SNAP CIRCUITS®

ELENCO

# LIGHT

## EVOLUTION IN LIGHTS

Simply Snap Together!

OVER 175 EXCITING PROJECTS

CONTAINS OVER 55 PARTS

Go to https://shop.elenco.com/consumers/snap-circuits-light.html to download projects 84-177 and *Bonus Projects 1-11!*


*PRINTED* 83 Projects

94+ *ONLINE* Projects

Ages 8-108

MADE WITH CIRCUITSAFE® fuse technology

STEM.ORG AUTHENTICATED™ EDUCATIONAL PRODUCT



SOURCE CODE:SCL-175V1 | REV-B | 753285

AWARD WINNING SNAP CIRCUITS GENUINE BRAND

ELENCO®
Learn by doing.®

# Table of Contents



Go to https://shop.elenco.com/consumers/snap-circuits-light.html to download projects 84-177 and *Bonus Projects 1-11!*

**WARNING FOR ALL PROJECTS WITH A ⚠ SYMBOL** - Moving parts. Do not touch the motor or fan during operation. Do not lean over the motor. Do not launch the fan at people, animals, or objects. Eye protection is recommended.

**WARNING: SHOCK HAZARD** - Never connect Snap Circuits® to the electrical outlets in your home in any way!

**WARNING: CHOKING HAZARD** - Small parts. Not for children under 3 years.

Conforms to all applicable government requirements

## Basic Troubleshooting

1. Most circuit problems are due to incorrect assembly, always double-check that your circuit exactly matches the drawing for it.
2. Be sure that parts with positive/negative markings are positioned as per the drawing.
3. Be sure that all connections are securely snapped.
4. Try replacing the batteries.
5. If the motor spins but does not balance the fan, check the black plastic piece with three prongs on the motor shaft, and replace it if it is damaged (this kit includes a spare). To replace, pry the broken one off the motor shaft using a screwdriver, then push the new one on.
6. If a fiber optics circuit isn't working, make sure the clear & black cable holders are pushed all the way onto the LED/phototransistor, and the fiber optic cable is pushed into the holders as far as it will go. The cable should be standing straight up in the holders.

**ELENCO® is not responsible for parts damaged due to incorrect wiring.**

**Note:** If you suspect you have damaged parts, you can follow the Advanced Troubleshooting procedure on page 14 to determine which ones need replacing.

**WARNING:** Always check your wiring before turning on a circuit. Never leave a circuit unattended while the batteries are installed. Never connect additional batteries or any other power sources to your circuits. Discard any cracked or broken parts.

**Adult Supervision:** Because children's abilities vary so much, even with age groups, adults should exercise discretion as to which experiments are suitable and safe (the instructions should enable supervising adults to establish the experiment's suitability for the child). Make sure your child reads and follows all of the relevant instructions and safety procedures, and keeps them at hand for reference.

This product is intended for use by adults and children who have attained sufficient maturity to read and follow directions and warnings.

Never modify your parts, as doing so may disable important safety features in them, and could put your child at risk of injury.

**CAUTION:** Persons who are extremely sensitive to flashing lights and rapidly changing colors or patterns should exercise caution when playing with this toy.

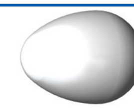
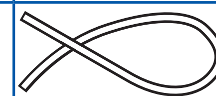
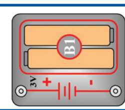
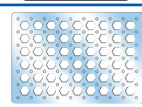
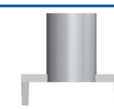
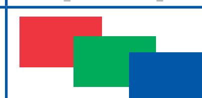
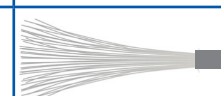
**CAUTION:** High intensity light. Do not look directly at white LED (D6).

## Batteries:

- Use only 1.5V "AA" type, alkaline batteries (not included).
- Insert batteries with correct polarity.
- Non-rechargeable batteries should not be recharged. Rechargeable batteries should only be charged under adult supervision, and should not be recharged while in the product.
- Do not mix old and new batteries.
- Do not connect batteries or battery holders in parallel.
- Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.
- Remove batteries when they are used up.
- Do not short circuit the battery terminals.
- Never throw batteries in a fire or attempt to open its outer casing.
- Batteries are harmful if swallowed, so keep away from small children.

# Parts List (Colors and styles may vary) Symbols and Numbers (page 1)

**Important:** If any parts are missing or damaged, **DO NOT RETURN TO RETAILER**. Call toll-free (800) 533-2441 or e-mail us at: help@elenco.com. Customer Service • 150 Carpenter Ave. • Wheeling, IL 60090 U.S.A.

| Qty. | ID | Name | Symbol | Part # | Qty. | ID | Name | Symbol | Part # |
|---|---|---|---|---|---|---|---|---|---|
| ❒ 3 | 1 | 1-Snap Wire |  | 6SC01 | ❒ 1 | D6 | White Light Emitting Diode (LED) |  | 6SCD6 |
| ❒ 6 | 2 | 2-Snap Wire |  | 6SC02 | ❒ 1 | D8 | Color Light Emitting Diode (LED) |  | 6SCD8 |
| ❒ 3 | 3 | 3-Snap Wire |  | 6SC03 | ❒ 1 | | Egg LED Attachment |  | 6SCEGG |
| ❒ 1 | 4 | 4-Snap Wire |  | 6SC04 | ❒ 1 | | Fiber Optic Cable |  | 6SCFC |
| ❒ 1 | 5 | 5-Snap Wire |  | 6SC05 | ❒ 1 | | Fiber Optic Cable Holder, black |  | 6SCFCHB |
| ❒ 1 | 6 | 6-Snap Wire |  | 6SC06 | ❒ 1 | | Fiber Optic Cable Holder, clear |  | 6SCFCHC |
| ❒ 2 | B1 | Battery Holder - uses two (2) 1.5V type "AA" (not Included) |  | 6SCB1 | ❒ 1 | | Prismatic Film |  | 6SCFILM |
| ❒ 1 | | Base Grid (11.0" x 7.7") |  | 6SCBG | ❒ 1 | | Mounting Base (for fiber optic tree) |  | 6SCFMB |
| ❒ 1 | C2 | 0.1μF Capacitor |  | 6SCC2 | ❒ 1 | | Red/Green/Blue Filters Set |  | 6SCFRGB |
| ❒ 1 | C4 | 100μF Capacitor |  | 6SCC4 | ❒ 1 | | Fiber Optic Tree |  | 6SCFT |
| ❒ 1 | D1 | Red Light Emitting Diode (LED) |  | 6SCD1 | ❒ 1 | | Jumper Wire (black) |  | 6SCJ1 |

**You may order additional / replacement parts at our website: www.elenco.com/replacement-parts/**

# Parts List (Colors and styles may vary) Symbols and Numbers (page 2)

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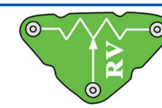
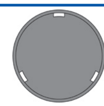
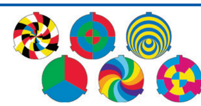
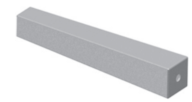
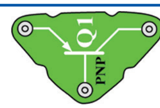
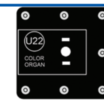
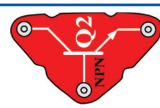
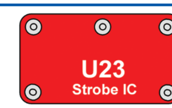
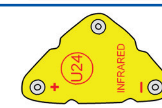
| Qty. | ID | Name | Symbol | Part # | Qty. | ID | Name | Symbol | Part # |
|---|---|---|---|---|---|---|---|---|---|
| ❐ 1 | | Jumper Wire (red) |  | 6SCJ2 | ❐ 1 | (R5) | 100kΩ Resistor |  | 6SCR5 |
| ❐ 1 | (M1) | Motor |  | 6SCM1 | ❐ 1 | (RV) | Adjustable Resistor |  | 6SCRV |
| ❐ 1 | | Disc Holder |  | 6SCM1DH | ❐ 1 | (S1) | Slide Switch |  | 6SCS1 |
| ❐ 1 | | Set of Disc Cutouts (6 pcs. / set) |  | 6SCM1DS | ❐ 1 | (S2) | Press Switch |  | 6SCS2 |
| ❐ 1 | | Glow Fan Blade |  | 6SCM1FG | ❐ 1 | (SP) | Speaker |  | 6SCSP |
| ❐ 1 | | Spare Motor Top |  | 6SCM1T | ❐ 1 | | Tower LED Attachment |  | 6SCTOWER |
| ❐ 1 | (Q1) | PNP Transistor |  | 6SCQ1 | ❐ 1 | (U22) | Color Organ |  | 6SCU22 |
| ❐ 1 | (Q2) | NPN Transistor |  | 6SCQ2 | ❐ 1 | (U23) | Strobe IC |  | 6SCU23 |
| ❐ 1 | (Q4) | Phototransistor |  | 6SCQ4 | ❐ 1 | (U24) | Infrared Receiver |  | 6SCU24 |
| ❐ 1 | (R1) | 100Ω Resistor |  | 6SCR1 | ❐ 1 | (X1) | Microphone |  | 6SCX1 |
| ❐ 1 | (R3) | 5.1kΩ Resistor |  | 6SCR3 | | | | | |

**You may order additional / replacement parts at our website: www.elenco.com/replacement-parts/**

# How to Use Snap Circuits®

Snap Circuits® uses building blocks with snaps to build the different electrical and electronic circuits in the projects. Each block has a function: there are switch blocks, light blocks, battery blocks, different length wire blocks, etc. These blocks are different colors and have numbers on them so that you can easily identify them. The blocks you will be using are shown as color symbols with level numbers next to them, allowing you to easily snap them together to form a circuit.

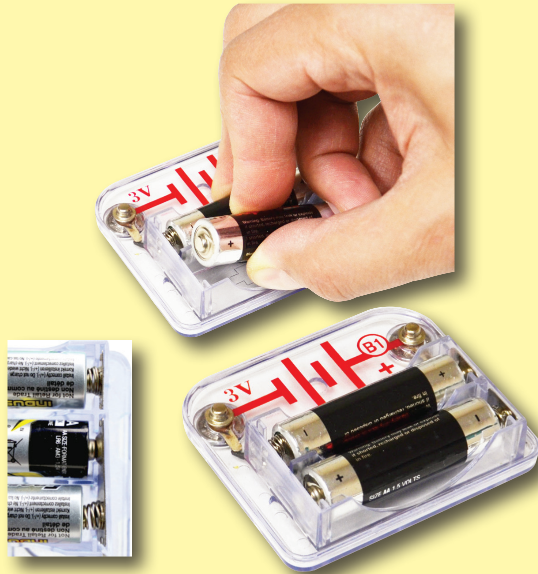
### *For Example:*

This is the switch block which is green and has the marking S2 on it. The part symbols in this booklet may not exactly match the appearance of the actual parts, but will clearly identify them.


This is a wire block which is blue and comes in different wire lengths.
This one has the number 2, 3, 4, 5, or 6 on it depending on the length of the wire connection required.


There is also a 1-snap wire that is used as a spacer or for interconnection between different layers.


You need a power source to build each circuit. This is labeled B1 and requires two (2) 1.5V "AA" batteries (not included).




When installing a battery, be sure the spring is compressed straight back, and not bent up, down, or to one side.

A large clear plastic base grid is included with this kit to help keep the circuit blocks properly spaced. You will see evenly spaced posts that the different blocks snap into. The base has rows labeled A-G and columns labeled 1-10.

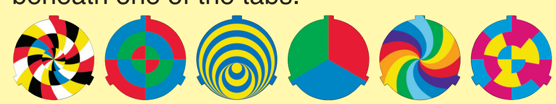
Next to each part in every circuit drawing is a small number in black. This tells you which level the component is placed at. Place all parts on level 1 first, then all of the parts on level 2, then all of the parts on level 3, etc.

Some circuits use the jumper wires to make unusual connections. Just clip them to the metal snaps or as indicated.

Usually when the motor M1 is used, the glow fan will usually be placed on it. On top of the motor shaft is a black plastic piece (the motor top) with three little tabs. Lay the fan on the black piece so the slots in its bottom "fall into place" around the three tabs in the motor top. If not placed properly, the fan will fall off when the motor starts to spin.


This set contains 6 pre-punched cardboard discs. These will be used with a strobe light in project 46 and others. The discs may be supplied as a single sheet; just punch them out.

To remove a disc from the holder, use your fingernail, or use a pencil to push it up from beneath one of the tabs.



# How to Use Snap Circuits®

This set contains three LED attachments, which can be mounted on the LED modules (D1, D6, D8, and on U22) to enhance their light effects. The egg and tower attachments are mounted directly on the LEDs, but the fiber optic tree must be mounted using the mounting base, as shown. This is described in the projects.

