

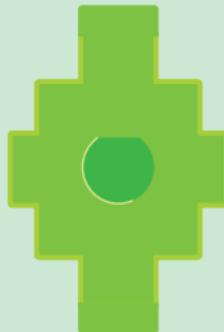
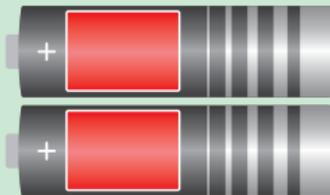
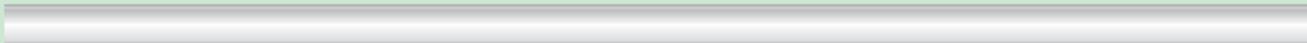
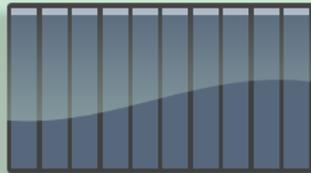
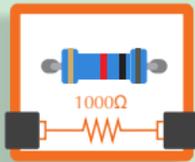
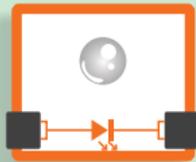
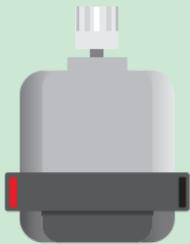
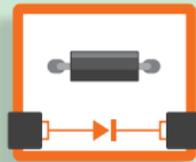
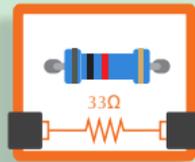
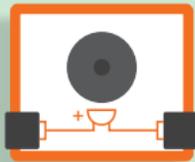
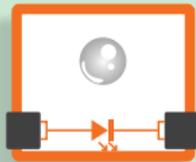
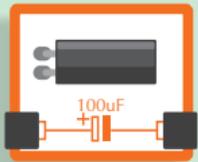
HELLO.

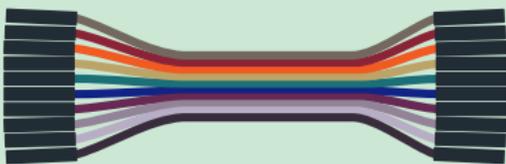
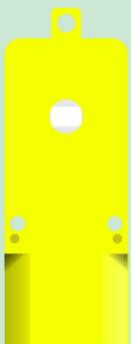
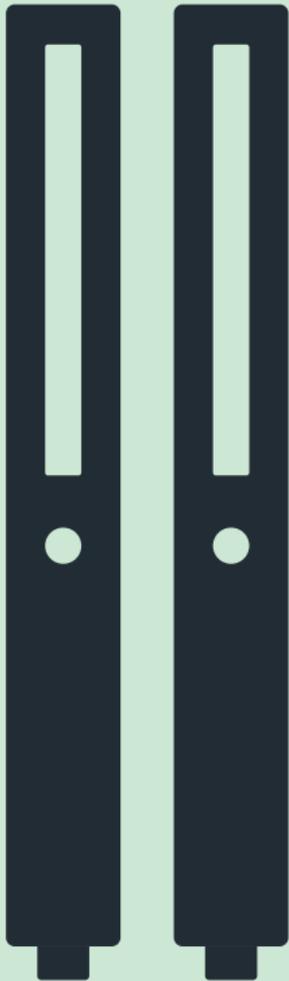
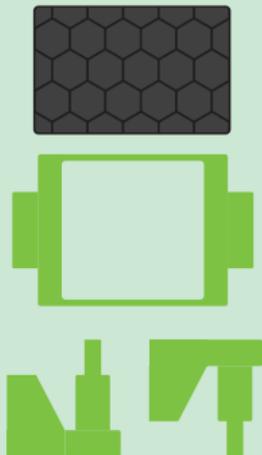
Future

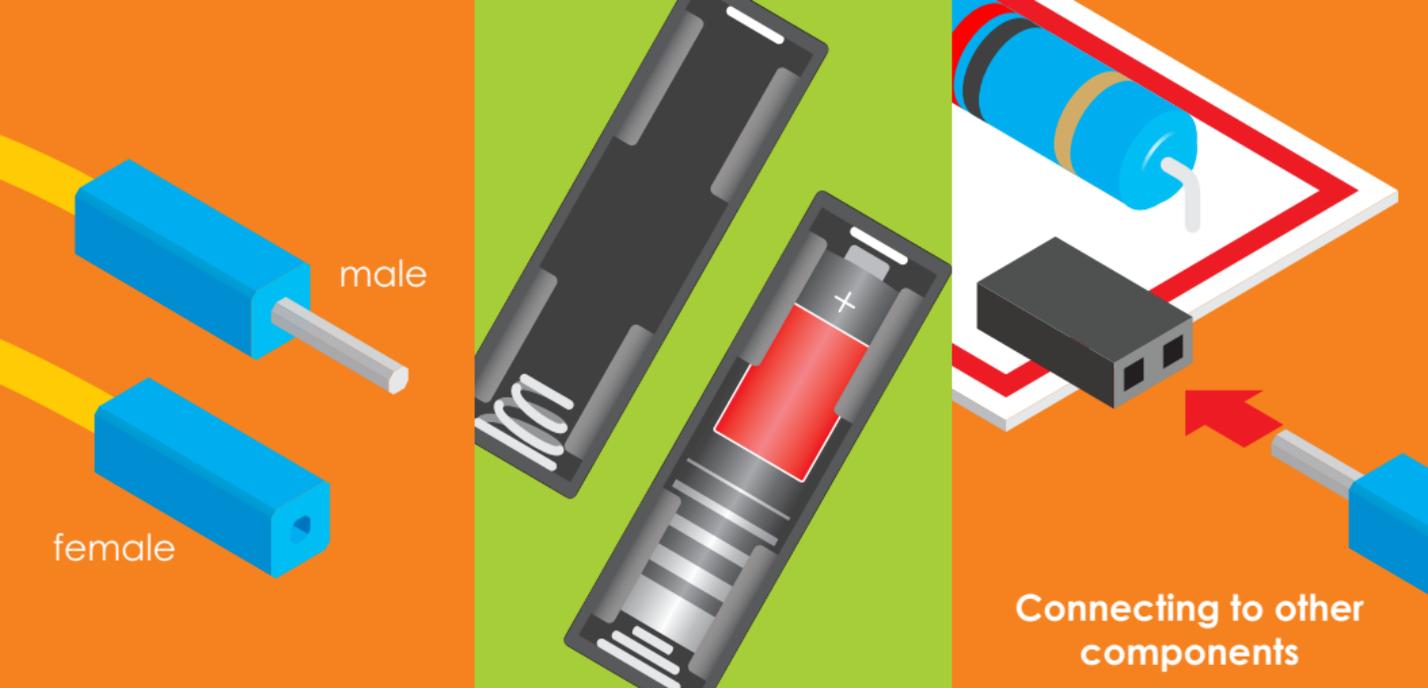
Engineer



Ready?





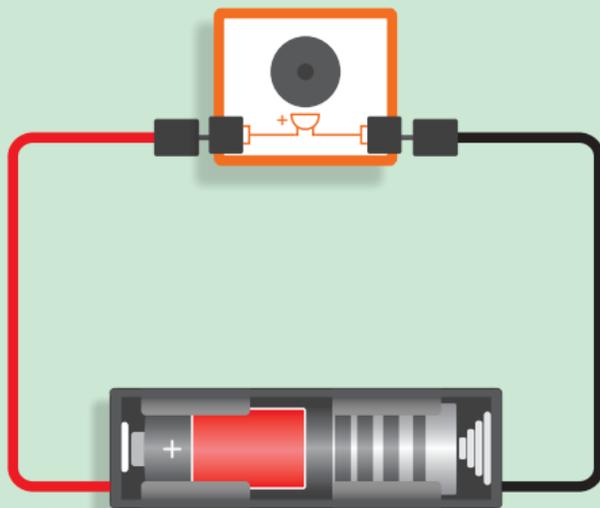


Making Connections

Connections are made easy using the attachments on your connecting wires. Connecting wires come in male and female wires

