
SKYRORA

Robotics Activity Pack

Ages 8 & Up

This activity should only be undertaken with adult supervision. Please contact us for more information if you have any concerns about health & safety precautions or if you would like more advice on how to complete this activity by emailing info@skyrora.com.

Materials Needed

- Toothbrush
- Side cutter or wire stripper
- 3-volt coin battery
- 10mm coin mobile phone motor (available on Amazon or eBay)
- 2mm – 3 mm flashing LED bulbs
- Double-sided adhesive circles
- Painter's tape or masking Tape

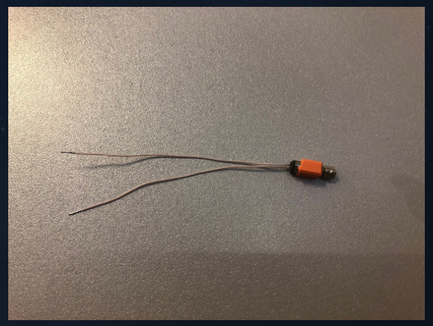
Materials Needed

Toothbrush

The biodegradable toothbrush must have **flat bristles, not angled. Please be environmentally friendly and consider biodegradable toothbrushes when gathering your materials for this activity.**

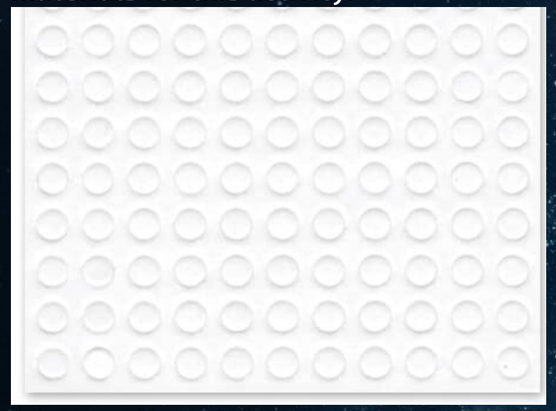
3-volt coin battery

These batteries can be purchased from eBay or Amazon here.



10mm coin mobile phone motor

These motors can be purchased from eBay or Amazon here.



Double-sided adhesive foam circles

These dot stick-on circles can be purchased from eBay or Amazon here.

2mm – 3mm flashing LED bulbs

These LED bulbs can be purchased from eBay or Amazon here.

Painter's tape or masking Tape

This tape can be purchased at your local supermarket or hardware store.