Egg LED attachment mounted to D6


Egg

Light Tower LED attachment mounted to D1

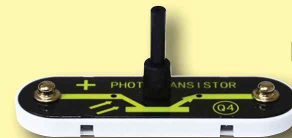
Fiber Optic Tree LED attachment mounted to D8


Fiber Optic Tree


Light Tower

Fiber Optic Tree LED attachment mounted to U22

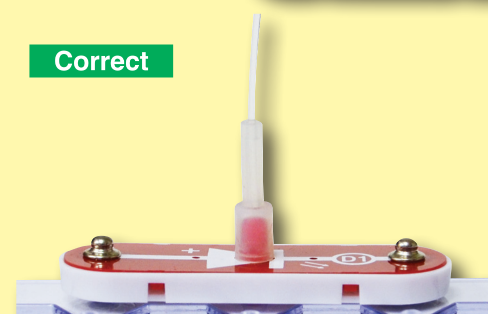
In some projects, the fiber optic cable will be mounted on the LEDs (D1, D6, D8, and on U22) or the phototransistor (Q4). This is done by placing the clear and black cable holders onto the LED/phototransistor, then inserting the fiber optic cable all the way into the holder. For best performance the cable should stand straight up in the holders, without bending them. This is described in the projects.



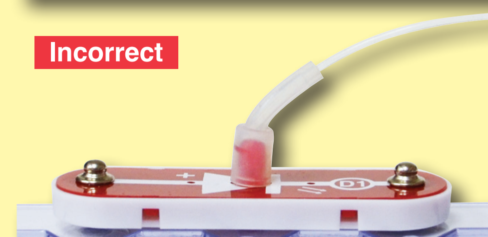
Black cable holder mounted to Q4

Clear cable holder mounted to D1

**Correct**



**Incorrect**



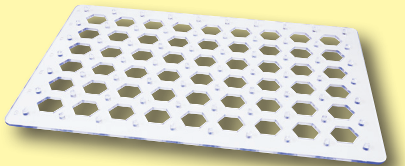
**Note:** While building the projects, be careful not to accidentally make a direct connection across the battery holder (a "short circuit"), as this may damage and/or quickly drain the batteries.

# About Your Snap Circuits® LIGHT Parts

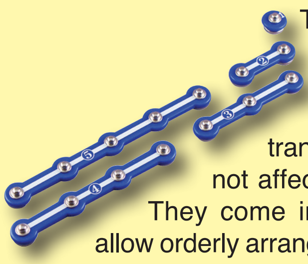
(Part designs are subject to change without notice).

## BASE GRID

The **base grid** is a platform for mounting parts and wires. It functions like the printed circuit boards used in most electronic products, or like how the walls are used for mounting the electrical wiring in your home.



## SNAP WIRES & JUMPER WIRES



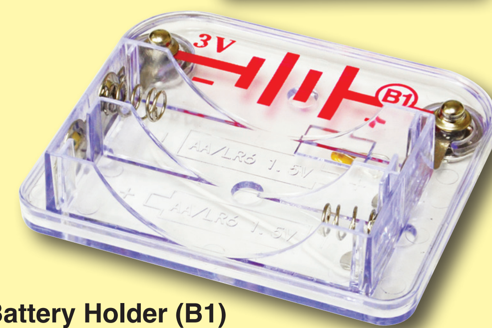
The blue **snap wires** are wires used to connect components. They are used to transport electricity and do not affect circuit performance. They come in different lengths to allow orderly arrangement of connections on the base grid.

The red and black **jumper wires** make flexible connections for times when using the snap wires would be difficult. They also are used to make connections off the base grid.

Wires transport electricity just like pipes are used to transport water. The colorful plastic coating protects them and prevents electricity from getting in or out.

## BATTERY HOLDER

The **batteries (B1)** produce an electrical **voltage** using a chemical reaction. This “voltage” can be thought of as electrical pressure, pushing electricity through a circuit just like a pump pushes water through pipes. This voltage is much lower and much safer than that used in your house wiring. Using more batteries increases the “pressure”, therefore, more electricity flows.

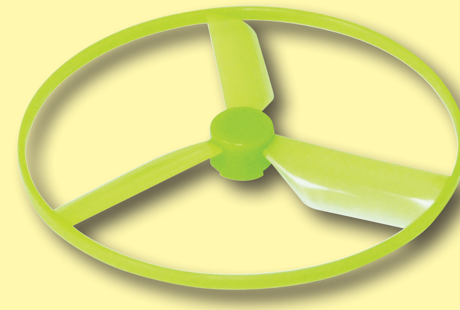



**Battery Holder (B1)**

## MOTOR

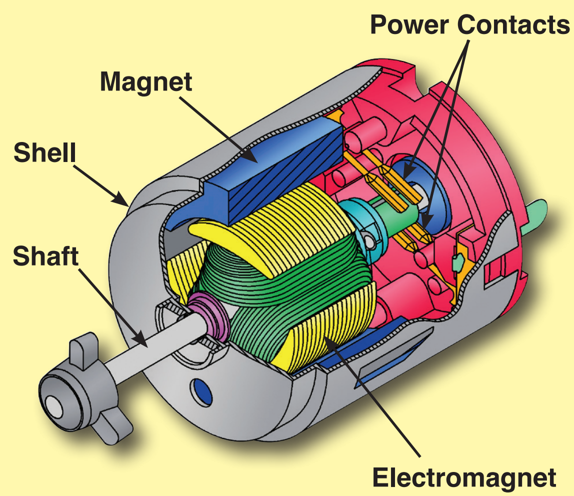
The **motor (M1)** converts electricity into mechanical motion. An electric current in the motor will turn the shaft and the motor blades, and the fan blade if it is on the motor.


**Motor (M1)**



**Glow-in-the-dark Fan**

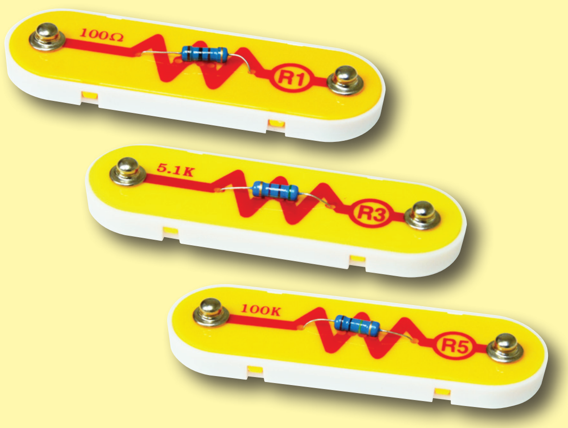
How does electricity turn the shaft in the motor? The answer is magnetism. Electricity is closely related to magnetism, and an electric current flowing in a wire has a magnetic field similar to that of a very, very tiny magnet. Inside the motor is a coil of wire with many loops wrapped around metal plates. This is called an electromagnet. If a large electric current flows through the loops, it will turn ordinary metal into a magnet. The motor shell also has a magnet on it. When electricity flows through the electromagnet, it repels from the magnet on the motor shell and the shaft spins. If the fan is on the motor shaft, then its blades will create airflow.



# About Your Snap Circuits® LIGHT Parts

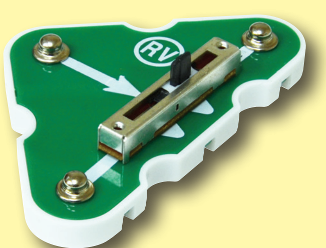
## RESISTORS

Resistors "resist" the flow of electricity and are used to control or limit the current in a circuit. Snap Circuits® LIGHT includes **100$\Omega$ (R1), 5.1k$\Omega$ (R3), and 100k$\Omega$ (R5) resistors** ("k" symbolizes 1,000, so R5 is really 100,000$\Omega$). Materials like metal have very low resistance (<1$\Omega$), while materials like paper, plastic, and air have near-infinite resistance. Increasing circuit resistance reduces the flow of electricity.




**Resistors (R1, R3, & R5)**

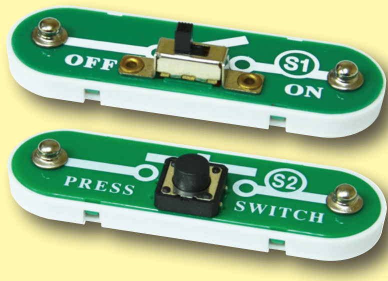
The **adjustable resistor (RV)** is a 50k$\Omega$ resistor but with a center tap that can be adjusted between 200$\Omega$ and 50k$\Omega$.




**Adjustable Resistor (RV)**

## SLIDE & PRESS SWITCHES

The **slide & press switches (S1 & S2)** connect (pressed or "ON") or disconnect (not pressed or "OFF") the wires in a circuit. When ON they have no effect on circuit performance. Switches turn on electricity just like a faucet turns on water from a pipe.




**Slide & Press Switches (S1 & S2)**

## SPEAKER

The **speaker (SP)** converts electricity into sound by making mechanical vibrations. These vibrations create variations in air pressure, which travel across the room. You "hear" sound when your ears feel these air pressure variations.


**Speaker (SP)**

## MICROPHONE

The **microphone (X1)** is actually a resistor that changes in value when changes in air pressure (sounds) apply pressure to its surface. Its resistance typically varies between 1k$\Omega$ and 10k$\Omega$.


**Microphone (X1)**

## LEDs

The **red, white, and color LED's (D1, D6, & D8)** are light emitting diodes, and may be thought of as a special one-way light bulbs. In the "forward" direction, (indicated by the "arrow" in the symbol) electricity flows if the voltage exceeds a turn-on threshold (about 1.5V for red, about 3.0V for white, and in between for other colors); brightness then increases. The color LED contains red, green, and blue LEDs, with a micro-circuit controlling then. A high current will burn out an LED, so the current must be limited by other components in the circuit. LED's block electricity in the "reverse" direction.

**LED's (D1, D6, & D8)**


## CAPACITOR

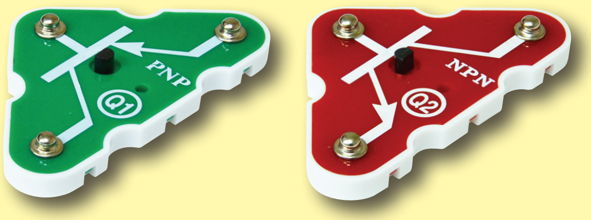
The **0.1$\mu$F and 100$\mu$F capacitors (C2 & C4)** can store electrical pressure (voltage) for periods of time. This storage ability allows them to block stable voltage signals and pass changing ones. Capacitors are used for filtering and delay circuits.


**Capacitors (C2 & C4)**

# About Your Snap Circuits® LIGHT Parts

## TRANSISTORS

The **PNP & NPN transistors (Q1 & Q2)** are components that use a small electric current to control a large current, and are used in switching, amplifier, and buffering applications. They are easy to miniaturize, and are the main building blocks of integrated circuits including the microprocessor and memory circuits in computers.



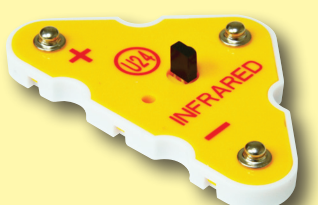

**PNP & NPN Transistors (Q1 & Q2)**

The **phototransistor (Q4)** is a transistor that uses light to control electric current.


**Phototransistor (Q4)**

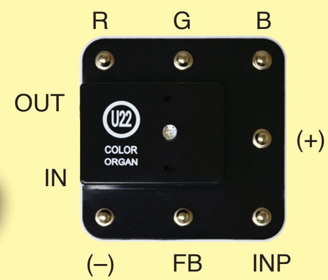
## ELECTRONIC MODULES

The **Infrared module (U24)** is a miniaturized infrared receiver circuit for remote control.




**Infrared module (U24)**

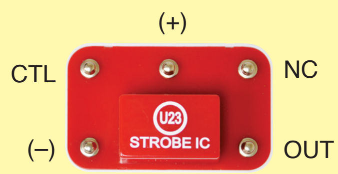
The **color organ (U22)** contains resistors, capacitors, transistors, a tri-color LED, and integrated circuits. The LED in it can change colors by direct control, or in synch with an audio input signal. A schematic for it is available at www.elenco.com/faqs/




**Connections:**
R - red color control
G - green color control
B - blue color control
(+) - power from batteries
INP - circuit input
FB - feedback connection
(–) - power return to batteries
IN - audio input jack
OUT - audio output jack

See projects 5, 6, 12, and 83 for examples of proper connections.

The **strobe IC (U23)** contains resistors, capacitors, and transistors that are needed to make a strobe light circuit. A schematic for it is available at www.elenco.com/faqs/

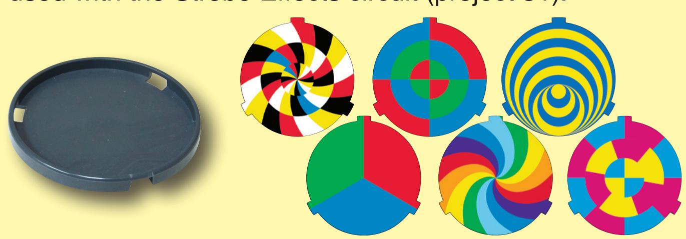



**Connections:**
(+) - power from batteries
(–) - power return to batteries
OUT - output connection
CTL - strobe speed control
NC - not used

See project 31 for example of proper connections.