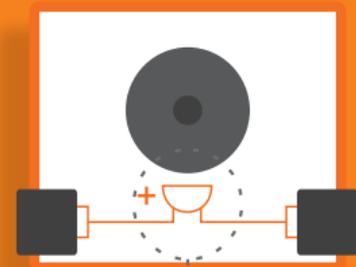
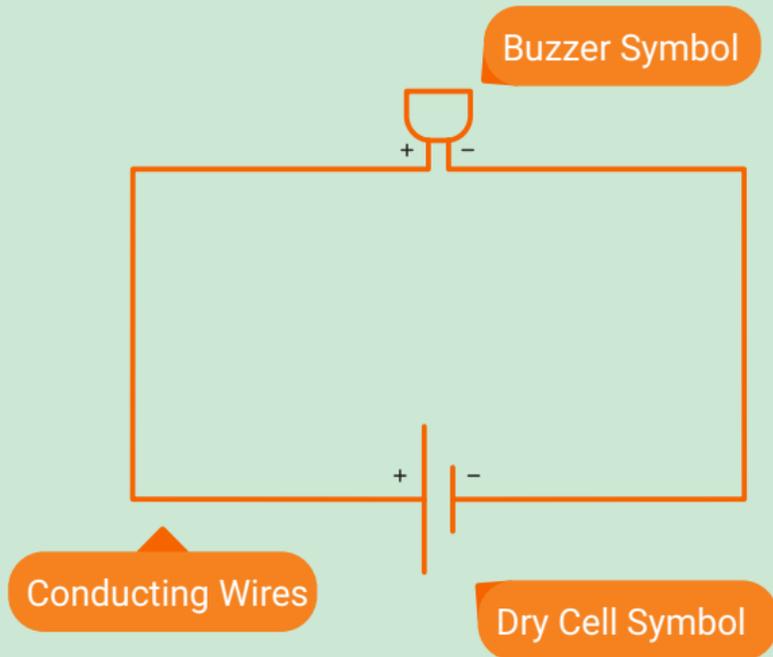
All connections are made by gently push the cable unto the leads on the component you want to connect to

Build your first circuit!



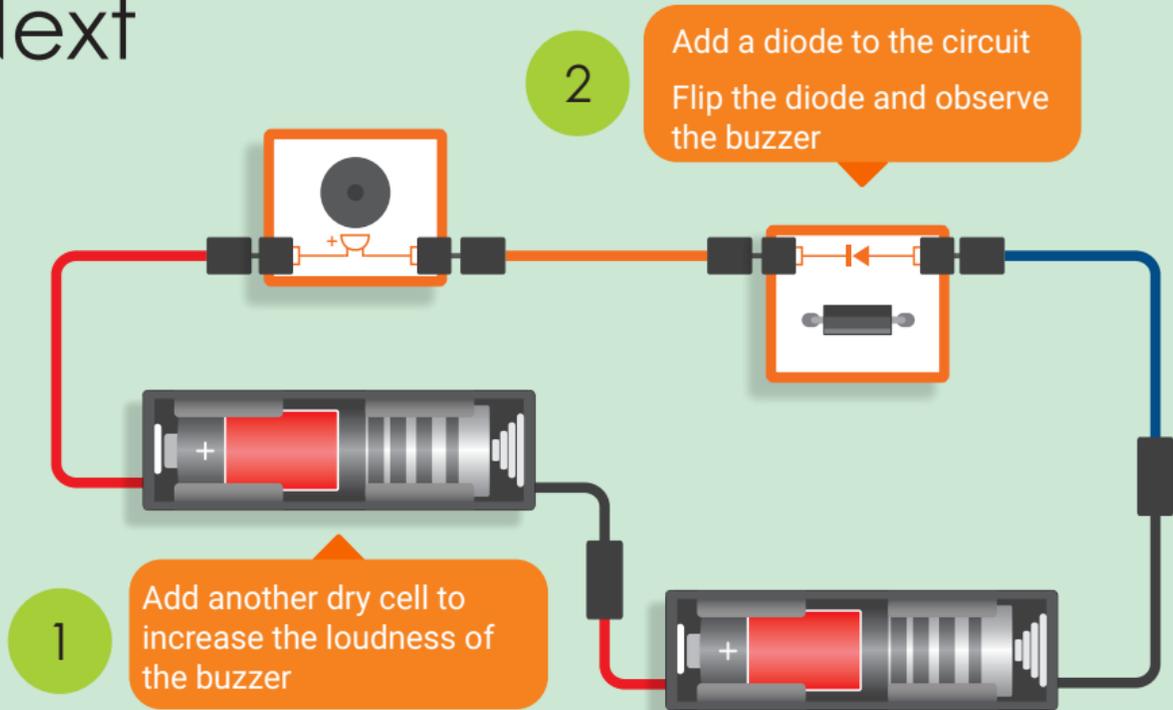
Your first circuit will be a very simple circuit. It will include a dry cell, a buzzer and connecting wires.

Next For every circuit there is a **circuit diagram**! A circuit diagram is a representation of the circuit, using symbols for components and lines as connecting wires.



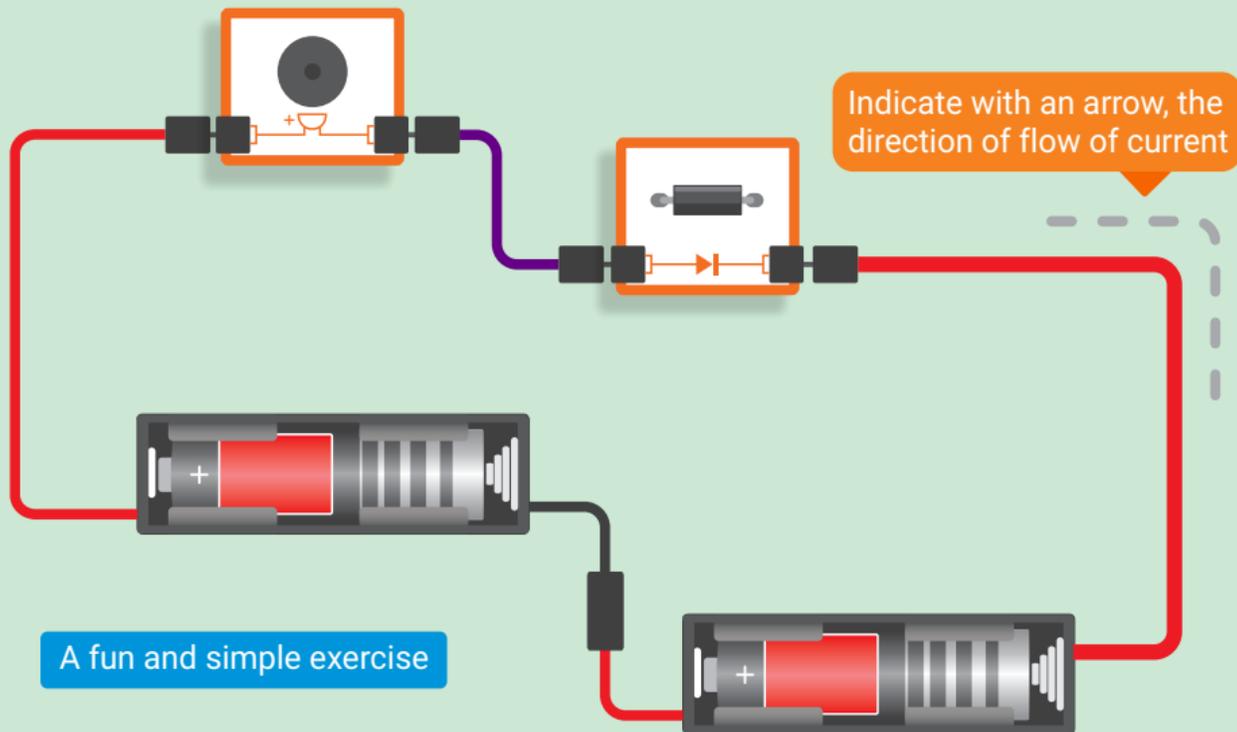
You can find the circuit symbol for each component is printed on it.

