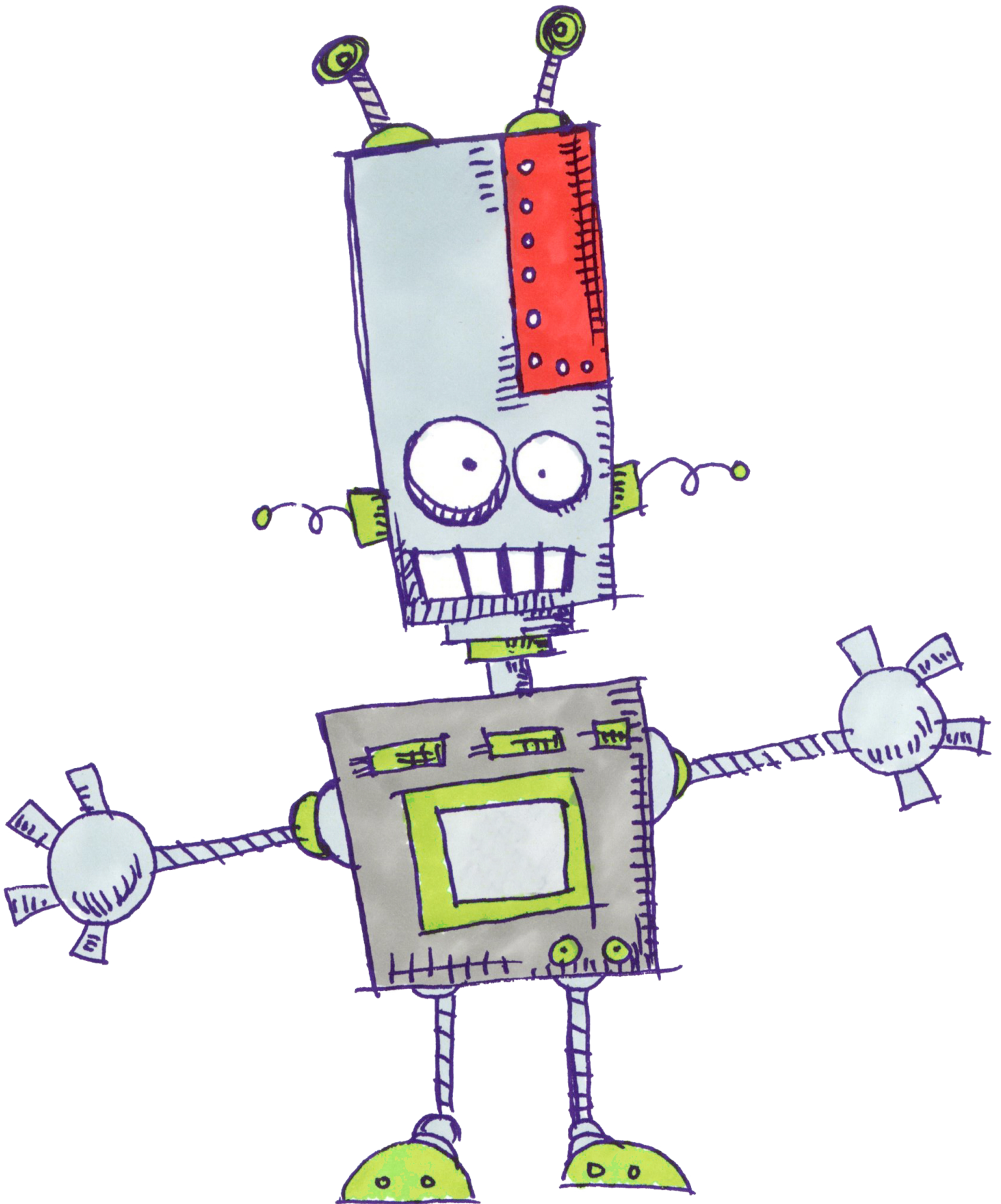
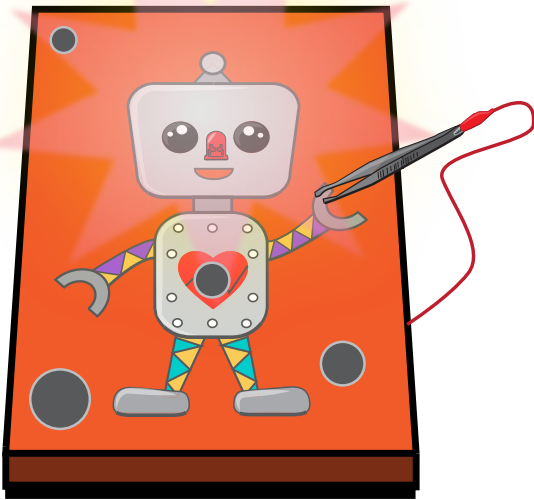