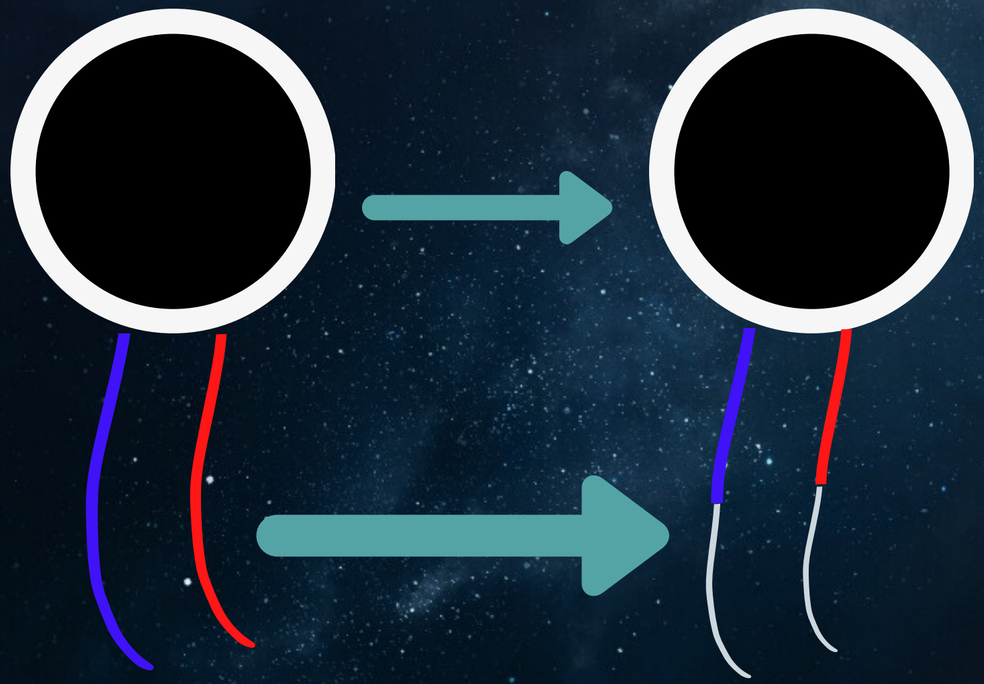
Step 1

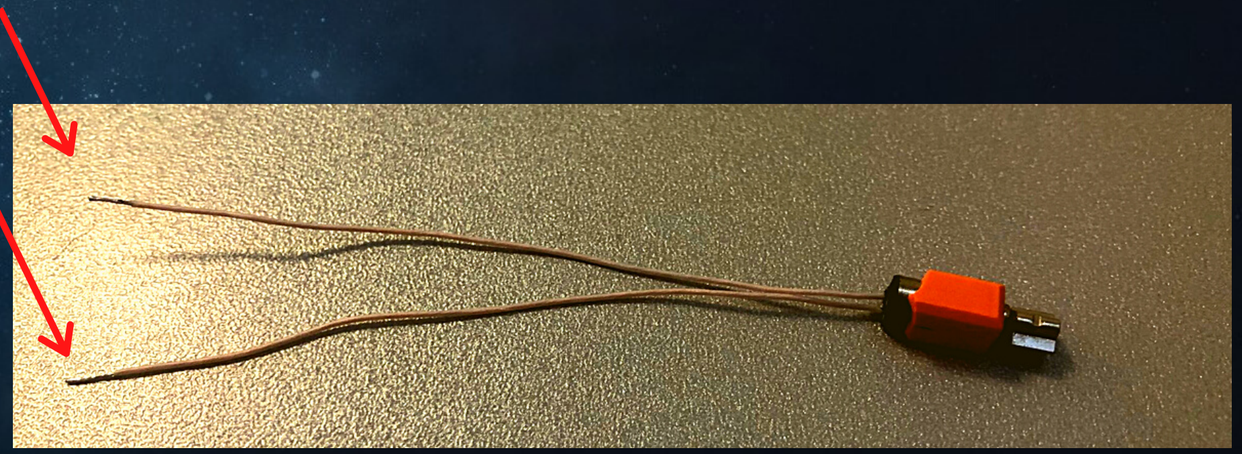
Cut the head of the toothbrush from the handle using the
side cutters or wire strippers.
Make sure that an adult completes this step for you.

This activity should only be undertaken with adult supervision.

Step 2

Strip some of the plastic covering from the wires on the mobile phone motor by carefully cutting through the plastic covering and removing it to leave the wiring exposed. This can be done using the side cutters or wire strippers. Be careful not to damage or cut through the wires themselves.





Discussion Time

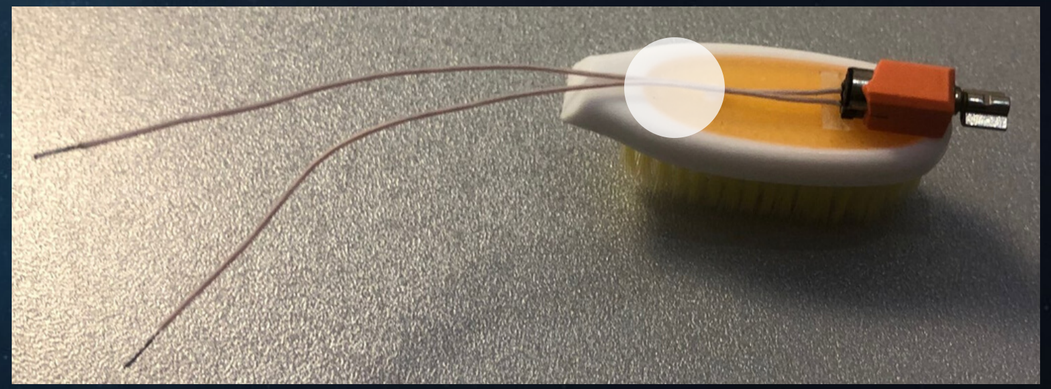
- Have you ever wondered what makes your mobile phone vibrate? The 10mm coin motor is what gives your phone the ability to vibrate.
- What would happen if you place the batteries in your game controller or TV remote the wrong way? Discuss the positive and negative sides of a battery and examine how this relates to the positive and negative wires on the motor and the LED bulbs (where the negative wire ‘leg’ is shorter than the positive wire ‘leg’).

Step 3 - Assemble The Robots

Peel back the plastic film from one side of an adhesive foam circle and stick it onto the head of the toothbrush.

Step 4 - Assemble The Robots

Peel back the other piece of plastic film and stick the motor down to the top end of the toothbrush, with the wires facing back down towards where the handle would have been.