Next



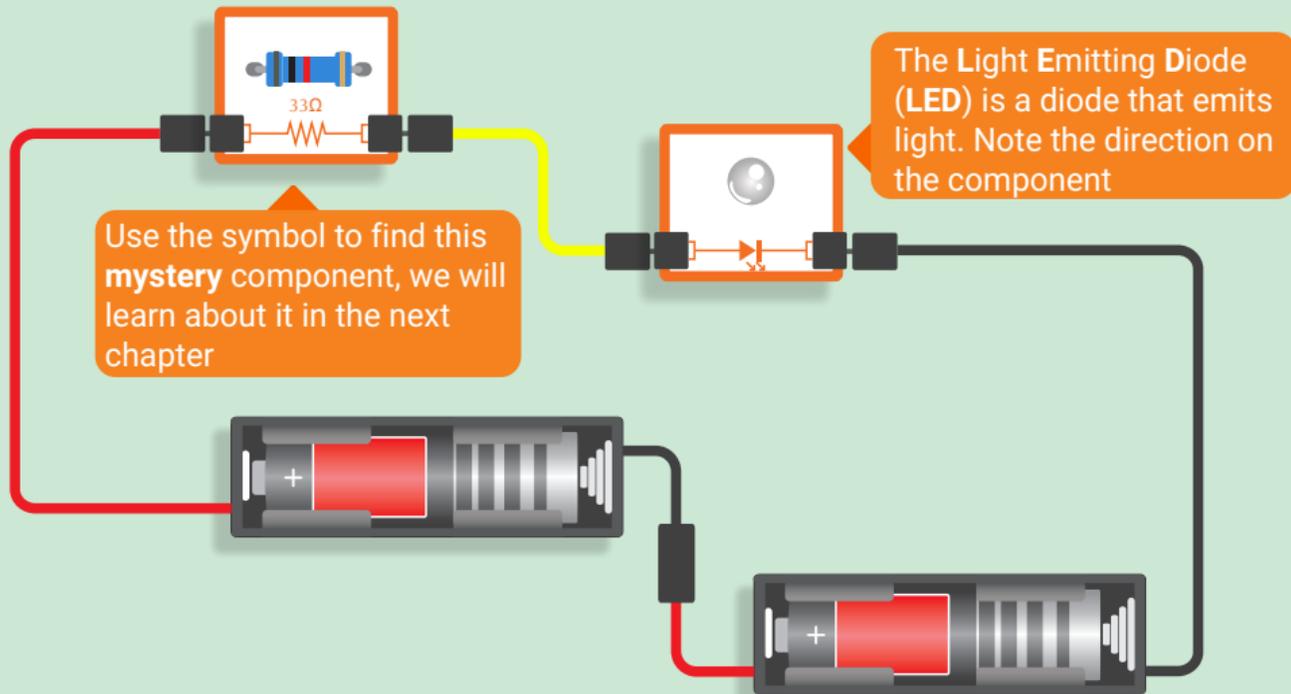
A diode is a component that allows current to flow in only one direction. If a diode is connected such that current flows through, it is **forward-biased**, otherwise, it is **reverse-biased**.

By observing the direction of the diode, in what direction does current flow?



Next

We see a diode that emits light and learn about a new component using the scientific process!



The Scientific Process

In order to find the function of our unknown component, we will apply the scientific process.

Hypothesis / Question

What is the function of the mystery component

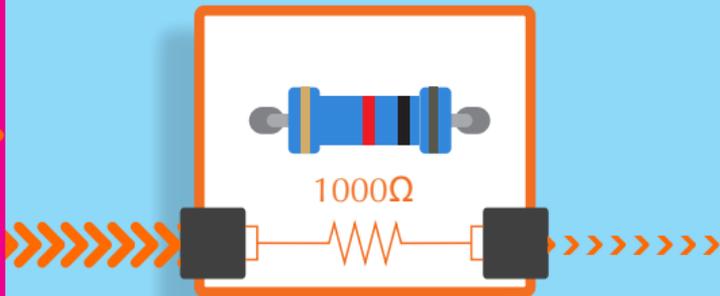
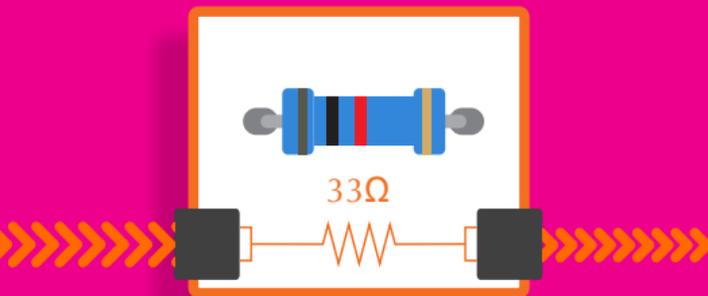
Experimentation

There are two of the mystery component in the science set.
Replace the one in the previous circuit with a higher one and observe the change in the LED. Switch them again

Observation

Record your observation. What do you see is the difference between the two components and what is the effect they have



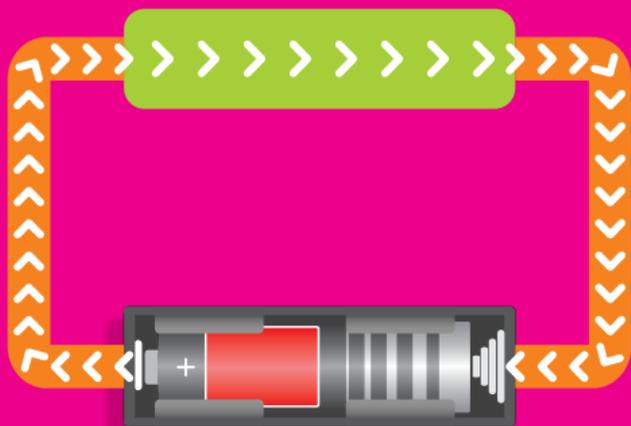


You should realize that the mystery component resists the flow of current. It is called a **resistor**. The higher the resistance, the lower the current as shown above

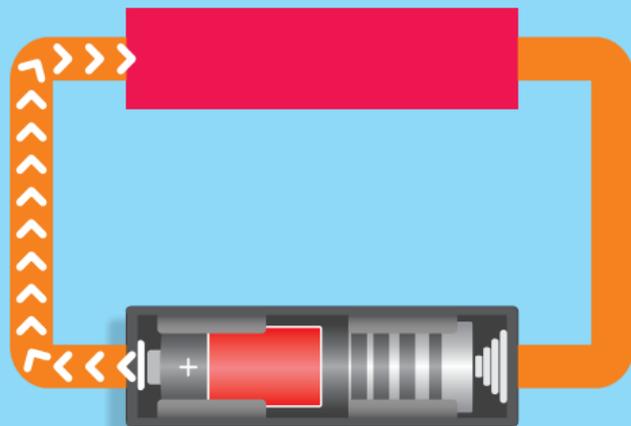
A resistor limits the flow of current but some materials do not allow current to flow through at all! Conductors allow current to flow through and non-conductor do not (as illustrated below).

An example of a conduction is the wires in the science set

Conductor

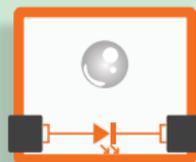
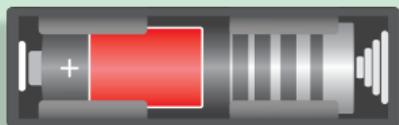


Non-Conductor

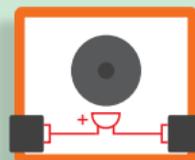




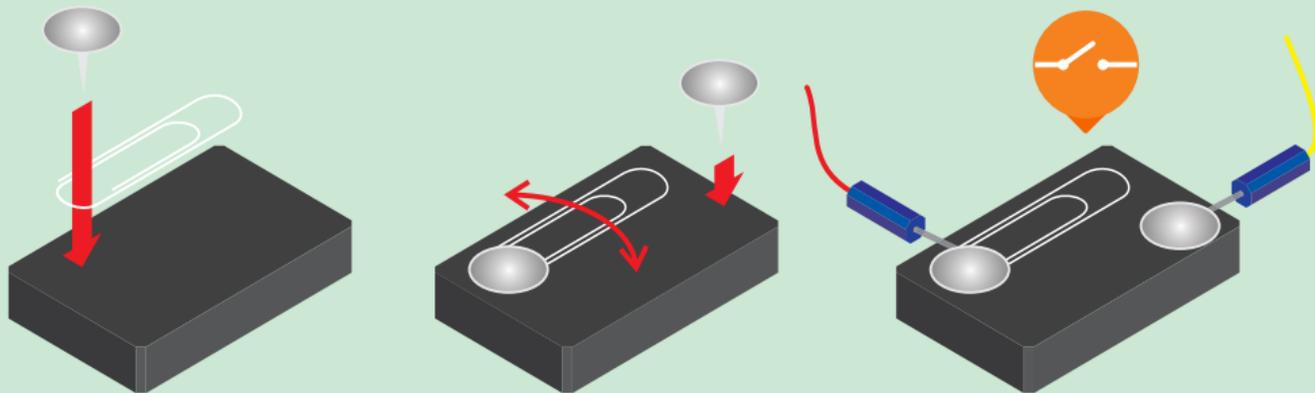
With adult supervision use the components below to build a simple device to test whether or not household items are conductors or not.