## OTHER PARTS

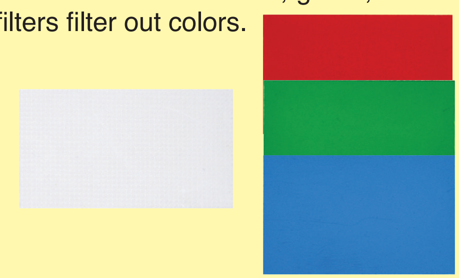
The disc holder and discs produce amazing effects when used with the Strobe Effects circuit (project 31).



The LED attachments can be used with any of the LEDs (red, white, color, and the color organ) to enhance the light effects.


The fiber optic cable carries light between two places. The light can be encoded to transmit information. The clear and black holders are used to attach it to circuits.

Prismatic film separates light into different colors. The red, green, & blue filters filter out colors.



# Introduction to Electricity

What is electricity? Nobody really knows. We only know how to produce it, understand its properties, and how to control it. Electricity is the movement of sub-atomic charged particles (called **electrons**) through a material due to electrical pressure across the material, such as from a battery.

Power sources, such as batteries, push electricity through a circuit, like a pump pushes water through pipes. Wires carry electricity, like pipes carry water. Devices like LEDs, motors, and speakers use the energy in electricity to do things. Switches and transistors control the flow of electricity like valves and faucets control water. Resistors limit the flow of electricity.

The electrical pressure exerted by a battery or other power source is called **voltage** and is measured in **volts** (V). Notice the "+" and "–" signs on the battery; these indicate which direction the battery will "pump" the electricity.

The **electric current** is a measure of how fast electricity is flowing in a wire, just as the water current describes how fast water is flowing in a pipe. It is expressed in **amperes** (A) or **milliamps** (mA, 1/1000 of an ampere).

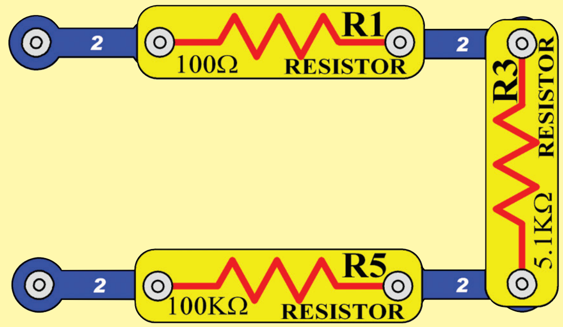
The "**power**" of electricity is a measure of how fast energy is moving through a wire. It is a combination of the voltage and current (Power = Voltage x Current). It is expressed in **watts** (W).

The **resistance** of a component or circuit represents how much it resists the electrical pressure (voltage) and limits the flow of electric current. The relationship is Voltage = Current x Resistance. When the resistance increases, less current flows. Resistance is measured in **ohms** (Ω), or **kilo ohms** (kΩ, 1000 ohms).

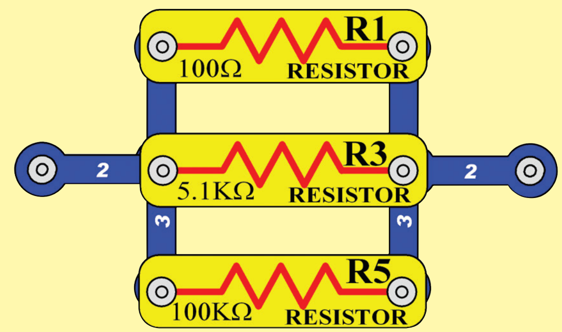
Nearly all of the electricity used in our world is produced at enormous generators driven by steam or water pressure. Wires are used to efficiently transport this energy to homes and businesses where it is used. Motors convert the electricity back into mechanical form to drive machinery and appliances. The most important aspect of electricity in our society is that it allows energy to be easily transported over distances.

Note that "distances" includes not just large distances but also tiny distances. Try to imagine a plumbing structure of the same complexity as the circuitry inside a portable radio - it would have to be large because we can't make water pipes so small. Electricity allows complex designs to be made very small.

There are two ways of arranging parts in a circuit, in series or in parallel. Here are examples:




**Series Circuit**




**Parallel Circuit**

Placing components in series increases the resistance; highest value dominates. Placing components in parallel decreases the resistance; lower value dominates.

The parts within these series and parallel sub-circuits may be arranged in different ways without changing what the circuit does. Large circuits are made of combinations of smaller series and parallel circuits.

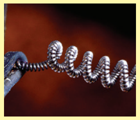
# Light in Our World

What would our world be like without light? Moving and doing things in total darkness would be much more difficult, because everyone would be blind. Plants rely on sunlight for energy and would die without it. If all the plants die, then people and animals would have nothing to eat, and would starve. Let's hope we never have to live in a world without light.

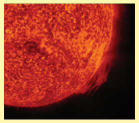
Light is energy, traveling at high speed. Sunlight can warm up your skin, as can bright lights in a concert hall or playhouse. Light can carry information. For example, our brains analyze the light received in our eyes, to learn what is around us. In fiber optic cables, beams of light carry data between cities. Infrared light from a remote control can tell a TV to change to a different channel.

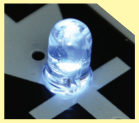
Light moves as super-tiny charges, which are so full of energy they go flying off in all directions.

This happens when a material has too much energy, and some of the energy changes form. For example, a light bulb makes light when an electric current makes the filament so hot that it glows. Some of the energy in a burning fire escapes by changing to light. Our bright sun makes so much light because it is basically a gigantic ball of thermonuclear reactions. Light emitting diodes (LEDs) make light by converting excess electrical energy.

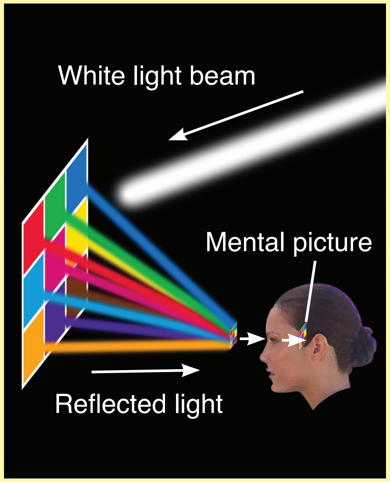

Light bulb filament


Glowing light bulb filament


Close-up view of the Sun


Glowing white LED (D6)

You "see" when light enters your eyes. When you turn on a light in a room, the light shines on everything around it. When light shines on something, some of the light is absorbed into it, and the rest is reflected off. The absorbed light is converted to heat, and the reflected light is scattered around the room. Some of the shining and reflected light might reach your eyes. Your brain interprets the light into your eyes, and makes the mental picture you see.

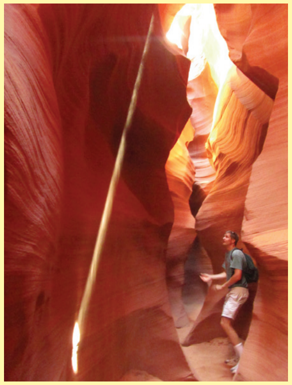



When all the light shining on something is absorbed, with none reflected towards your eyes, then you can't see it. The object will appear dark. The brighter an object appears, the more light was reflected off it and into your eyes. Some materials, like air and clear glass, let light pass through them.

You can only see the moon when light from the sun bounces off it, and reflects to earth.

You can't see a beam of light traveling across a room, unless something scatters the light and some reaches your eyes. In a dusty room, sometimes you can see the dust particles floating in the air when sunlight hits them.

In this photograph, sand has been tossed into the air, which is illuminated by a narrow beam of sunlight coming down into the canyon.



When you turn on a light, you instantly see everything. This happens because light is very fast, and travels about 186,000 miles a second in air.

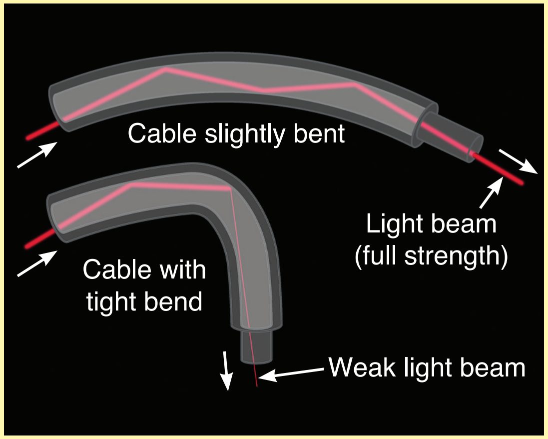
Light rays can bend when they pass between different materials, such as air and water. Light bends because its speed changes. The speed of light in water is only about 125,000 miles a second.

The part of the pen in water looks distorted, because light changes speed when entering and leaving the water.

When you look directly out a glass window, you can see clearly through it. When you look through the window at a wide angle, you can see through it, but also see a reflection in it. When you try to look through the window at a really wide angle, you can't see through it at all, and only see reflections. Try looking through a window in your home at really wide angles.

# Light in Our World

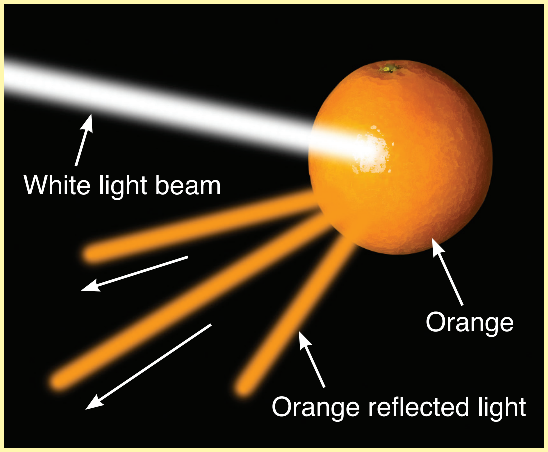
When light hits a glass surface at a wide enough angle, all the light is reflected. Fiber optic cables have arrays of flexible glass fibers. In these cables, light rays move through by bouncing along the inside walls at wide angles, and can travel great distances. Light moves through the cable even if it is bent a little, but if there is a tight bend then most of the light will be absorbed instead of reflected forward. Translucent materials, such as the tower and egg LED attachments in this set, allow some light to pass through but scatter it around.




## Color

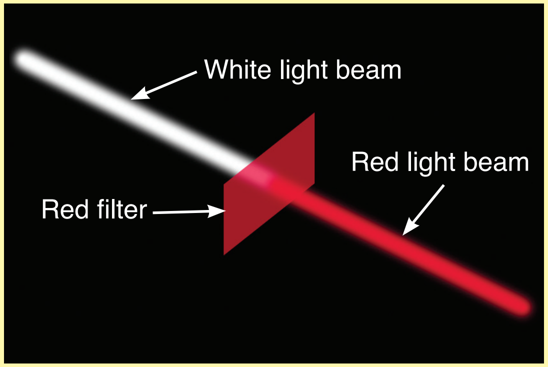
The things around you have different colors because they reflect the colors that you see, while absorbing the other colors. Light produced by the sun or a light bulb is called white light. White light is not really a color itself, but is a mixture of all the colors seen in a rainbow.

White light shines on an orange. All colors in the light are absorbed except orange, which is reflected off. The reflected orange light reaches our eyes, so we see it as having orange color.




White light can be split up into its different colors. This happens when light passes between different materials, and the different colors in it are bent by different amounts. You can see this by viewing white light through prismatic film, as you do in project 51. Sometimes water in the air can bend sunlight by just the right amounts, and make a rainbow.

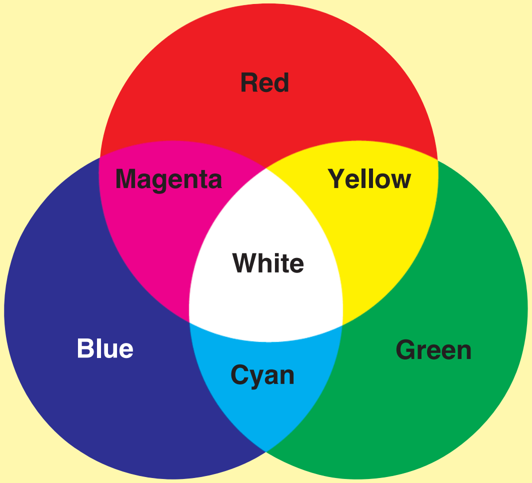
Color filters allow one color to pass through, and absorb the other colors. When you look through a red filter, everything looks red (or black, if there isn't any red in what you are looking at). This set includes red, green, and blue filters, so try looking through them.




Any color of light can be made, by mixing different amounts of red, green, and blue light. Mixing equal amounts of these colors produces white light. If you look at a TV screen with a magnifying glass, you will see it actually consists of tiny red, green, and blue lights, using different intensities to make all the colors.

This set includes several LEDs (D1, D6, D8, and in U22) with different colors. The color emitted by an LED depends on the material used in it. LEDs are more energy-efficient than incandescent light bulbs, can be made smaller, and last longer.