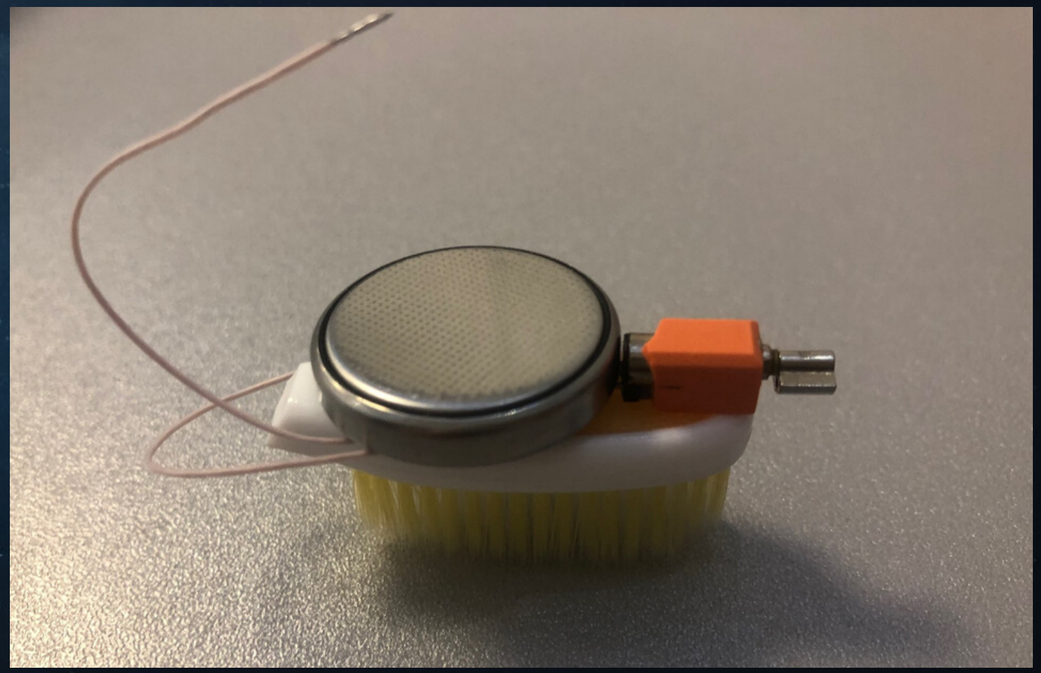
Peel back the plastic film from another adhesive circle and stick it to the end of the toothbrush where the handle used to be, on top of the motor wires.

Separate the wires gently to make clear which wire is the negative wire and which is the positive. Carefully bend the positive wire upward to easily identify the correct wire.

Step 5 - Assemble The Robots

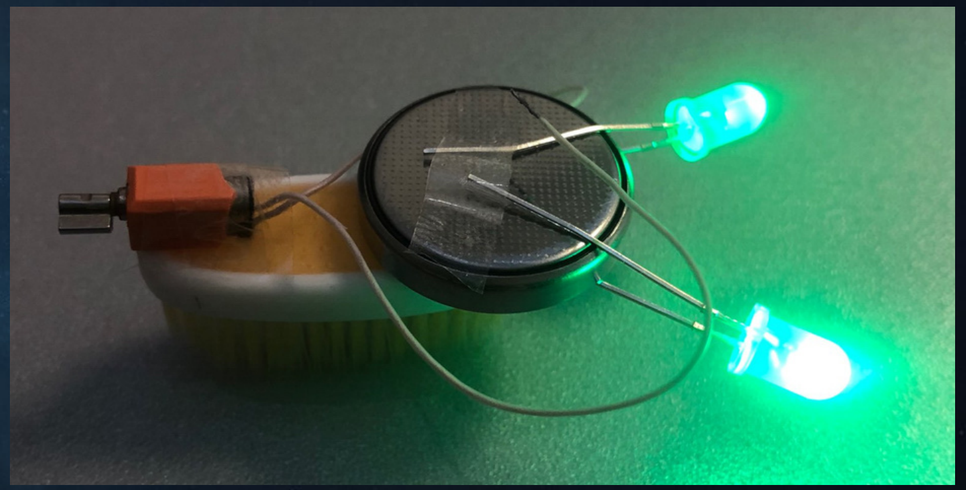
Peel back the remaining plastic film from the adhesive circle on top of the motor wires and place the battery on top of the adhesive pad.

As soon as the positive wire touches the battery your robot will begin to vibrate.



Step 6 - Final Assembly

Add the ‘eyes’ to your robot by sliding the LED's onto the battery with the bulbs facing the end of the toothbrush where the handle would be. The negative ‘leg’ of the bulb should be underneath the battery and the positive ‘leg’ should be on top of the battery.