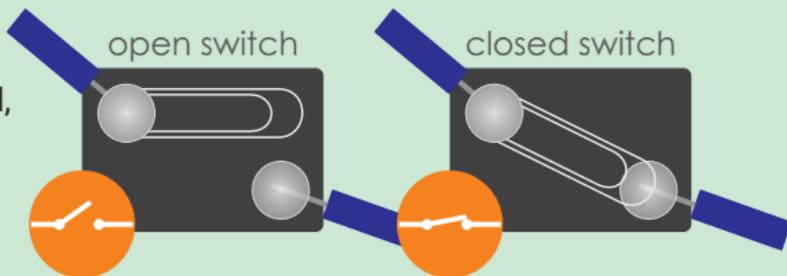
or



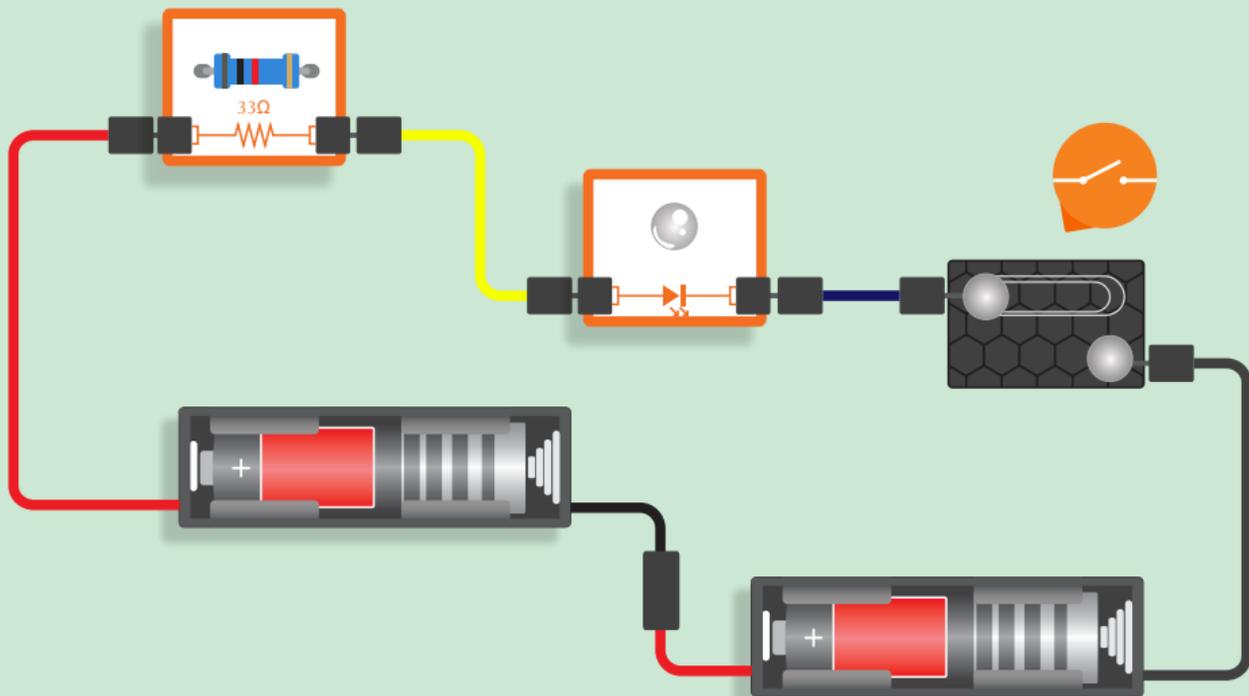
Lets use what we know about conductors and non-conductors to build a switch in order to open and close our circuits without having to disconnect wires



A switch only has two states. Closed, where it allows current to flow through or open when current does not flow through



Lets add our switch to the last LED circuit. We should be able to switch the LED on and off by opening or closing the switch

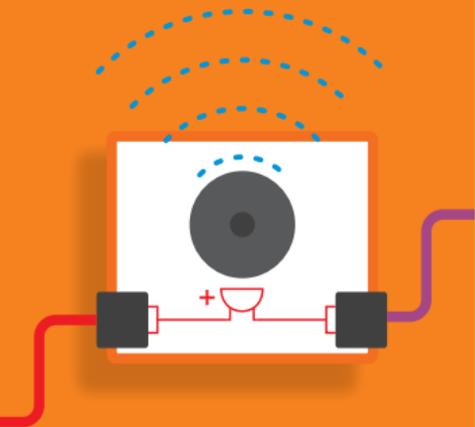


Developing your problem solving skills

Mr Antepem likes to spend his time in his garden. Two local burglars want to take that opportunity to steal from him.

Can you use what you've learned so far to create a device to alert Mr Antepem when the burglars try to enter his house?

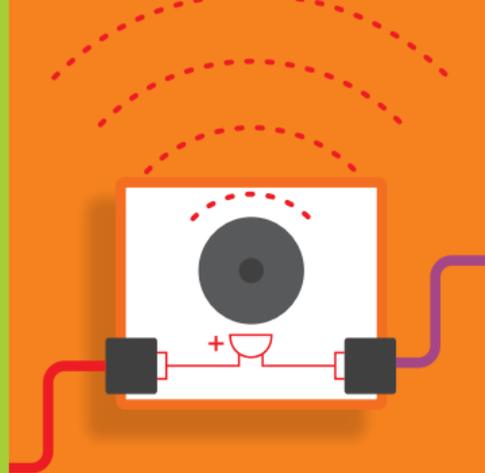




Remember the buzzer circuit? This could produce sound to alert Mr. Antepem.



From our lesson on conductors, we could use the different materials as a trigger to close and open the buzzer circuit

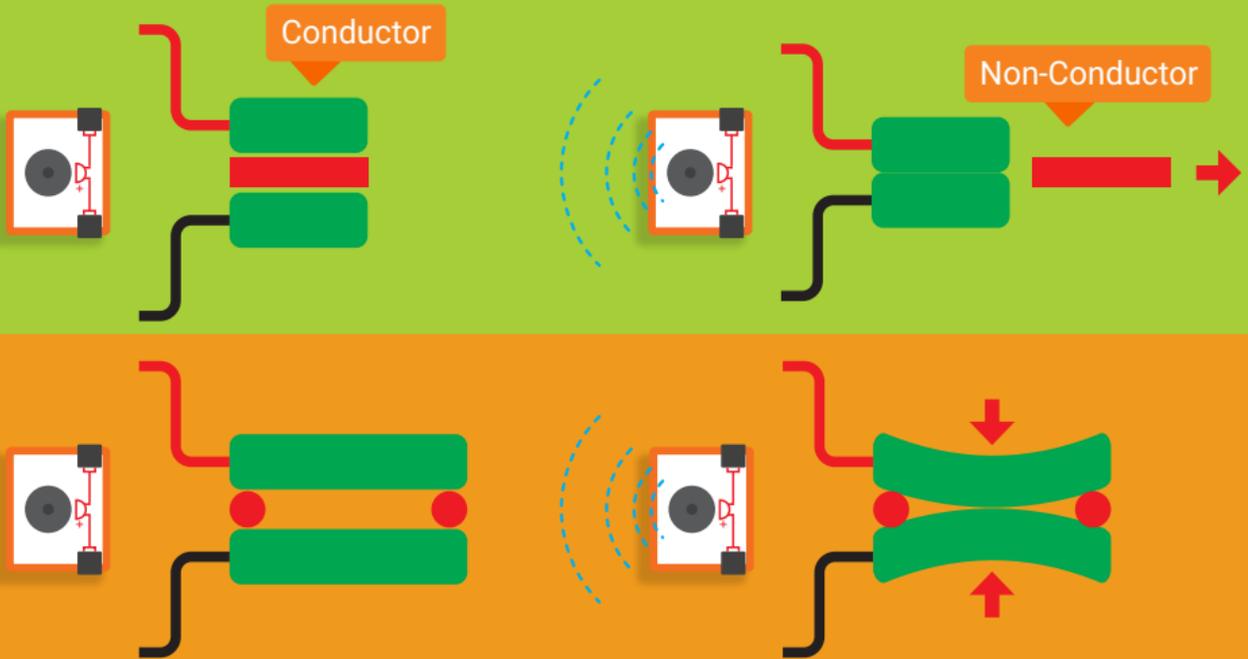


We have also discussed how to make the buzzer louder with more batteries

When designing a solution to a problem, you often have to rely on existing knowledge.

