

## Circuits in Motion



### What Will You Learn?

Let's jump in and put some circuits to work. We'll explore circuits and make two moving paper circuits -- a race car with a vibrating offset motor and a vibrobot that uses a disc motor like the ones found in cell phones.

### Materials

- Coin Cell Batteries
- Shake It Board (Battery Pack and Vibrating Motor)
- Disc Motor with Leads
- Conductive Maker Tape Roll
- Scissors
- Invisible Tape or Glue
- Markers or Colored Pencils

## Make It



1. Today we'll be using circuits to set things in motion using motors. We'll be starting with using a vibrating motor to make a paper race car.
2. Color your race car template as desired.
3. Assemble the paper template. (Fig. 1)
  - a. Cut along the solid lines.
  - b. Fold along the dotted lines.
  - c. Glue or tape the tabs into place.



1. Test your Shake It Board.
  - a. Place a battery into your battery pack with the smooth positive side facing up.
  - b. Turn the switch to "on."
  - c. What is causing the motion? Look closely at the shaft of the motor.
  - d. Turn the switch to "off."
2. Slip the Shake It Board into the body of the racer. Turn on the switch. (Fig. 2)

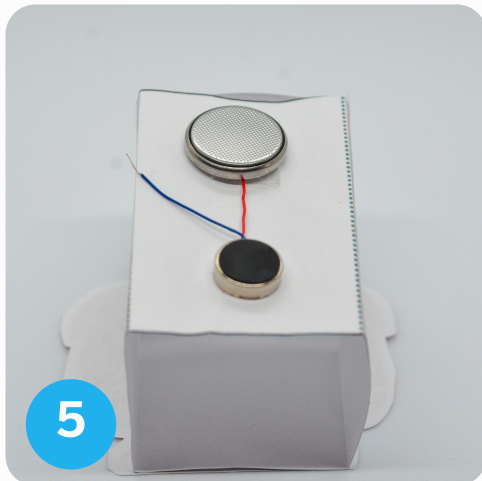


1. Gather materials such as drinking straws, pipe cleaners, paperclips, buttons, etc. Try making wheels or blades for your racer. How can you reduce friction so that the car moves more quickly? (Fig. 3)
2. Try adding weight to different parts of the car to see how it affects the motion. Does the weight of the car affect the motion? How? Why?

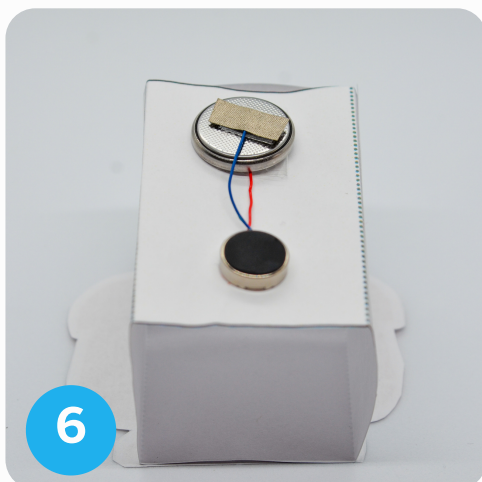
## Make It



1. Let's try a different motor to build a vibrobot. A vibrobot is a tiny robot powered by a vibrating motor, like the type found in cell phones.
2. Color your robot template as desired.
3. Assemble the paper template.
  - a. Cut along the solid lines.
  - b. Fold along the dotted lines.
  - c. Glue or tape the tabs into place.
4. Stick the disc motor to the back of your paper bot, near the bottom. (Fig. 4)



1. Connect the red wire to the positive side (+) of a battery with Maker Tape.
2. Use a loop of invisible tape to attach the battery to the back of the robot near the top with the positive side face down. (Fig. 5)
3. Connect the blue wire to the negative side of the battery with Maker Tape. (Fig. 6)



1. Try using paper clips as weights to adjust the balance of the robot and make him spin. Can you use items like drinking straws to make him move faster? Can you design a way to turn the bot on and off?
2. Compare the two bots. Swap the motors between the race car and vibrobot. Which do you prefer? Why?
3. Try making a track for your race car or create a ring to battle your bots.

# Maker Camp

## Mix It Up

- Build a better bot! How can you improve on your vibrobot? Use these ideas as inspiration to create your own version of a vibrobot.
- Let's draw! Use markers or colored pencils to create an art bot that scribbles on paper.
- Build beyond the bot. Can you invent a bot to accomplish a task, like mopping a floor, entertaining a pet, or mixing up salad dressing?



## Words to Know

- **Battery:** The battery will power your circuit. It generates electricity through a chemical reaction. A coin battery, like the one we will use, has a smooth positive side marked by a plus sign (+) and a rough negative side.
- **Disc Motor:** This type of small, flat motor has no external parts and instead uses a spring inside to create the movement.
- **Vibrating Motor:** This tiny DC (direct current) motor has an external shaft with an unbalanced weight on it. When that weight is rotated it wobbles, creating vibrations.



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## Meet Your Camp Guide

Sandy Roberts has been a certified STEM educator for over 13 years. She shares her love of science, engineering, technology, and maker activities through her business, Kaleidoscope Enrichment, as Maker Camp Coordinator, and as the author of The Big Book of Maker Camp Projects.