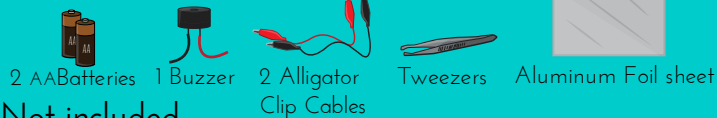
3. OPERATION GAME

You've probably played Operation, the game where you're a doctor armed with a pair of tweezers, trying to fix a patient with a big red nose. Like most things, it's much more fun when you make your own! Let's do this! Estimated time: 25-30 min



What you need

Included in kit



Not included

1 box (a gift box, cereal box, or shoe box lid is good!)
 Scissors *ask a parent!*

Small things to pick up (gummy bears, Play-Doh balls, Tic-Tacs, etc.)

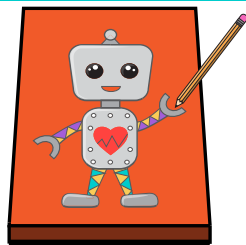
Stuff to draw with (colored pencils, crayons, etc.)

Tape

How To

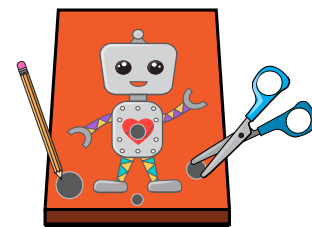
Step 1: Draw your character

1 box
 Stuff to draw with

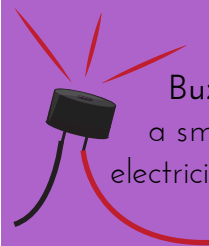


Step 2: Make operation spots

Stuff to draw with
 Scissors



Components guide



Buzzer: Buzzes! A piezoelectric buzzer has a small "piezo" plate in it that vibrates when electricity goes through. The plastic case makes the buzz sound louder.

LED: LED stands for Light Emitting Diode. An LED is like a tiny lightbulb that requires less power. It lights up when connected to a battery. The LED has two legs that are called leads. The long lead is the positive and the shorter lead is negative.

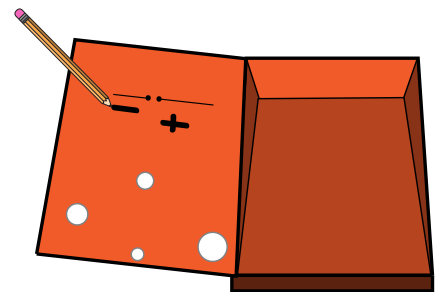
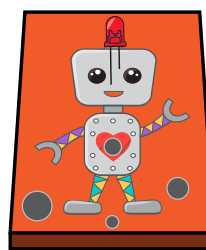


- Think up a character and draw it on your box! It can be a person, an animal, an alien, a robot... If you don't want to draw, you can use the included robot template instead! Just paste/tape it to the front of your box.
- On the bottom half of your character, draw 3-5 spots of different sizes..
- Cut out the circles. *Ask a parent for help!*

Step 3: Add the LED

1 LED

- Pick a spot for your LED.
- Poke the LED in from the top of the box.
- On the inside of the box, label the + positive leg (the long one), and the - negative leg (the short one).