1

Consider where to place your device. For example, doors, window, or even door mats. Consider the points of entry and how the burglars will interact with them



2

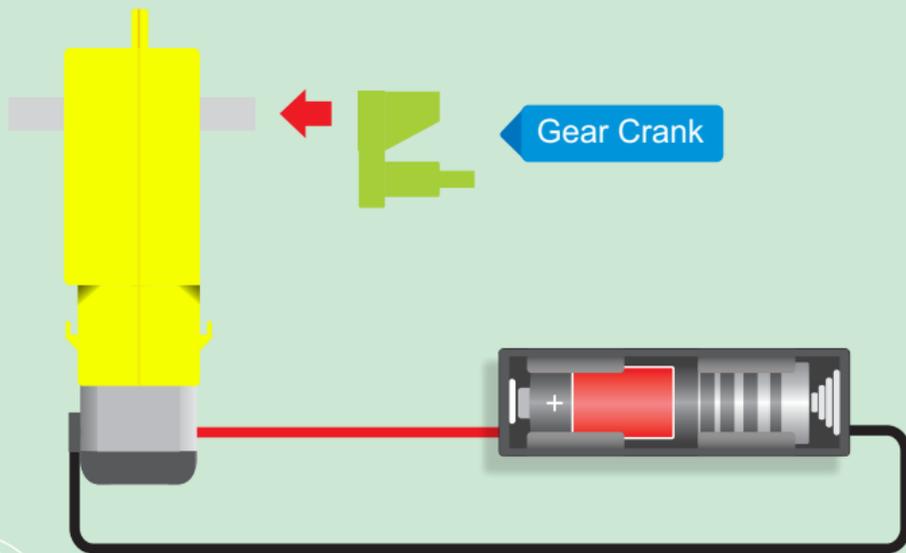
To complete your device you will need a way to trigger your circuit. A trigger can consist of conductors and non-conductors arranged in different ways. Create your own trigger or use one of the two above for your security device.

You can share your device or any other solution and also view other people solutions on our website.



Scan the QR code above or visit
www.thescienceset.com/tutorials/

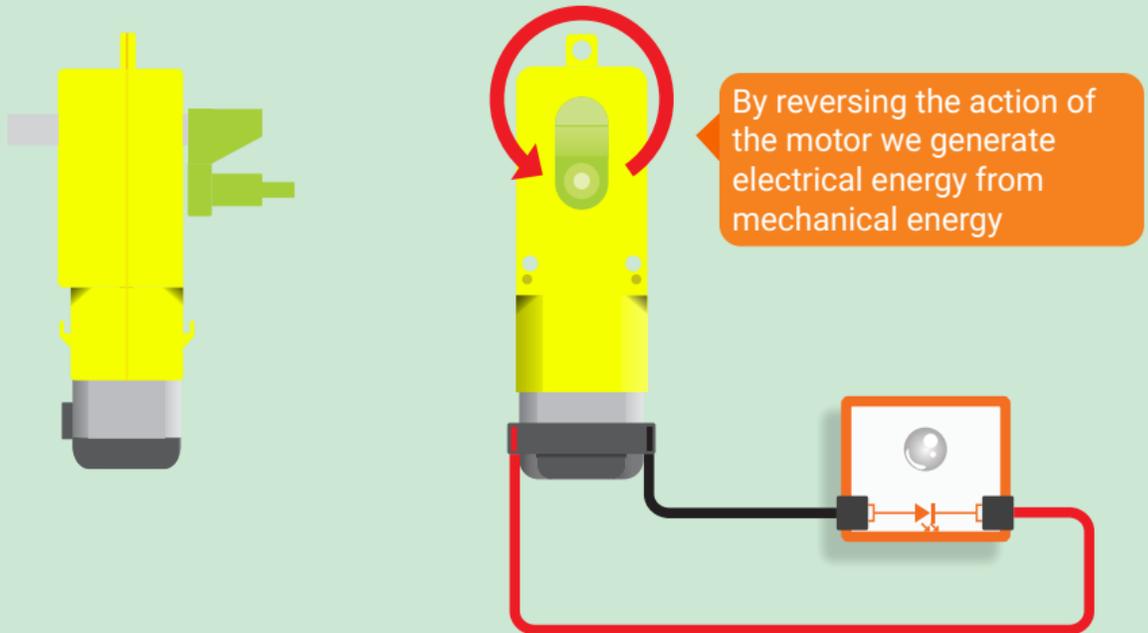
So far we have been able to convert electrical energy into sound and light now lets make things move. Add one of the green gear cranks to the geared motor as shown below. Connect the motor to a battery and observe the crank spin.



You can use conversion of electrical energy to mechanical energy to build household items like Fans and blenders energy. You can also build exciting technology like **robots**.

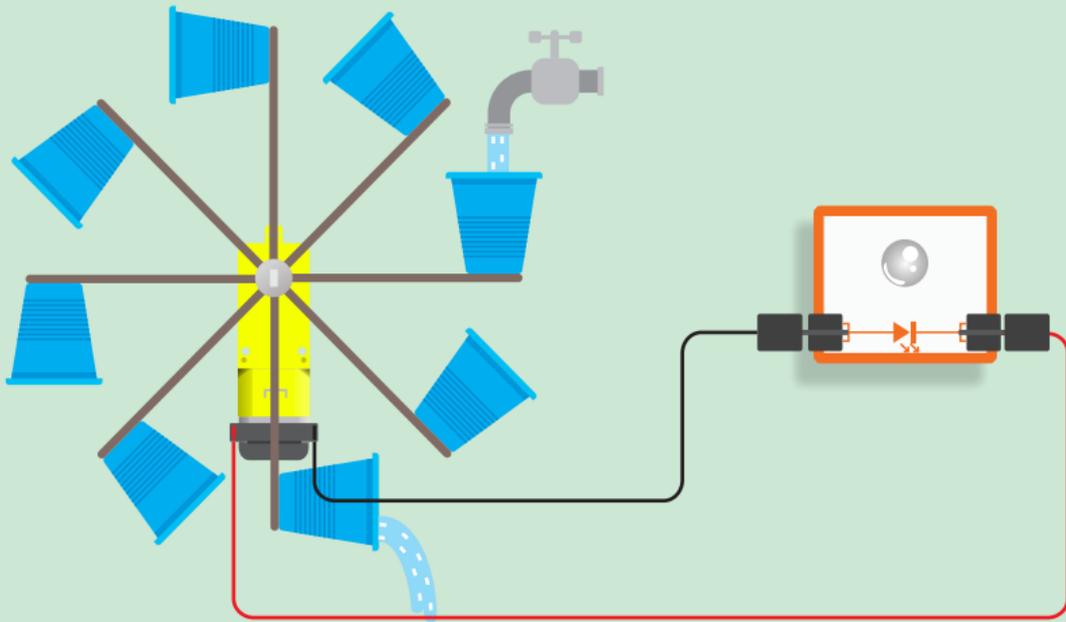


The motor spins when we connected a battery to it. What do you think will happen if we spin the motor ourselves