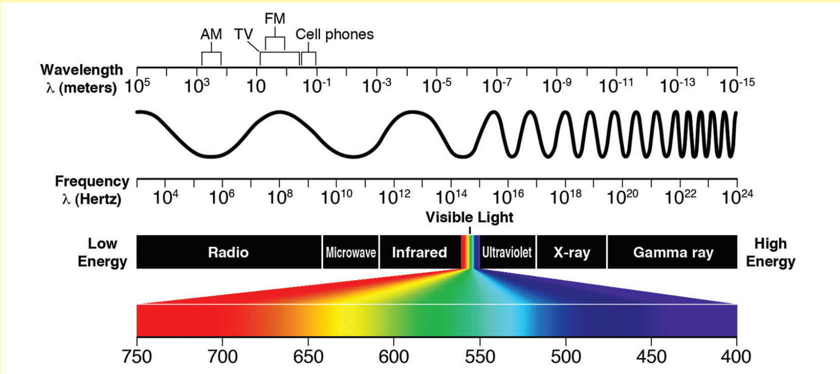
The LED in the color organ module (U22) contains separate red, green, and blue LEDs. The color organ can combine these colors to make yellow, cyan, purple, and white, as shown in project 6. The color organ does not allow you to adjust the amount of each color. In project 34, several colors are mixed together on a spinning disc.



# Light in Our World

## The Spectrum of Light

The light our eyes see is only part of what is around us. Visible light, infrared light, radio waves (including TV broadcasting and cell phones), microwaves, and x-rays are all forms of electromagnetic radiation. They are actually changing electric and magnetic fields. This radiation travels like waves in water, spreading out from where it was created. These waves all travel at the speed of light, but some are longer (higher wavelength) and some repeat faster (higher frequency). Together they are called the electromagnetic spectrum: The visible colors (red, orange, yellow, green, blue, and violet) have different

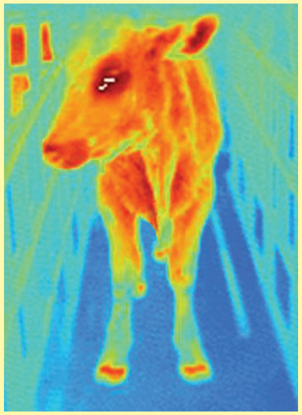



wavelengths. In the right conditions white light from the sun can be separated according to wavelength, producing a rainbow of color. This happens with an actual rainbow, and with prismatic film.

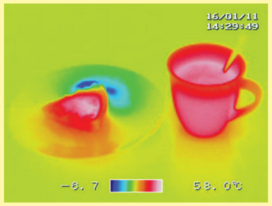
Why is the sky blue? Some sunlight is scattered by tiny particles in the earth's atmosphere. The shorter wavelength blue light is scattered more than the other colors, so the sky appears blue. At sunrise or sunset, longer wavelength colors like red or yellow are more visible in the sky, because sunlight passes through more of the atmosphere before reaching your eyes. In space, the sky always appears black because there is no atmosphere or scattering effect.

## Infrared

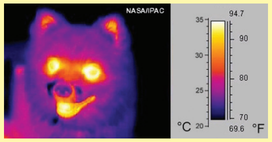
Infrared light is invisible light given off by anything warm. Infrared is used in remote controls to control TVs and appliances. Infrared is invisible, so it doesn't disrupt your view of the TV. Infrared doesn't go through walls, so it doesn't interfere with devices in other rooms.



The remote control sends a stream of infrared light pulses to the TV, encoded with the desired commands. The infrared light is created using an infrared light emitting diode (LED). Infrared detectors convert the received light to electric current, and decode the commands. The detectors are tuned to focus on the infrared light, and ignore visible light. This set contains an infrared detector (U24), which can be activated by a TV remote control; see projects 18 and 25 for examples.



Infrared has other uses such as night vision devices help to see people and animals in the dark, by looking at the heat they give off as infrared light. You probably saw this in the movies.




## Glow-in-the-dark

Some materials can absorb light, store it for a while, and slowly release it back out. "Glow-in-the-dark" materials can be "charged" by bright light, then will slowly emit light and "glow" for a while in a dark room. The glow fan blade in this set has a glow powder mixed in the plastic.
It's like a slow, delayed reflection of the light.

## Sound

Sound, like light, spreads out like waves from where it was made. Sound is variations in air pressure. You "hear" sound when your ears feel these air pressure variations. Sound has much longer wavelength than light, which enables sound to travel around corners. Sound can also be thought of as a wave of vibration, and can travel through water and solid objects. Sound travels about 1,000 feet per second in air, and about 5,000 feet per second in water.

# DO's and DON'Ts of Building Circuits

After building the circuits given in this booklet, you may wish to experiment on your own. Use the projects in this booklet as a guide, as many important design concepts are introduced throughout them. Every circuit will include a power source (the batteries), a resistance (which might be a resistor, capacitor, motor, integrated circuit, etc.), and wiring paths between them and back. You must be careful not to create "short circuits" (very low-resistance paths across the batteries, see examples at right) as this will damage components and/or quickly drain your batteries. Only connect the color organ (U22), strobe IC (U23) and infrared module (U24) using configurations given in the projects, incorrectly doing so may damage them. **ELENCO® is not responsible for parts damaged due to incorrect wiring.**

### *Here are some important guidelines:*

***ALWAYS*** **USE EYE PROTECTION WHEN EXPERIMENTING ON YOUR OWN.**

***ALWAYS*** include at least one component that will limit the current through a circuit, such as the speaker, capacitors, ICs (which must be connected properly), motor, microphone, phototransistor, or resistors.

***ALWAYS*** use LEDs, transistors, and switches in conjunction with other components that will limit the current through them. Failure to do so will create a short circuit and/or damage those parts.

***ALWAYS*** connect capacitors so that the "+" side gets the higher voltage.

***ALWAYS*** disconnect your batteries immediately and check your wiring if something appears to be getting hot.

***ALWAYS*** check your wiring before turning on a circuit.

***ALWAYS*** connect the color organ (U22), strobe IC (U23) and infrared module (U24) using configurations given in the projects or as per the connection description on page 8.

***NEVER*** connect to an electrical outlet in your home in any way.

***NEVER*** leave a circuit unattended when it is turned on.

***NEVER*** touch the motor when it is spinning at high speed.

For all of the projects given in this book, the parts may be arranged in different ways without changing the circuit. For example, the order of parts connected in series or in parallel does not matter — what matters is how combinations of these sub-circuits are arranged together.

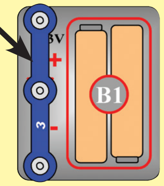
You are encouraged to tell us about new circuits you create. If they are unique, we will post them with your name and state on our website at **www.elenco.com/showcase**.
Send your suggestions (with photos) to **info@elenco.com**.

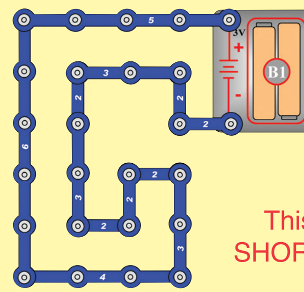
Elenco® provides a circuit designer so that you can make your own Snap Circuits® drawings. This Microsoft® Word document can be downloaded from **www.elenco.com/for-makers.**

**Examples of SHORT CIRCUITS - NEVER DO THESE!!!**

Placing a 3-snap wire directly across the batteries is a SHORT CIRCUIT.

NEVER DO!



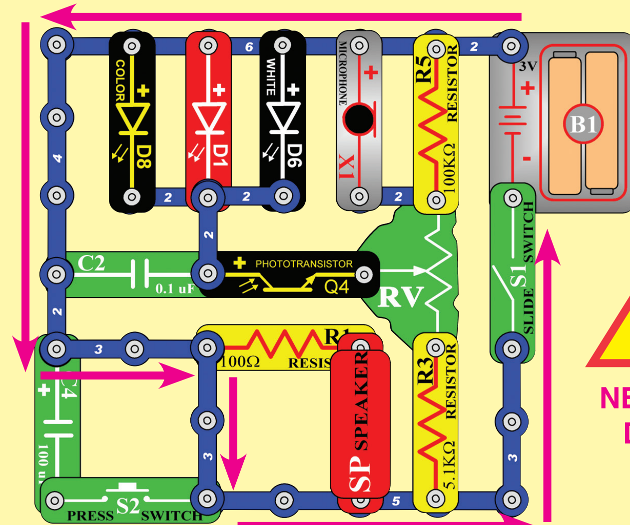




NEVER DO!

This is also a SHORT CIRCUIT.

When the slide switch (S1) is turned on, this large circuit has a SHORT CIRCUIT path (as shown by the arrows). The short circuit prevents any other portions of the circuit from ever working.

NEVER DO!




NEVER DO!

**WARNING: SHOCK HAZARD** - Never connect Snap Circuits® to the electrical outlets in your home in any way!

**Warning to Snap Circuits® owners:** Do not use parts from other Snap Circuits® sets with this kit. Other sets use higher voltage which could damage parts.

# Advanced Troubleshooting (Adult supervision recommended)

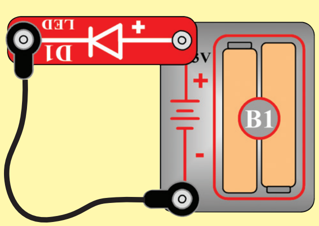
**ELENCO® is not responsible for parts damaged due to incorrect wiring.**

**If you suspect you have damaged parts, you can follow this procedure to systematically determine which ones need replacing:**

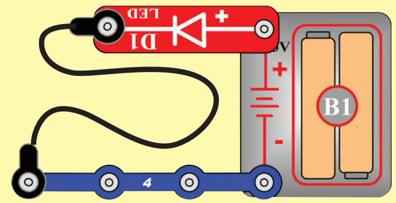
**(Note: Some of these tests connect an LED directly across the batteries without another component to limit the current. Normally this might damage the LED, however Snap Circuits® LEDs have internal resistors added to protect them from incorrect wiring, and will not be damaged.)**

1. **Red LED (D1), motor (M1), speaker (SP), and battery holder (B1):** Place batteries in holder. Place the red LED directly across the battery holder (LED + to battery +), it should light. Do the same for the motor, it should spin. “Tap” the speaker across the battery holder contacts, you should hear static as it touches. If none work, then replace your batteries and repeat. If still bad, then the battery holder is damaged.
   If the motor spins but does not balance the fan, check the black plastic piece with three prongs on the motor shaft, and replace it if it is damaged (this kit includes a spare). To replace, pry the broken one off the motor shaft using a screwdriver, then push the new one on.

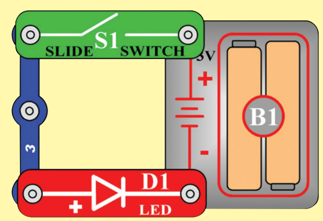
2. **Red & black jumper wires:** Use this mini-circuit to test each jumper wire, the LED should light.




3. **Snap wires:** Use this mini-circuit to test each of the snap wires, one at a time. The LED should light.

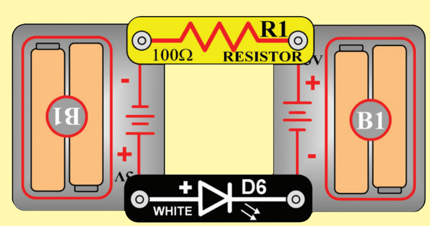



4. **Slide switch (S1) and Press switch (S2):** Use this mini-circuit; if the LED doesn’t light then the slide switch is bad. Replace the slide switch with the press switch to test it.




5. **100Ω (R1) and 5.1kΩ (R3) resistors:** Use the mini-circuit from test 4 but replace the switch with the 100Ω resistor (R1); the LED will be bright if the resistor is good. Next use the 5.1kΩ resistor in place of the 100Ω resistor; the LED should be much dimmer but still light.

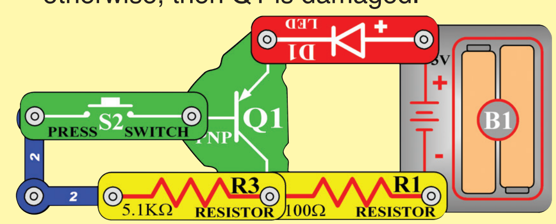
6. **White LED (D6) and color LED (D8):** Use this mini circuit; if the white LED doesn’t light then D6 is bad. Replace the white LED with the color LED; it should change colors in a repetitive pattern, otherwise D8 is bad.



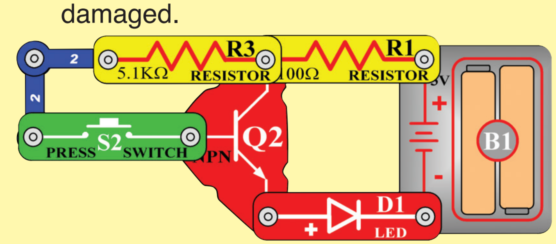

7. **Microphone (X1) and Phototransistor (Q4):** Use the mini-circuit from test 6 but replace the 100Ω resistor with the microphone (+ on right); if blowing into the microphone does not change the LED brightness then X1 is bad. Replace the microphone with the phototransistor (+ on right). Waving your hand over the phototransistor (changing the light that shines on it) should change the brightness of the LED or Q4 is bad.

8. **Adjustable resistor (RV):** Build project 81, but use the red LED (D1) in place of the color LED (D8). Move the resistor control lever to both sides. When set to each side, one LED should be bright and the other off (or very dim); otherwise RV is bad.