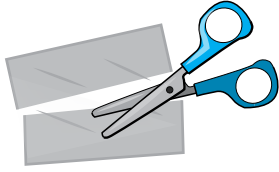


3. OPERATION GAME

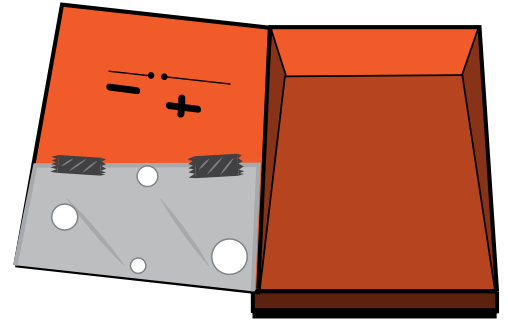
Step 4: Foil!

1 sheet of foil

Scissors



- Tear off two small strips of foil, and set them aside for later.
- Flip your box over to the back.
- Tape the big piece of foil to the back of the box, bottom half.
- Flip the box over again.
- Cut out the foil in your circles.
- Fold the edges of the foil over the edges of the spots.

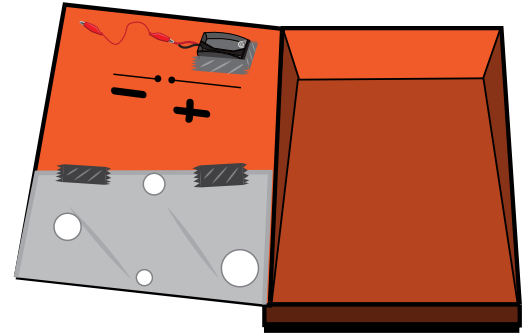


Step 5: Add power

1 battery pack

1 alligator clip cable

- Flip your box over to the back.
- Tape down the battery pack in the upper left.
- Attach the alligator clip to the red wire on the battery pack (the + side).

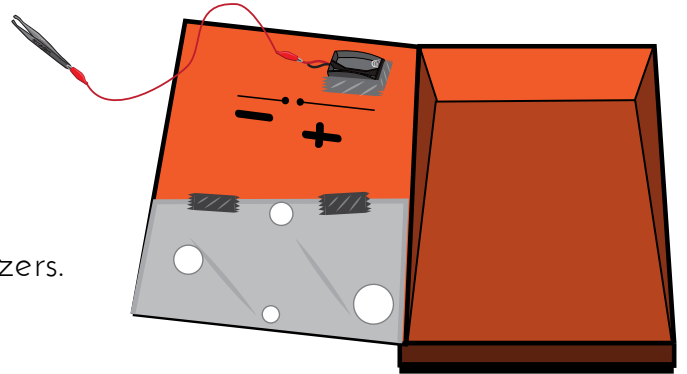


Step 6: Add tweezers

1 alligator clip cable

Tweezers

- Attach the other end of the alligator clip to the tweezers.



Time out! How should we set up the LED and the buzzer?

When you're just connecting one thing to a power source, it's pretty easy to plan. Just connect the LED...to...the battery. Boom. But when you're connecting more stuff, you have more options. The simplest way is a series circuit. In a series circuit, you just put everything in a row. It's easy, but the problem is if one thing breaks, nothing works. So, we're going to put the LED and the buzzer in a parallel circuit. In a parallel circuit, each component has its own branch from the power source. If one piece breaks, the other one keeps on working. So, for our game, we'll have two branches: one for the buzzer, one for the LED. We're going to attach strips of foil to each end of the power source so we can send power to each branch. Ok, let's go!

3. OPERATION GAME

Step 7: Connect LED to power

2 small strips of foil

1 alligator clip cable

Tape

- Tape a strip of foil to the - negative leg of the LED.
- Tape the - negative wire (the black wire) from the battery pack to the foil too.
- Tape a strip of foil to the + positive leg of the LED.
- Attach the alligator clip to the foil too.