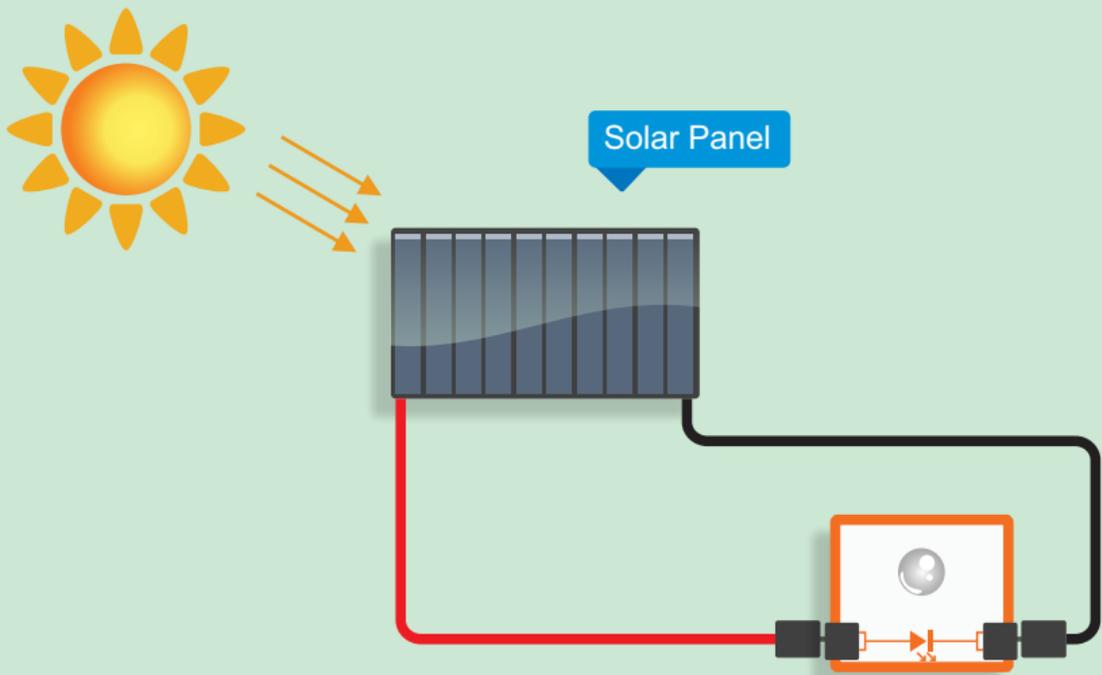
This is how electrical energy is generated in most cases. For instance by using the action of wind or water to create mechanical force which is converted to electrical energy through a generator similar to what you have

Can you put together a mechanism that uses the force of water to generate electrical energy? Such a system is known as a hydro-electric generator



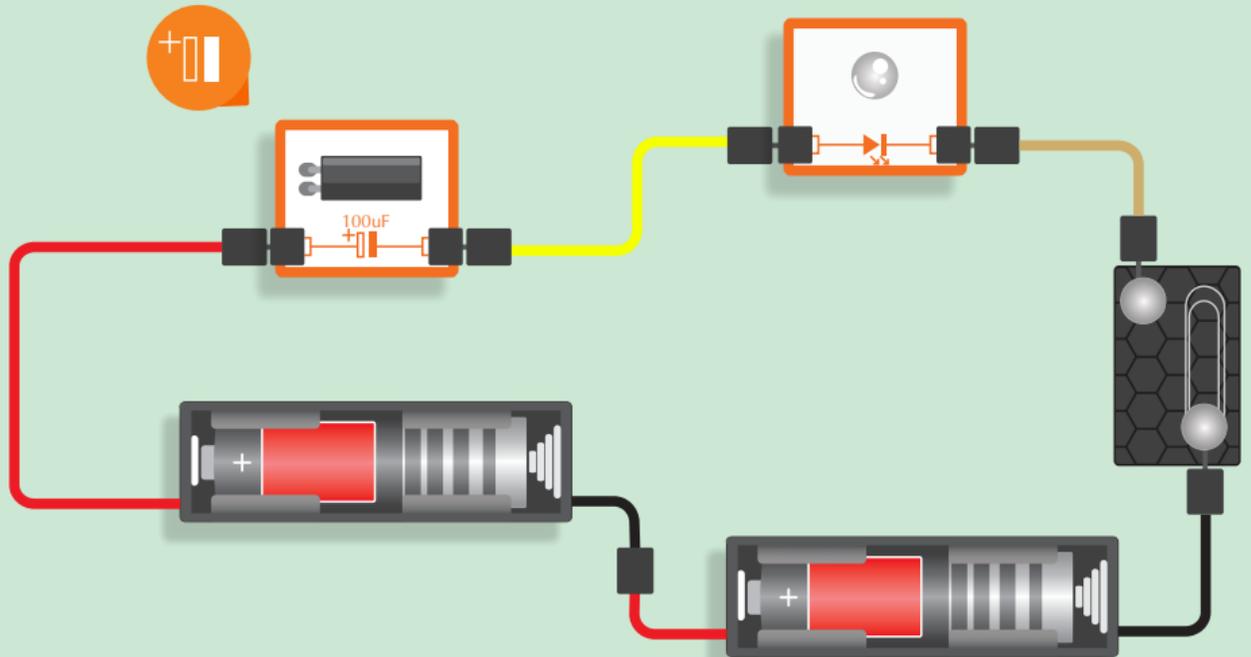
Construction of the Akosombo hydro electric dam in Ghana created the worlds largest man-made lake. The dam supplies power to more than 50 million people

Remember we generated light from electricity? Can we reverse that as well? Yes! With a solar panel!



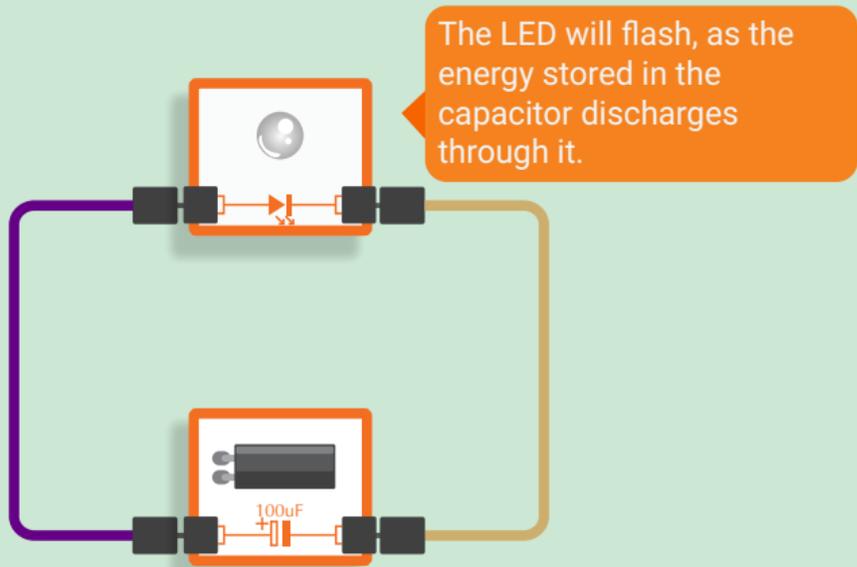
solar panels have special materials that converts the energy from light into electrical energy. Build this setup and shine some light unto your solar panel!

When you generate electricity but need it for later? You can store it in a rechargeable battery or in a **capacitor**!



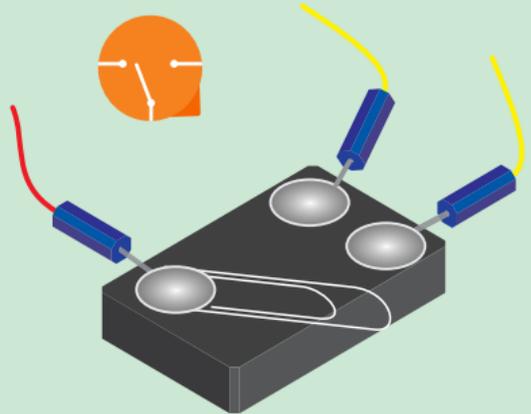
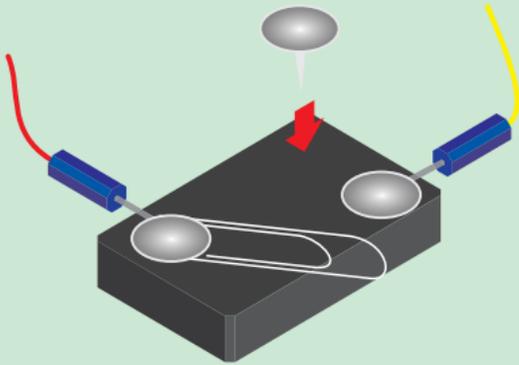
Build the circuit above. Current will flow while the capacitor charges and stop when it is done. Keep an eye on the LED. Now your capacitor is charged. Lets discharge it!

Carefully connect the capacitor and the LED alone like this. Note, avoid touching the terminals of the capacitor.

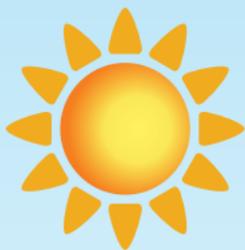


From your own observation, what do you think a capacitor is?

We can build a circuit that will enable us charge and discharge a capacitor without removing it from the circuit.