9. **PNP transistor (Q1):** Build the mini-circuit shown here. The red LED (D1) should only be on if the press switch (S2) is pressed. If otherwise, then Q1 is damaged.

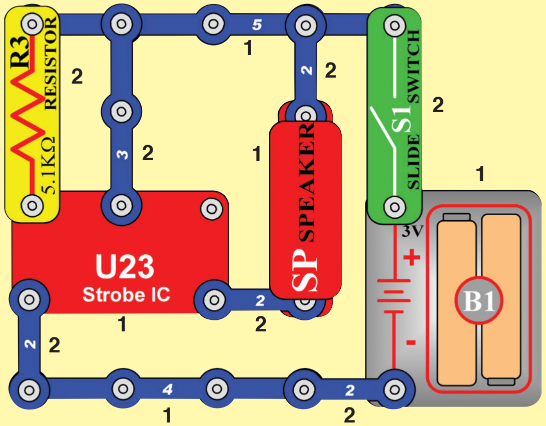



10. **NPN transistor (Q2):** Build the mini-circuit shown here. The red LED (D1) should only be on if the press switch (S2) is pressed. If otherwise, then Q2 is damaged.



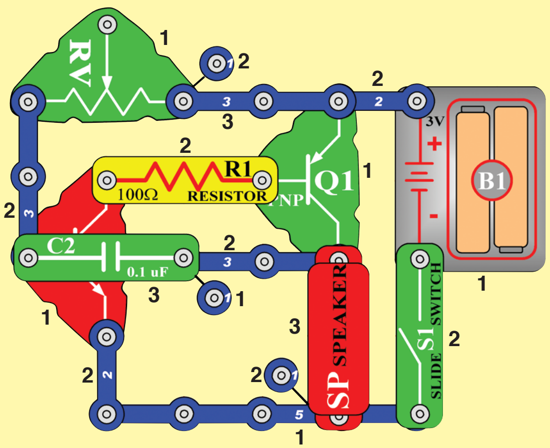
# Advanced Troubleshooting (Adult supervision recommended)

11. **Strobe IC (U23) and 100kΩ resistor (R5):** Build the mini-circuit shown here, and turn on the switch (S1). The speaker should make a buzzing sound or U23 is bad. Next use the 100kΩ resistor in place of the 5.1kΩ resistor; the sound should be a beeping sound now or R5 is bad.




12. **Infrared module (U24):** Build project 18, the remote control should turn the red LED (D1) on; otherwise U24 is bad.

13. **0.1µF capacitor (C2) and 100µF capacitor (C4):** Build this circuit. There should be a buzzing sound, or C2 is bad. Next, replace C2 with C4; now you should hear beeps every 5 seconds, or C4 is bad. The setting on RV does not matter.




15. **Color organ (U22):** Do project 83. If parts A or B do not work, U22 is damaged.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150 Carpenter Avenue
Wheeling, IL 60090 U.S.A.
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Fax: (847) 520-0085
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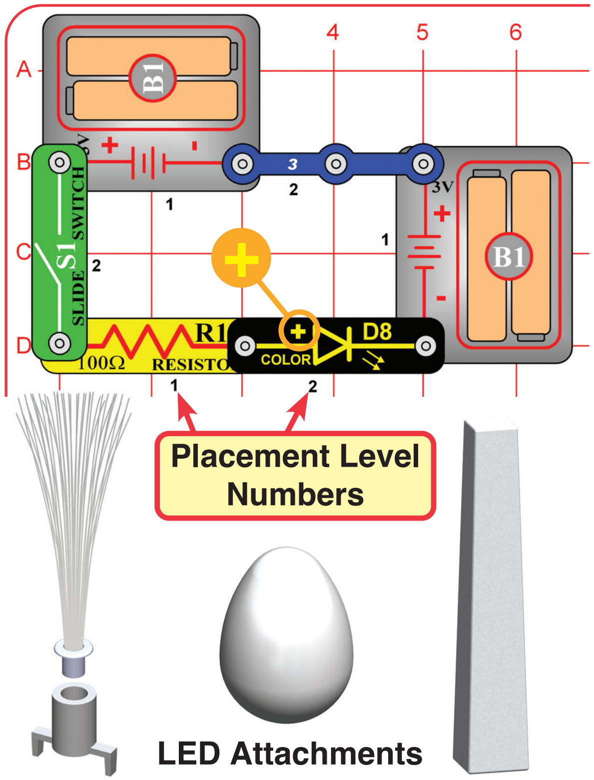
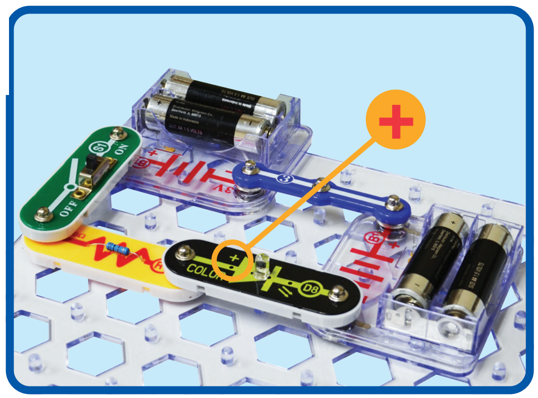
# ☐ Project 1



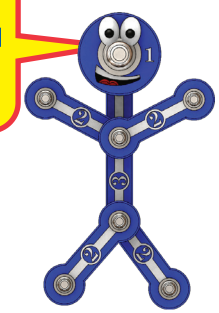

# Color Light

Build the circuit shown on the left by placing all the parts with a black 1 next to them on the board first. Then, assemble parts marked with a 2. Install two (2) “AA” batteries (not included) into each of the battery holders (B1) if you have not done so already. **When installing a battery, be sure the spring is compressed straight back, and not bent up, down, or to one side. Battery installation should be supervised by an adult.**

Turn on the slide switch (S1), and enjoy the light show from the color LED (D8). For best effects, place one of the LED attachments (tower, egg, or fiber optic tree) on the color LED, and dim the room lights. The fiber optic tree must be used with its mounting base.



Snappy says the color LED actually contains separate red, green, and blue lights, with a micro-circuit controlling them.



# ☐ Project 2 White Light

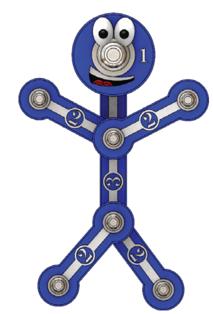

Use the circuit built in project 1, but replace the color LED (D8) with the white LED (D6). Try it with one of the LED attachments, and in a dark room.

The white LED produces very bright light. LEDs are this one are increasingly being used for home lighting and flashlights. They are more efficient than normal light bulbs.

# ☐ Project 3 Red Light


Use the circuit built in project 2, but replace the white LED (D6) with the red LED (D1). Try it with one of the LED attachments, and in a dark room.

The red LED is not nearly as bright as the other LEDs. LEDs like this one are used as indicators in many products in your home. They are inexpensive, but don’t produce much light.



# ☐ Project 4

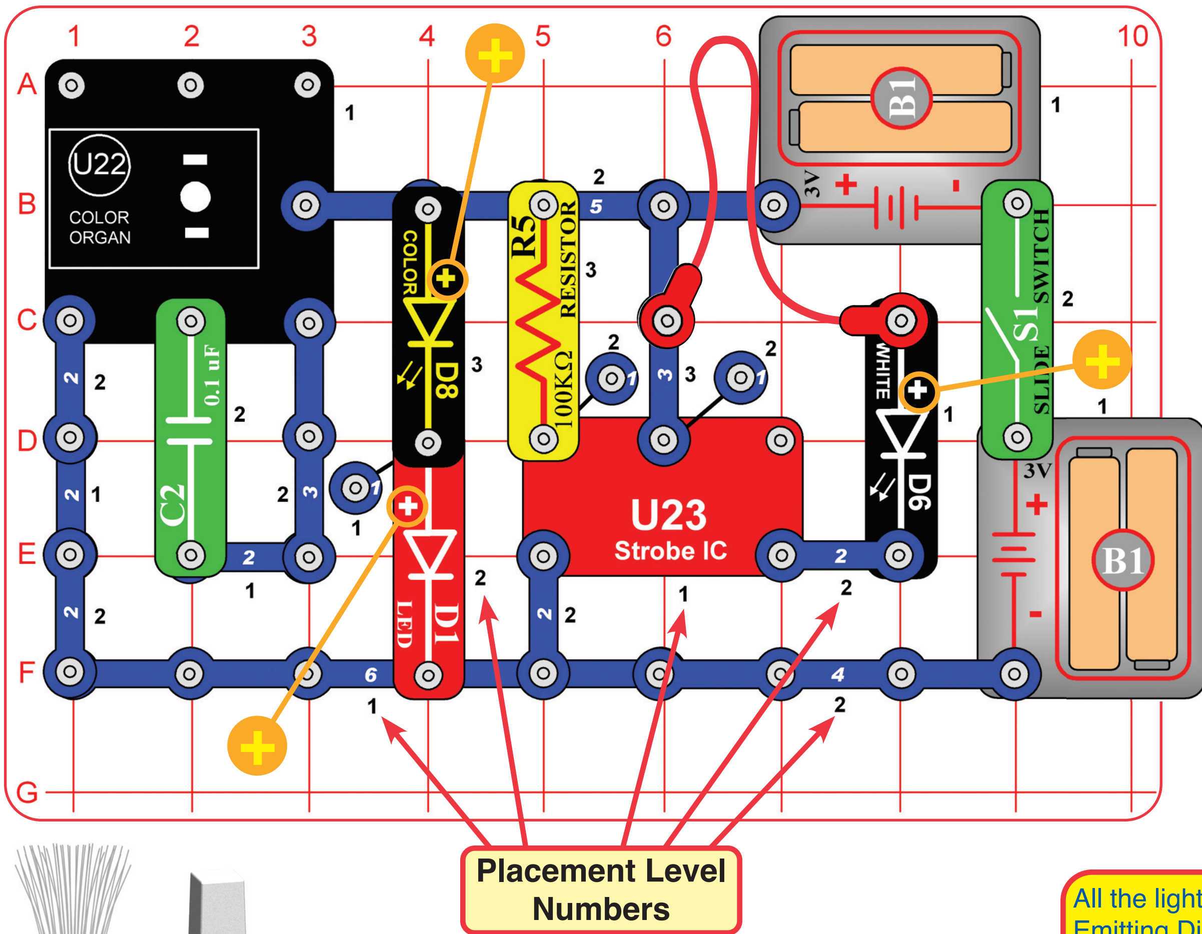
# Light Show

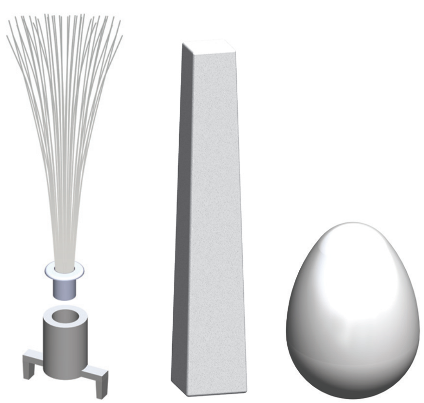
Snap Circuits® uses electronic blocks that snap onto a clear plastic grid to build different circuits. These blocks have different colors and numbers on them so that you can easily identify them.

Build the circuit shown above by placing all the parts with a black **1** next to them on the board first. Then, assemble parts marked with a **2**.

If desired, place any of the LED attachments (tower, egg, or fiber optic tree) on any of the LEDs (red (D1), color (D8), white (D6), or the LED on the color organ IC (U22). Note that the fiber optic tree requires its mounting base.

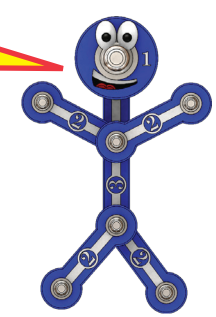
Turn on slide switch (S1) and enjoy the show!



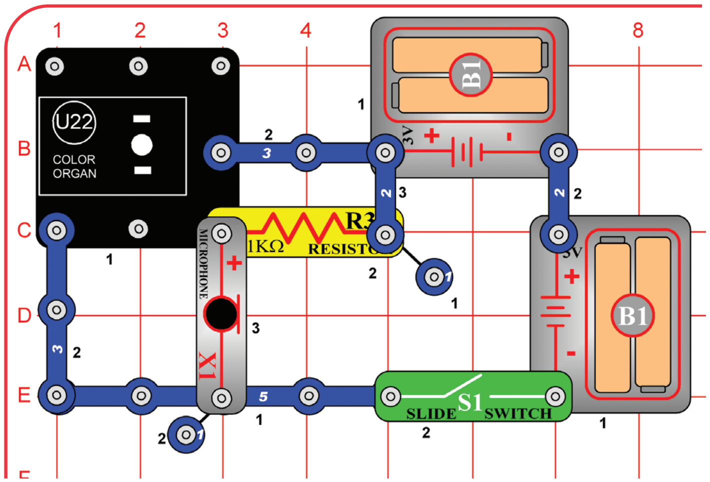
LED Attachments

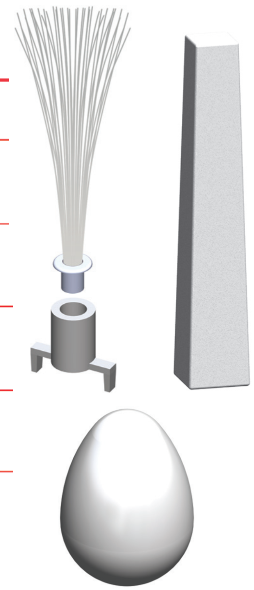
All the lights in this set are LEDs - Light Emitting Diodes. LEDs convert electrical energy into light; the color of the light emitted depends on the characteristics of the material used in them.