Step 8: Add the buzzer branch

Buzzer

- Connect the - negative wire (the black wire) of the buzzer to the foil that's with the - negative leg of the LED.
- Connect the + positive wire (the red wire) of the buzzer to the foil that's with the + positive leg of the LED.

Step 9: Connect your character

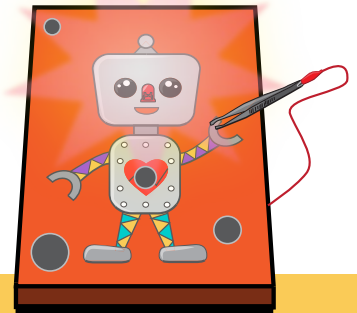
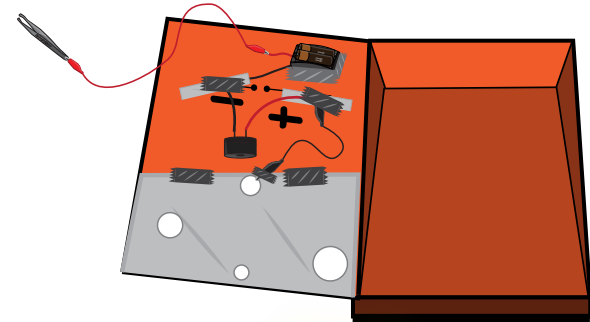
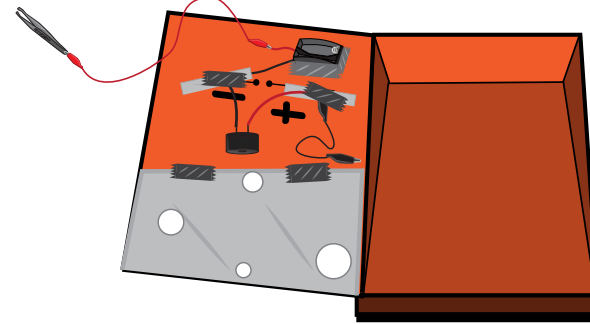
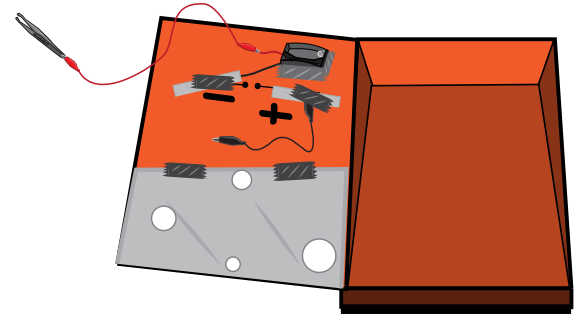
1 alligator clip

- Attach the remaining end of your alligator clip to one of the spots in your character.
- Make sure it's making good contact with the foil!
- Test your circuit by touching the tweezers to the foil in one of your spots.
- If the LED lights up and the buzzer goes off, you're good to go!

Step 10: Play!

Small things to pick up (gummy bears, Play-Doh balls, Tic-Tacs, etc.)

- Turn your box over, then place a small object in each of the spots.
- Try to pick them up with the tweezers without setting off the alarm!



Troubleshooting

If your LED or buzzer don't work, make sure you have the foil strips taped to the metal parts of the wires (not the plastic insulated parts). If a spot stops working, check the foil around the spot. Sometimes it can rip and separate that spot from the rest of the circuit.

What's going on here?

For the LED to light up and the buzzer to make noise, they need power. But instead of sending the negative end of the battery directly to them, we send it to the tweezers. Then we, connect the rest of the circuit to the foil that goes in your spots. When the tweezers touch the foil, the circuit is complete, the power flows, the lights go off, the buzzer buzzes, woo! In other words, the tweezers and the foil act like a big switch.