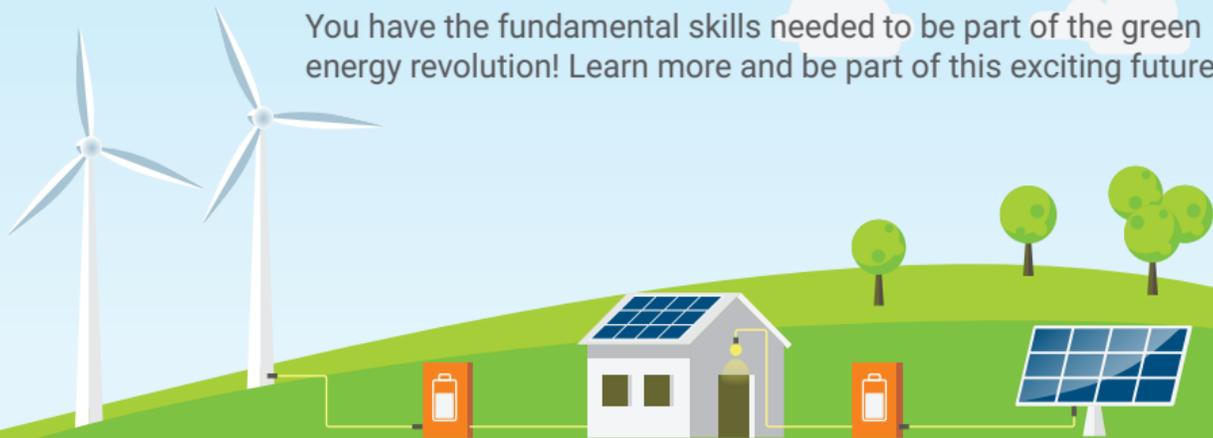


To do this we will need a special kind of switch. A two way switch! Follow the steps above to build your two way switch.



When we use the wind to spin a generator to get electricity that wind does not pollute the environment. There is also an abundant supply of wind. This is the same for using water or sunlight. These types of resources are termed sustainable energy sources. The green energy revolution is the idea that we could use only these types of energy sources in the future.

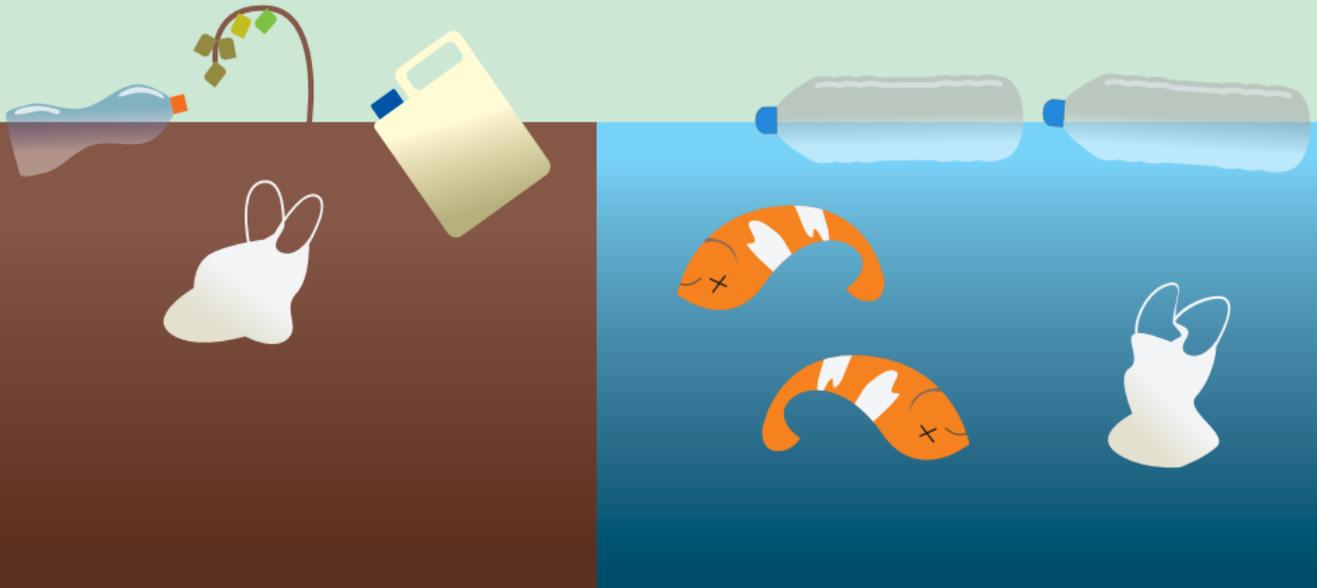
You have the fundamental skills needed to be part of the green energy revolution! Learn more and be part of this exciting future!



Plastics can be very useful for carrying groceries. However after disposing them off, Plastics can take thousands of years to degrade. This means plastics can be harmful for the environment when they are not disposed properly.

On land, waste plastics can release harmful chemicals that affects plants and animals. In the ocean, fishes and other sea life suffers.

To prevent this we need to recycle or reuse plastics. Lets explore one interesting idea of reusing plastic. **Building a vertical farm!**

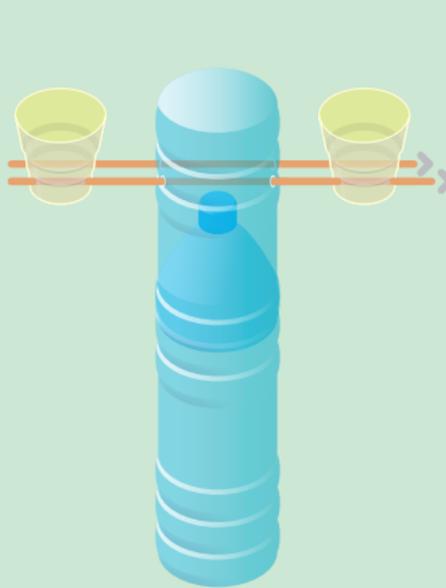




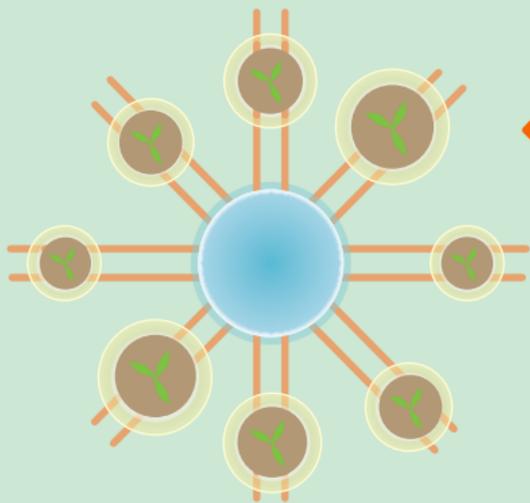
The sun powers everything! From the wind that can produce electricity to the rain and the plants that we make our food!

Traditional farming requires a lot of land space. Unfortunately, the available land space will not be enough for the growing population. To solve this problem what if we build farms like story buildings?

Note; don't forget to do this project with adult supervision. Make sure you wear protective gear and wash any used plastic thoroughly. It is highly recommended that you use waste plastics that you generated yourself



You will need bamboo skewers disposable cups and used plastic bottles to build a simple vertical farm. Use as many plastic bottles and disposable cups as you can.