# ☐ Project 5

# Voice Light Show



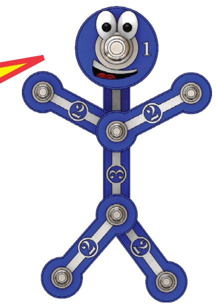
LED Attachments

Build the circuit as shown, and place one of the LED attachments (tower, egg, or fiber optic tree) over the LED on the color organ (U22). Turn on the switch (S1) and talk. The color organ light will follow your voice, in tone and loudness.

## ☐ Project NEW1 Light Changer

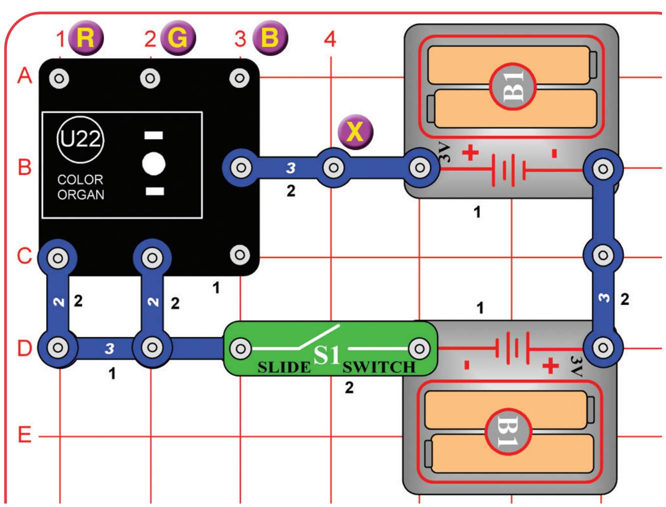
Replace the microphone (X1) with the phototransistor ("+" on top) and vary the amount of light shining on it. The light on the color organ is changing only if there is enough light on the phototransistor.

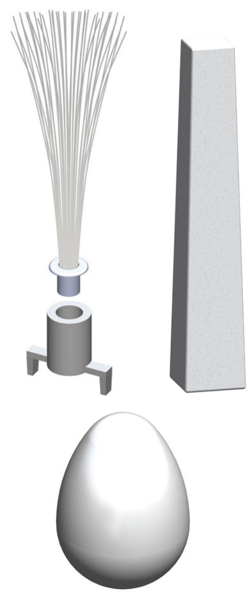
How does it work? The microphone converts your voice to an electrical signal, which controls an electronic counter in the color organ. The counter controls a red-green-blue LED.



# ☐ Project 6

# Play the Color Organ

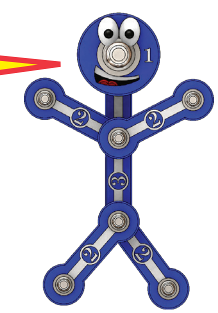


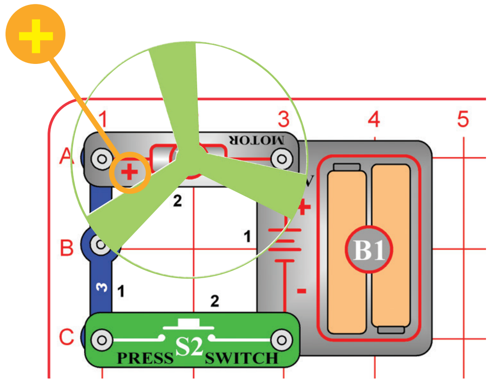
LED Attachments

Build the circuit as shown, and turn on the switch (S1). Place one of the LED attachments on the color organ (U22). Wet your fingers, and touch them between the point marked "X", and points marked "R", "G", or "B" in the drawing. Try X with every combination of R, G, and B, including touching them all at the same time.

The light in the color organ module is actually red, green, and blue LEDs together. The points marked R, G, and B control the light for those colors. Combining red and green makes yellow, green and blue makes cyan, red and blue makes purple, and combining all three colors makes white.



# ☐ Project 7




WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

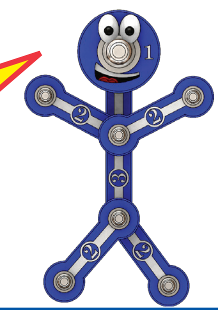
# Flying Saucer

Push the press switch (S2) until the motor reaches full speed, then release it. The fan blade should rise and float through the air like a flying saucer. Be careful not to look directly down on fan blade when it is spinning.

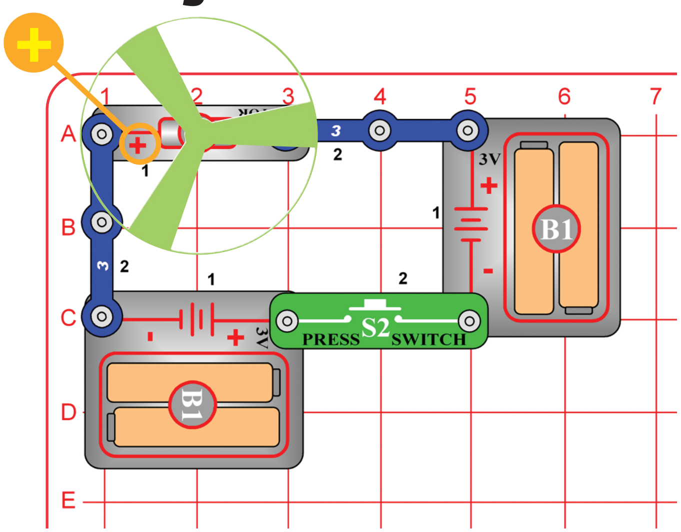
If the fan doesn't fly off, then press the switch several times rapidly when it is at full speed. The motor spins faster when the batteries are new.

The glow fan will glow in the dark. It will glow best after absorbing sunlight for a while. The glow fan is made of plastic, so be careful not to let it get hot enough to melt. The glow looks best in a dimly lit room.

The air is being blown down through the blade and the motor rotation locks the fan on the shaft. When the motor is turned off, the blade unlocks from the shaft and is free to act as a propeller and fly through the air. If speed of rotation is too slow, the fan will remain on the motor shaft because it does not have enough lift to propel it.



# ☐ Project 8




WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

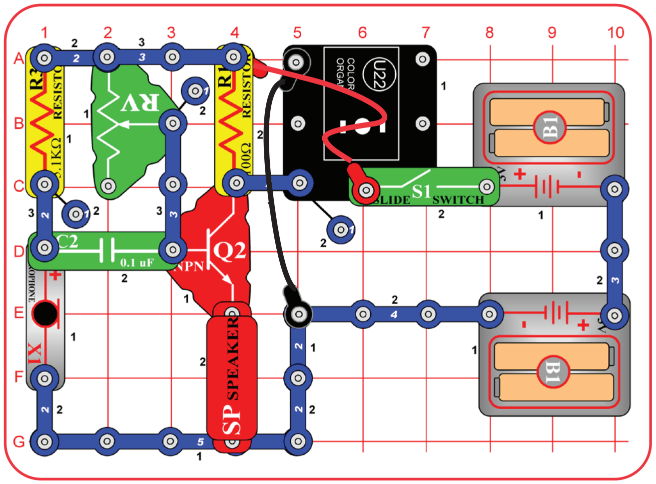
# Super Flying Saucer

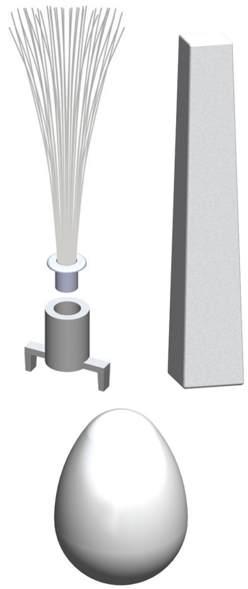
This circuit will make the fan spin faster and fly higher than the preceding circuit, making it easy to lose your fan.

**WARNING: Elenco® Electronics Inc. is not responsible for lost or broken fans!** You may purchase replacement fans at www. snapcircuits.net.

Push the press switch (S2) until the motor reaches full speed, then release it. The fan blade should rise and float through the air like a flying saucer. Be careful not to look directly down on fan blade when it is spinning.

## ☐ Project 9





LED Attachments

# Super Voice Light Show

This circuit is similar to project 5, but more sensitive. Build the circuit as shown, initially set the adjustable resisitor (RV) to the middle, and place one of the LED attachments (tower, egg, or fiber optic tree) over the LED on the color organ (U22). Turn on the switch (S1) and talk, or place a device playing music near the micorphone (X1). The color organ light will follow the sound, in tone and loudness.The speaker (SP) is used here to regulate a transistor amplifier for the microphone, and will not make sound.

### ☐ Project 10 Finger Light Show

Replace the microphone (X1) with the motor (M1). Spin the motor top with your fingers to change the color organ light.

### ☐ Project 11 Funky Show

Replace the motor with the color LED (D8) to create some interesting effects.

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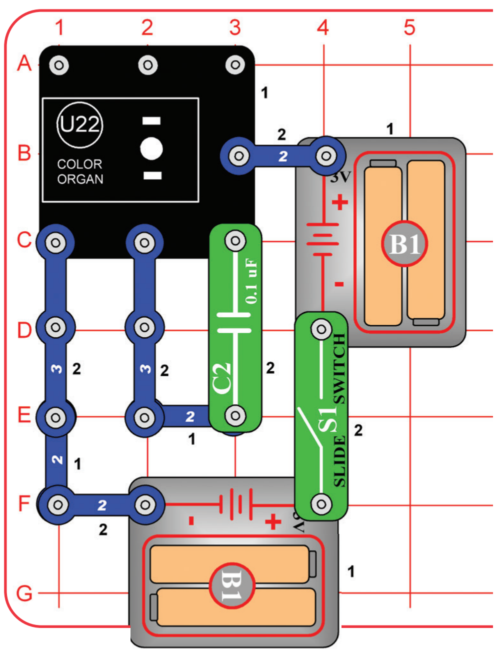
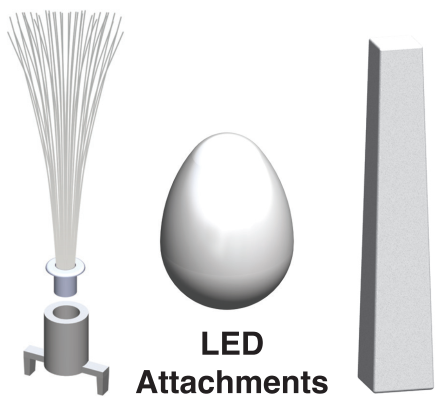
## ☐ Project 12





LED Attachments

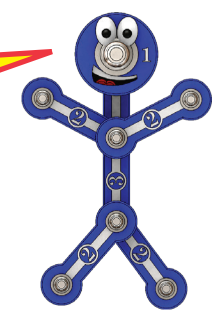
# Color Oscillator

Build the circuit as shown, and place one of the LED attachments (tower, egg, or fiber optic tree) over the LED on the Color Organ (U22). Turn on the switch (S1) and watch. The color organ light will change colors on its own.

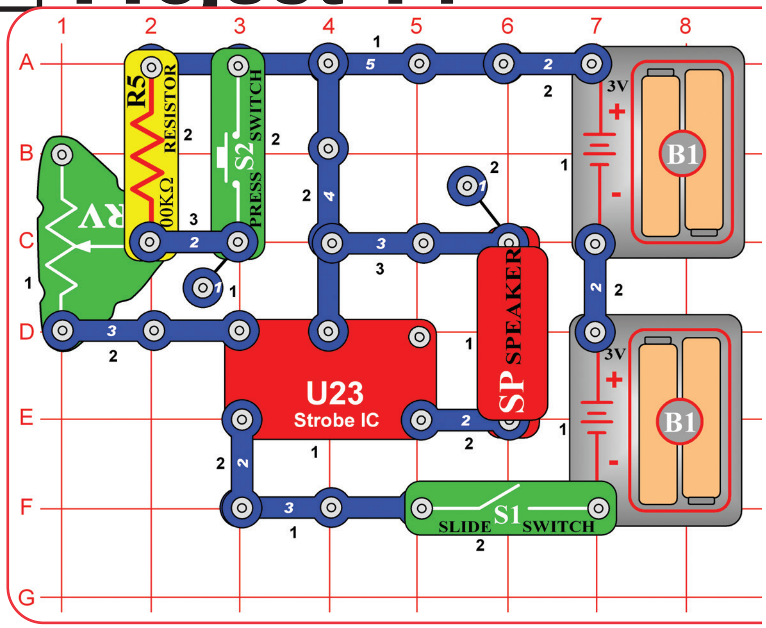
### ☐ Project 13 Slower Oscillator

Replace the 3-snap wire that is across base grid locations C2-E2 (next to the 0.1μF capacitor (C2)) with the 100kΩ resistor (R5). Now the color organ light changes more slowly.

