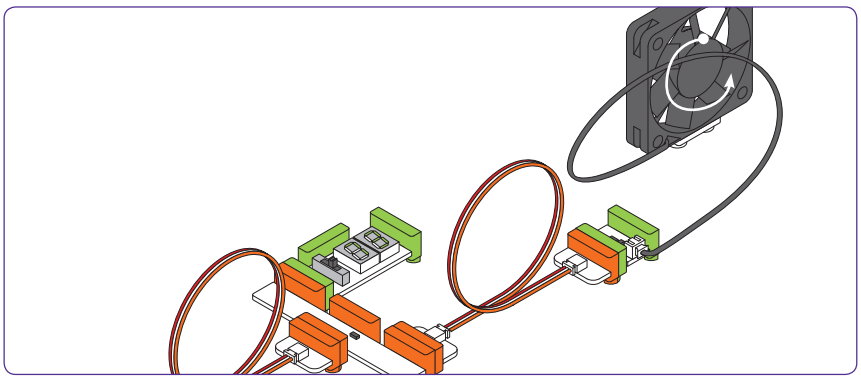
8. Attach the wire and fan Bit to the last bitSnap of the fork.



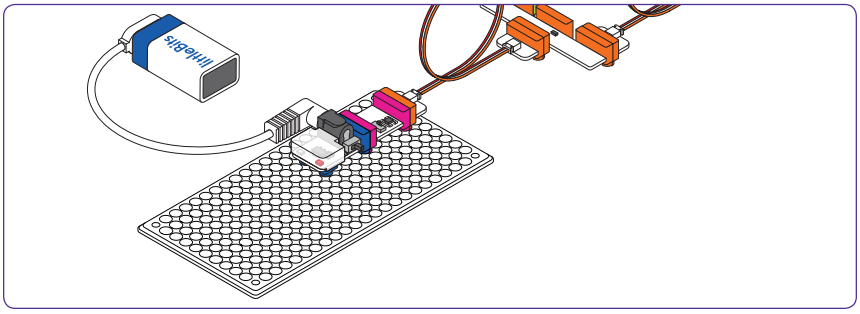
9. Let's test that your circuit works. Power on your circuit!



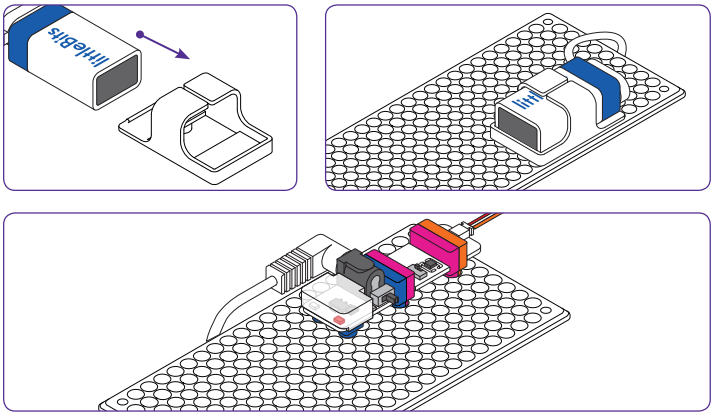
10. The number Bit should give you a numerical reading and the fan should spin.



11. Press the power + temperature sensor + wire into the mounting board.



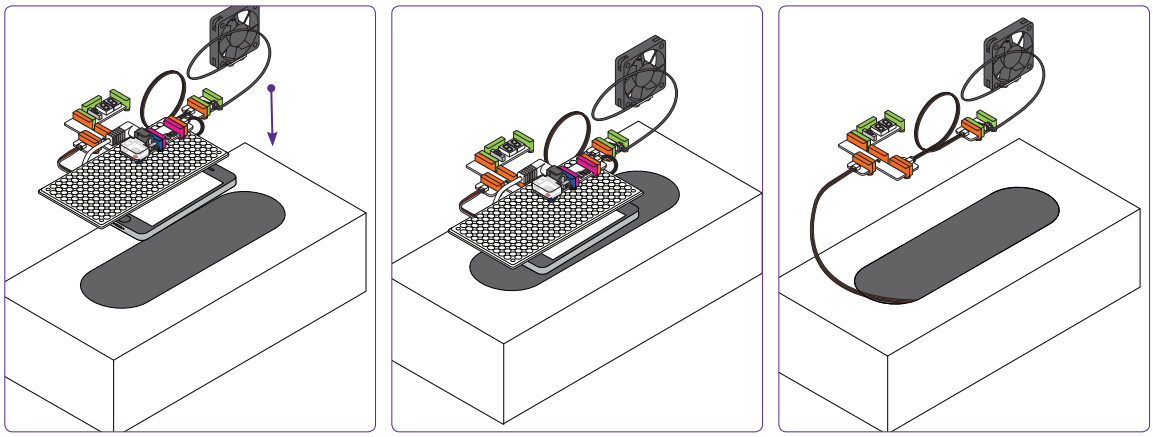
12. Slide the battery into the battery clip. Press the battery clip onto the back of the mounting board.



PLAY

PLAY

13. Stream music/video or set up directions in a map app on your devices (make sure they are on mute!). Then, place the mounting board and devices into the box and keep the rest of the circuit outside of the box.



WRITE

14. Let the devices sit in the box for three minutes, then record the temperature and conditions under "Reading #1" in Writing Box #1 in your guided handout.

WRITE

15. Complete Writing Box #2 in your guided handout.

16. After discussing your plan with your group, engineer a cooling solution. After setting up your device and letting your experimental condition run for 3 minutes, record "Reading #2" in your chart.

REMIX

REMIX

- If time allows, try remixing your design to get an even lower reading. Run your devices again for three minutes and record "Reading #3" in your chart.

SHARE

SHARE

- Discuss with your group the following questions:
  - What worked in your design?
  - What didn't work?

WRITE

- Complete Writing Box #3 in your guided handout.

CLEAN

CLEAN UP

- **Until next time, littleBits!** Place the Bits gently back in the box according to the diagram on the back of the Bit Index; return classroom materials to their proper place and check the area around your workstation.

littleBits

KEEP IT COOL

Name:

CHALLENGE OVERVIEW

Let's model data centers by designing and testing a cooling system for our devices.

GUIDING QUESTIONS TO REACH LEARNING OBJECTIVES

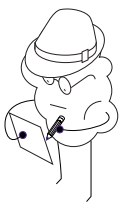
How can we engineer and test our models, then apply them to larger situations?

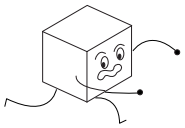
CREATE

1.

	VALUE	CONDITIONS
READING #1		
READING #2		
OPTIONAL: READING #3		

2. Work with your group to come up with a list of ways that you can decrease the temperature inside the box and sketch out your ideas. Be sure to take the following constraints into account:
   - Devices must remain inside the box;
   - The box must remain partially intact (just as a computer must have some sort of protective casing);
   - No liquids inside the box (just as moisture can damage a computer).





SHARE

3. Explain what the independent/dependent/controlled variables are in this experiment.

CONTROLLED VARIABLE(S) Things that we need to remain constant throughout the whole experiment to ensure results are consistent.	
DEPENDENT VARIABLE(S) Things that we change and adjust in order to observe the outcome(s). It's important to only change one dependent variable at a time.	
INDEPENDENT VARIABLE(S) The outcome(s) we're trying to affect with our changes and adjustments.	