Using the masking tape, stick the positive wire and the LED bulbs down onto the battery.

Watch your robot come alive!

Step 7 - Continue the Activity

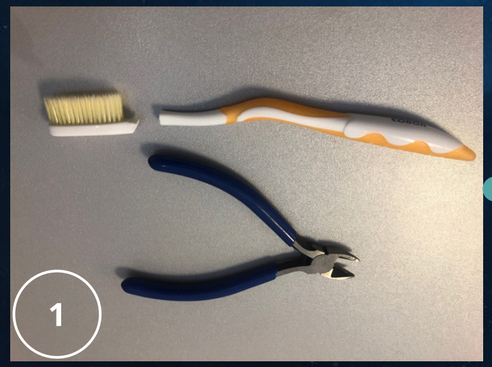
Continue the Activity:

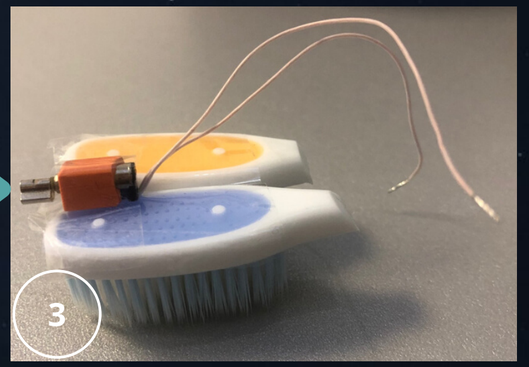
Create an obstacle course for your robot! Race different robots against one another.

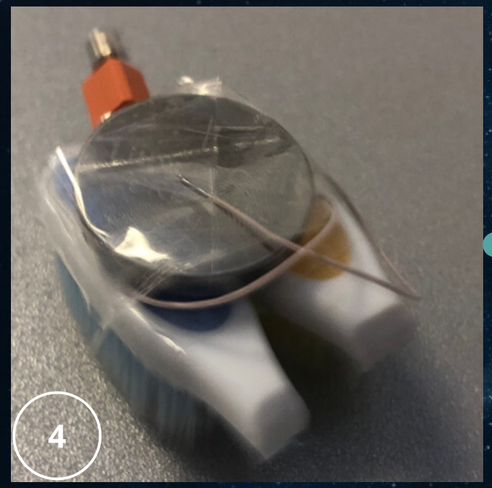
To Save the Battery:

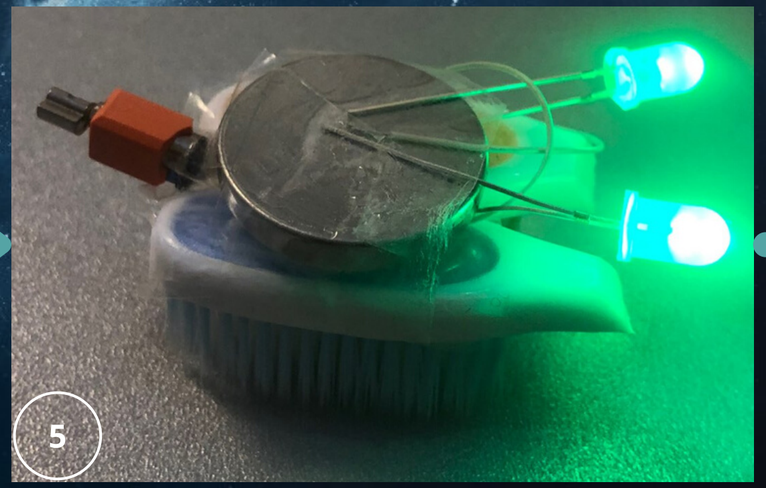
When you are finished playing with your robot, remove LED's and the tape from the top of your battery and fold the positive wire down so that it is no longer touching the battery. Place the tape back onto the battery so that the positive wire cannot touch it – this will keep the battery from running down.