This circuit is an oscillator; it uses the color organ to control itself.



# ☐ Project 14 Sound Maker




Build the circuit and turn on the switch (S1). You hear sound from the speaker. Adjust the sound using the lever on the adjustable resistor (RV), and by pushing the press switch (S2).

**Note:** In rare cases the circuit may not work at all settings on RV. If this happens, move the RV lever to the side near the strobe IC, turn the slide switch off and on to reset the circuit, and only move the RV lever over a small range.

## ☐ Project 15 Strobe Light

Use the preceding circuit, but replace the speaker with the white LED (D6). Now you have a strobe light! When S2 is pressed, the light may be blinking so fast that it appears to be on continuously.

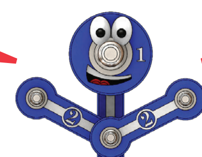
## ☐ Project 16 Color Strobe Light

Use the preceding circuit, but replace the white LED with the color LED (D8).

## ☐ Project 17 Red Light Strobe

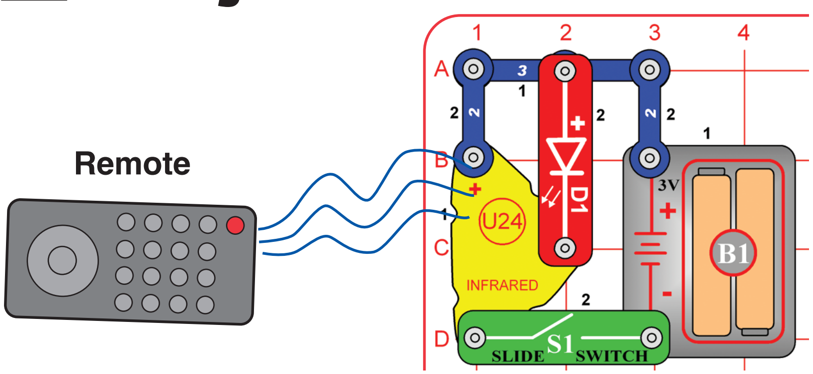
Use the preceding circuit but replace the color LED (D8) with the red LED (D1).

The strobe IC (U23) produces an electrical “tone”. The pitch of the “tone” is adjusted by changing how much electricity flows into its upper-left snap, using a resistor. The electrical tone it produces can be used to make sound using a speaker, or to control the flash rate of an LED.



The color LED will not be changing colors like it does in other circuits. When the strobe IC (U23) turns the color LED on and off, it resets the color-control microcircuit in the color LED. Even your slowest strobe speed is too fast for the color LED.

# ☐ Project 18 Infrared Detector

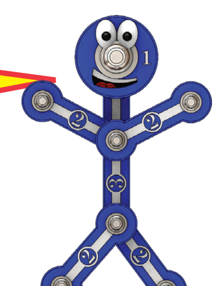



You need an infrared remote control for this project, such as any TV/stereo/DVD remote control in your home.

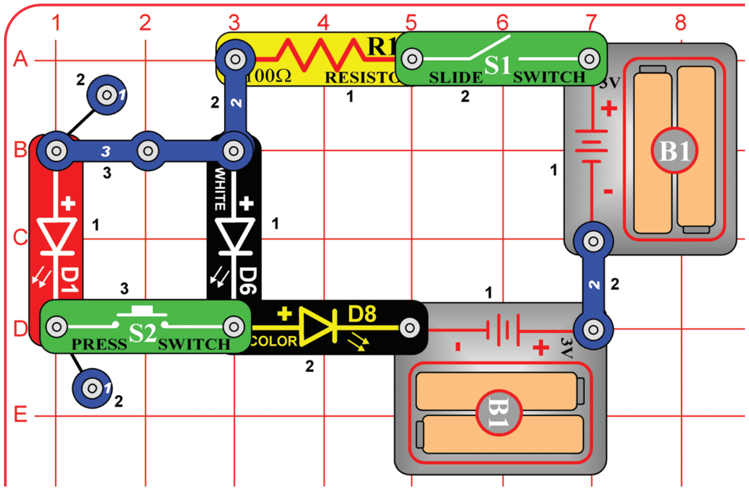
Build the circuit and turn on the switch (S1). Point your remote control toward the infrared module (U24) and press any button to activate the red LED (D1).

Sometimes this circuit may activate without a remote control, due to infrared in sunlight or some room lights. If this happens, try moving to a dark room.

TV remote controls transmit a sequence of pulses representing the TV model and the button that was pressed. The U24 infrared detector is just looking any infrared signal.



# ☐ Project 19 Blinking Colors

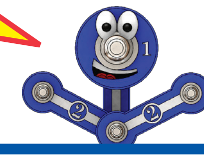



Build the circuit as shown and turn on the slide switch (S1). The white and color LEDs (D6 & D8) are blinking.

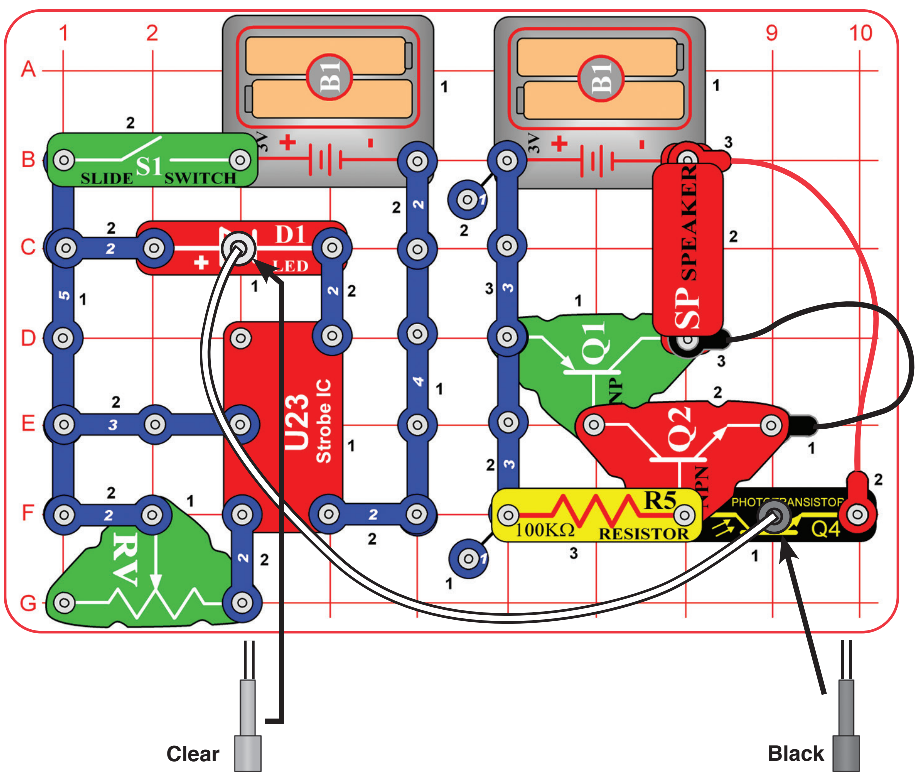
Push the press switch (S2). Now the red LED (D1) is blinking but the white LED is much dimmer or off.

If you swap the locations of the red and white LEDs, then the red LED will be blinking and the white LED will be off, and pushing the press switch may dimly light the white LED but the red LED will hardly be affected.

Red light is easier for LEDs to produce than white light. When the red and white LEDs are connected in parallel (which happens when S2 is pressed), the red LED will dominate because it turns on more easily.



# ☐ Project 20 Fiber Optics



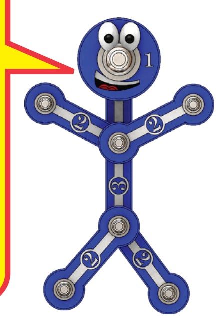

Build the circuit as shown. Place the clear cable holder on the red LED (D1) and the black cable holder on the phototransistor (Q4), then place the fiber optic cable into the holders as far as it will go. For best performance the cable should stand straight up in the holders, without bending them.

Turn on slide switch (S1) and move the lever on the adjustable resistor (RV) around. The sound from the speaker (SP) changes as you move the lever on RV.

This project is more exciting than it looks. The tone sounds produced by the strobe IC (U23) are played on the speaker (SP), even though there is no electrical connection between them.

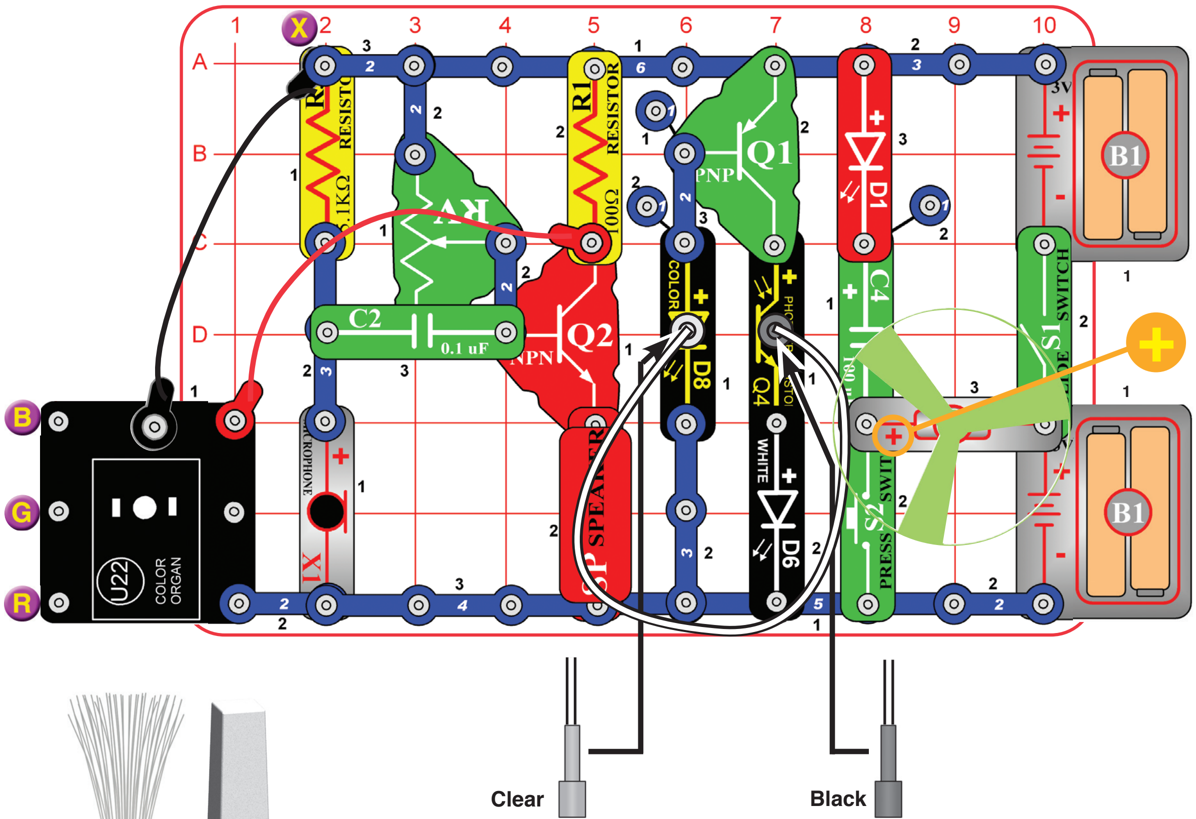
The left half the circuit makes a coded light signal, which you see in the red LED (D1). The right half of the circuit decodes the light signal and plays it on the speaker. The fiber optic cable is used to transmit the light signal between the two sides of the circuit. There is no electrical connection between the left and right halves of the circuit, only a light connection using fiber optics! If your fiber optic cable was longer, the two halves of the circuit could be many miles apart.

This circuit is an example of using fiber optic cables for communication. Fiber optics allows information to be transmitted across great distances at very high speeds with very low distortion, by using light.



# ☐ Project 21

# Big Circuit

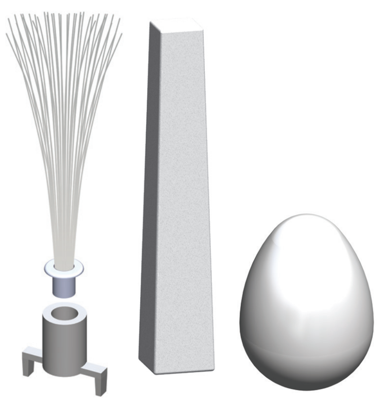



Build the circuit as shown. Place either the glow fan or the light fan on the motor (M1) shaft, so that it is stable on the little black piece. Place the clear fiber optic holder on the color LED (D8) and the black fiber optic holder on the phototransistor (Q4), then insert the fiber optic cable between them, but don't let it lay close to the fan on the motor. For best performance the fiber optic cable should stand straight up in the holders, without bending them. For best effects, place one of the LED attachments over the light on the color organ.