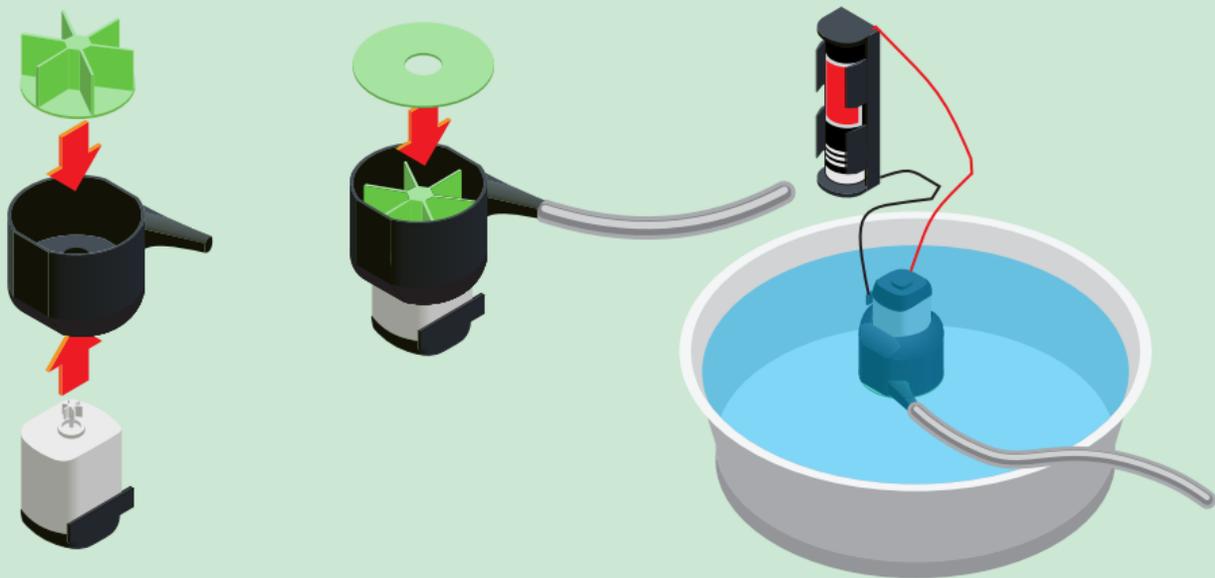


Make sure all the cups have direct sunlight.



- 1 Fill the disposable cups with fertile soil
- 2 Plant seeds of small crops like tomato
- 3 Build an irrigation system for your vertical farm.

Building a irrigation system

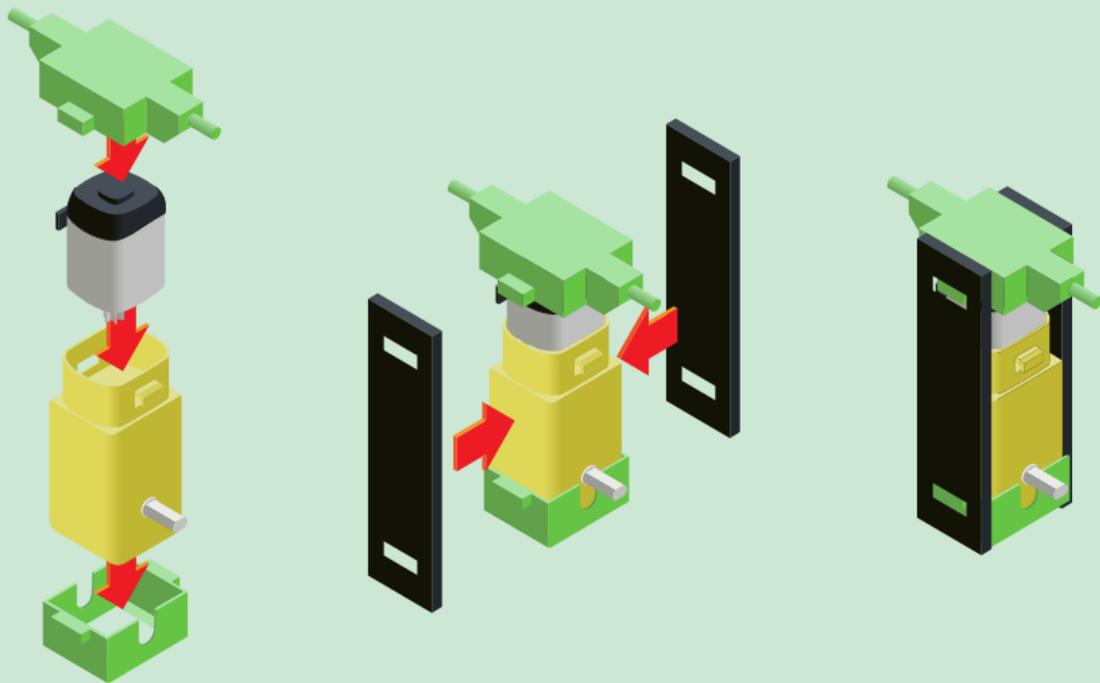


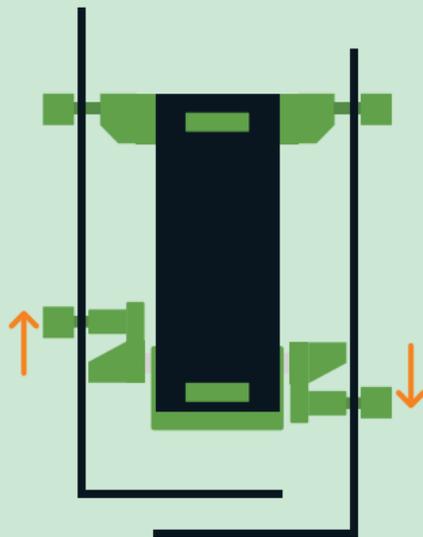
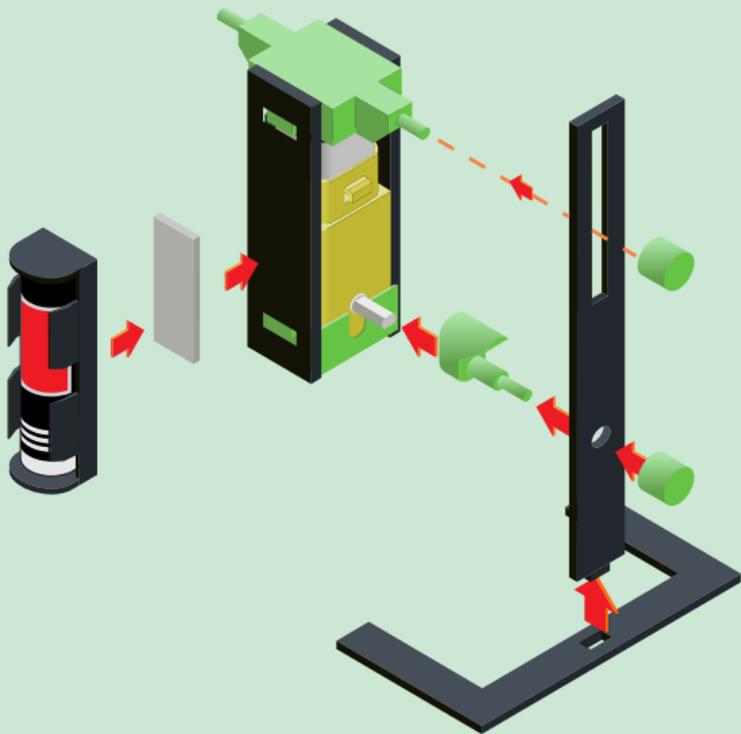
Using these materials from the set, we can construct a simple pump. Immerse the entire pump in water for it to function well.

Now you have built the most important part of the irrigation system, the pump. here comes the interesting part! design a way to make sure that water can reach every plant without moving the pump from plant to plant.

Lets build a robot!

Using your knowledge of electrical energy to mechanical energy, can you follow the instruction to build a robot?





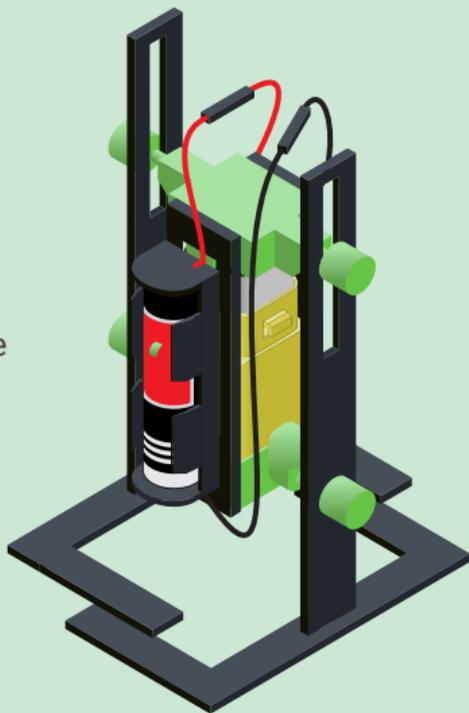
Make sure one gear crank points opposite the other

Complete Robot

Congratulations on building your first robot

There are many kinds of robots that are used to do many things. robots can be used to do tasks that are too dangerous or difficult for humans to do.

Some robots can swim, jump or even fly!





Go and become an awesome innovator! What else can you do with your motor? Will you want to be part of those who build the solution and technologies of tomorrow? Learn more, keep innovating... visit thescienceset.com for more projects and get ready to live the awesome life of an engineer.



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