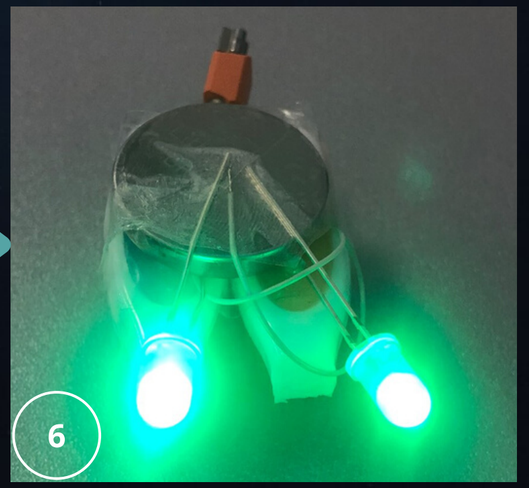
Step 7 - Alternative Method











Activity Application

Robots like this use the exact same electrical principles as the control systems in our rockets.
Massive versions of this 10 mm coin cellphone motor are used to direct the rocket engine (known as Gimbaling), and are controlled by precise calculations on a computer.
This activity demonstrates Ohm's law, as we can analyse how fast the motor will turn, given the voltage of the battery. It also demonstrates Kirchhoff's voltage law, as the LEDs operate at full brightness.

By understanding how electricity flows in a basic circuit (out of the battery and through each component), we can analyse how motors can be controlled through changing the battery voltage.

1.

Many of Skyrora’s manufacturing equipment uses circuits like these such as our 3D printers. The 3D printers use three motors to control a 3D print-head, that can be thought of as a 3D pen. The print-head is moved using a carefully controlled mechanism to sculpt the chosen product.

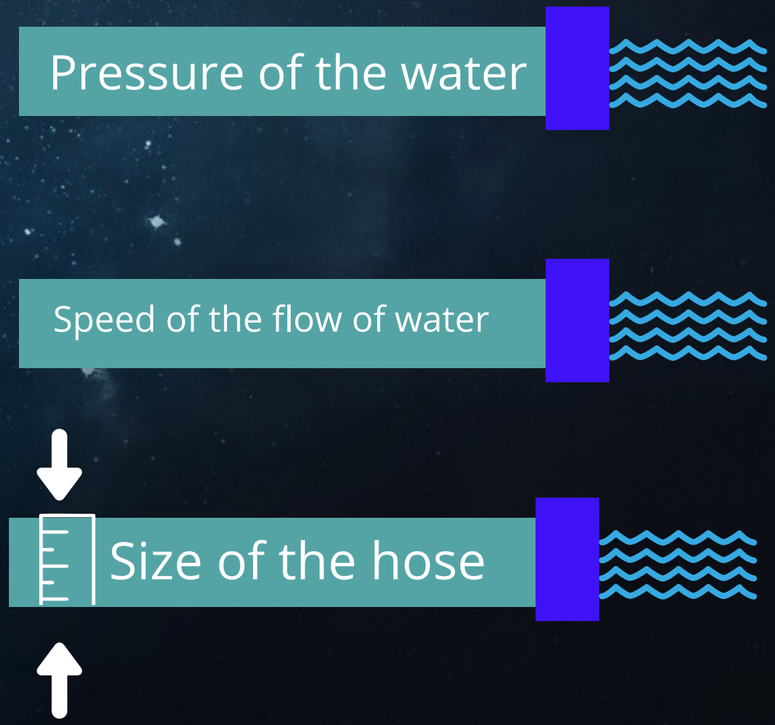
Scientific Explanation

Principles of electricity:

Voltage **Current** **Resistance**

Think of Electricity in terms of a water hose:

Quantities	Units for Quantities
Voltage	Volts (V)
Current	Amps (A)
Resistance	Ohms (Ω)



Scientific Explanation

Principles of electricity:

Voltage **Current** **Resistance**

Think of Electricity in terms of a water hose:

VOLTAGE (V) can be thought of as the pressure that pushes the water through the hose. This is measured in volts.

CURRENT (I) can be thought of the amount of water flowing through the hose, pushed through by the voltage. This is measured in amperes.

RESISTANCE (R) Resistance can be thought of as the size of the hose, it's more difficult to push the same amount of water through a small hose than a bigger one.. This is measured in ohms.

Scientific Explanation

The characteristics of simple circuits like this with positive and negative wires and the flow of electricity are fundamental in being able to calculate how the motors in our rocket systems will operate. This circuit demonstrates all the electrical fundamentals (Ohm's law, Kirchhoff's laws.) that we scale up into all of our electronic rocket systems.

Ohm's law is stated in a simple mathematical formula as the following:

$$V = I \times R \qquad \text{so} \qquad I = V/R \qquad \text{or} \qquad R = V/I.$$

Ohm’s law describes one of the foundational relationships found in electronic circuits. The law states that for any given resistance, current is directly proportional to voltage.Therefore if you increase the voltage that runs through a circuit whose resistance is fixed, the current goes up. If you decrease the voltage, the current goes down.
Where V = Voltage (in volts), I = Current (in amperes), and R = Resistance (in ohms).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