Turn on slide switch (S1). Talk into the microphone (X1) and adjust the lever on the adjustable resistor (RV) for best sound and light effects.

Push the press switch (S2) until the motor reaches full speed, then release it. The fan will rise into the air like a flying saucer.

"Playing the Color Organ": Wet your fingers, and touch them between the point marked "X", and "R", "G", or "B" in the drawing.

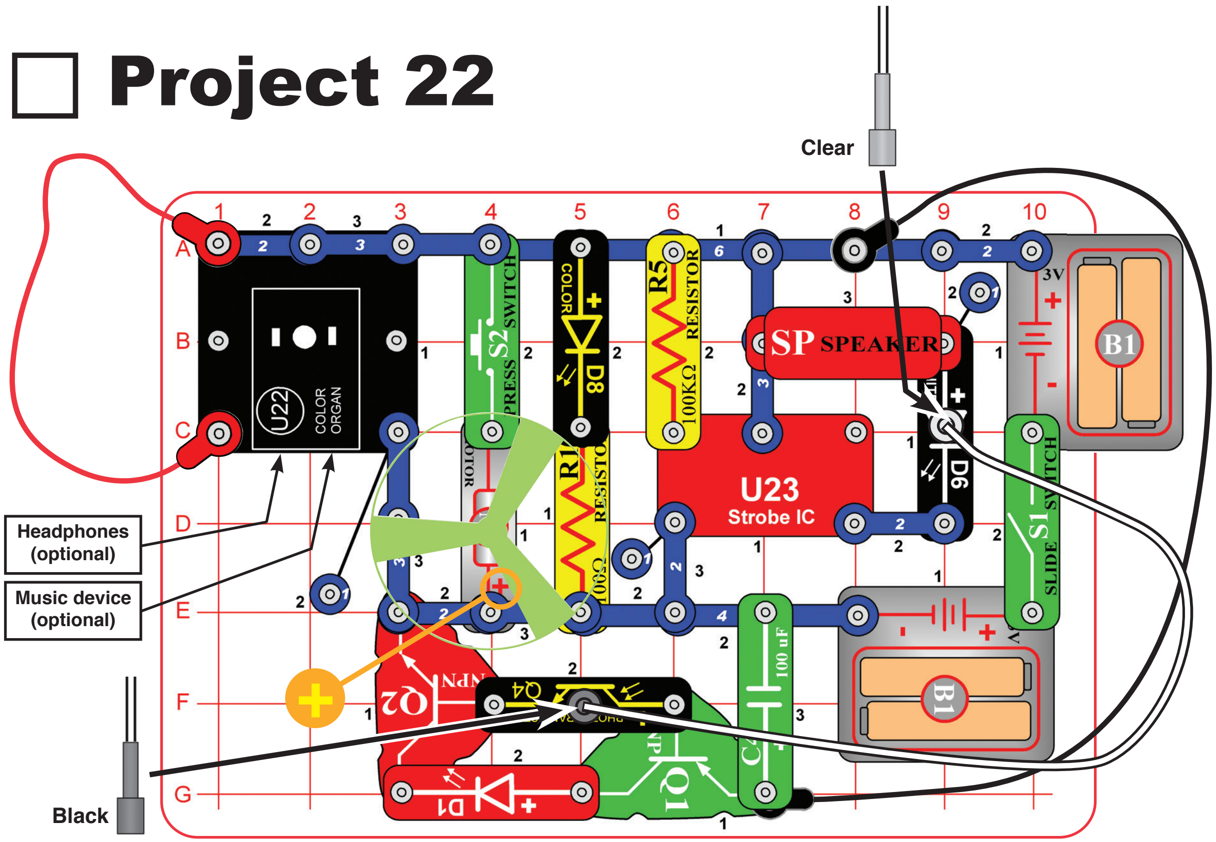


LED Attachments


**WARNING:** Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

## ☐ Project 22

# Super Circuit




Build the circuit as shown. Place the glow fan on the motor (M1) shaft, so that it is stable on the little black piece. Place the clear fiber optic holder on the white LED (D6). and the black fiber optic holder on the phototransistor (Q4), then insert the fiber optic cable between them, but don't let it lay close to the fan on the motor. For best performance the fiber optic cable should stand straight up in the holders, without bending them. For best effects, place one of the LED attachments over the light on the color organ, and one on the color LED (D8).

*Optional: connect a music device to the color organ (U22) as shown, and start music on it (the color organ light will change to the music, but you will not hear it unless you also connect headphones).*

Turn on slide switch (S1). A tone is heard from the speaker (SP), and all the lights (D1, D6, D8, and on U22) are on.

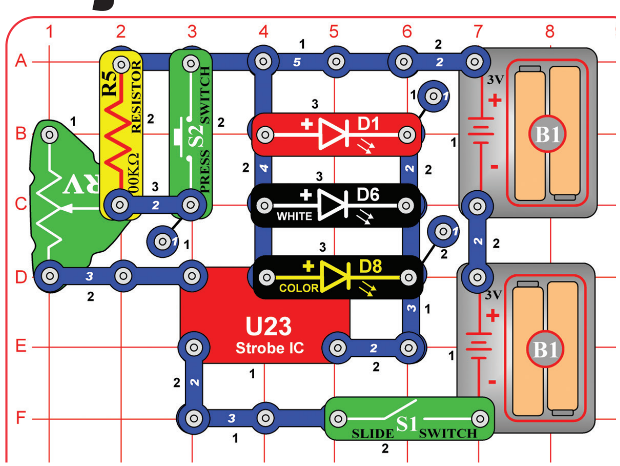
Push the press switch (S2) until the motor reaches full speed, then release it. The fan will rise into the air like a flying saucer. Be careful not to look down on the fan when it is spinning.

This circuit also works if you move the clear fiber optic holder from the white LED (D6) to the color LED (D8).

**WARNING:** Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

## ☐ Project 23

# Triple Strobe Light




Build this circuit and turn on the slide switch (S1). Adjust the blink rate using the lever on the adjustable resistor (RV), and by pushing the press switch (S2).

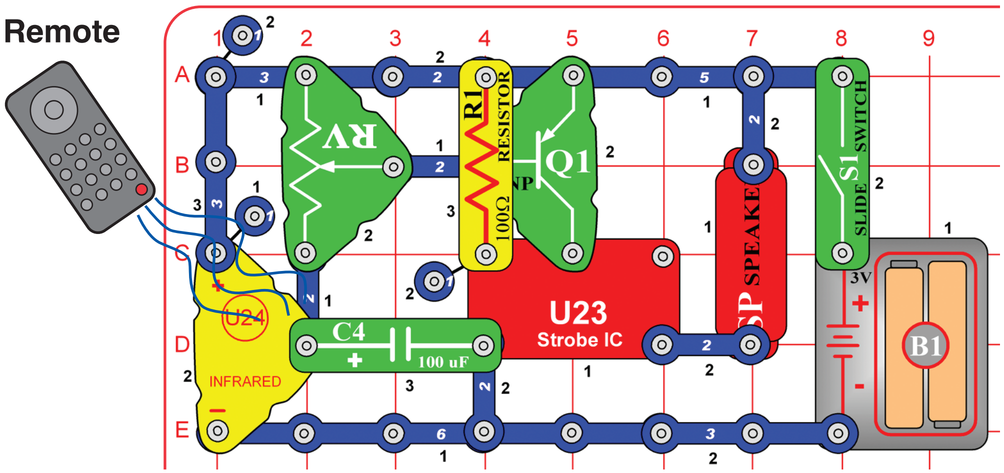
**Note:** In rare cases the circuit may not work at all settings on RV. If this happens, move the RV lever to the side near the strobe IC, turn the slide switch off and on to reset the circuit, and only move the RV lever over a small range.

### ☐ Project 24 Noisy Double Strobe Light

Use the preceding circuit but replace one of the LEDs (D1, D6, or D8) with the speaker (SP).

# ☐ Project 25

# Audio Infrared Detector



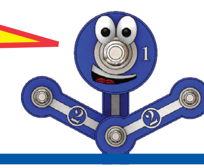

You need an infrared remote control for this project, such as any TV/stereo/ DVD remote control in your home.

Build the circuit, set the lever on the adjustable resistor (RV) all the way towards the infrared module (U24), and turn on the switch (S1). Point your remote control toward the infrared module and press any button to activate an alarm sound. The lever on the adjustable resistor sets how long the alarm plays for, but it only works over a narrow range.

Next, replace the 100Ω resistor (R1) with the 5.1kΩ resistor (R3). The alarm sound is a little different, but the control range on RV is wider.

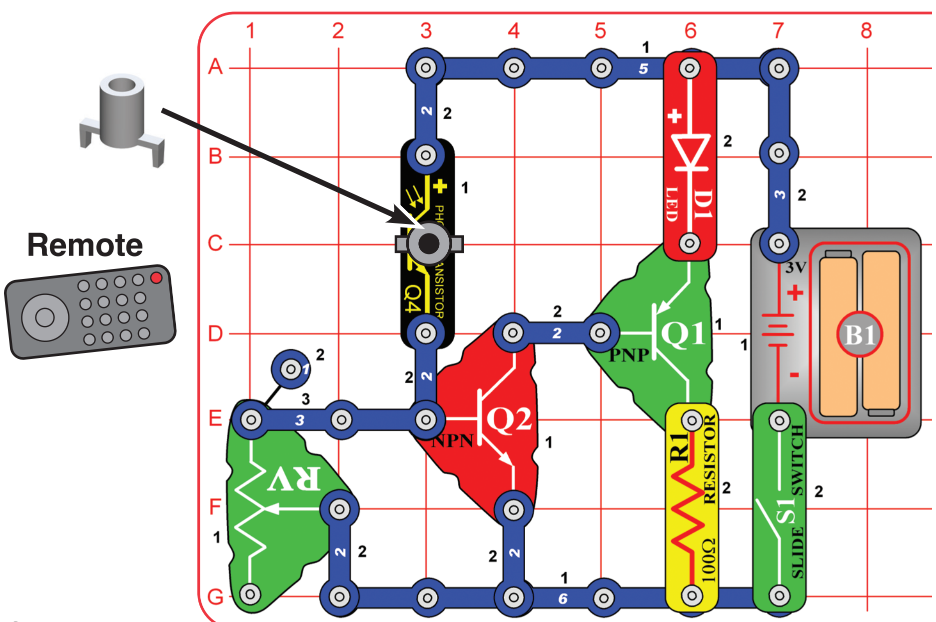
Sometimes this circuit may activate without a remote control, due to infrared in sunlight or some room lights. If this happens, try moving to a dark room.

Sunlight and other light sources emit some infrared light, and may activate the infrared detector. See if you can activate it without a remote control.



# ☐ Project 26

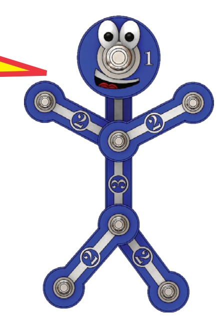
# Photo Infrared Detector



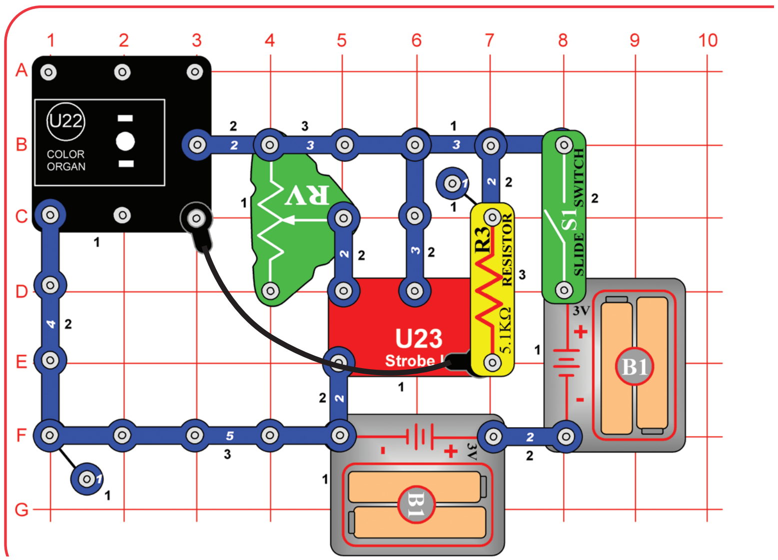

You need an infrared remote control for this project, such as any TV/stereo/ DVD remote control in your home.

Build the circuit and turn on the switch (S1). Place the mounting base (normally used with the fiber optic tree) on the phototransistor (Q4). Set the lever on the adjustable resistor (RV) so the red LED (D1) just turns off; if it never turns off, move away from room lights. Point your remote control directly into the mounting base on Q4, and press any button to activate the red LED (D1).

The phototransistor can detect light, and infrared light is light. The infrared module (U24) is designed to focus only on infrared light.



# Project 27 Adjustable Color Changer




Turn on the slide switch (S1) and move the lever on the adjustable resistor (RV) to change how fast the light in the color organ (U22) changes colors.

## Project 28 Audio Adjustable Color Changer

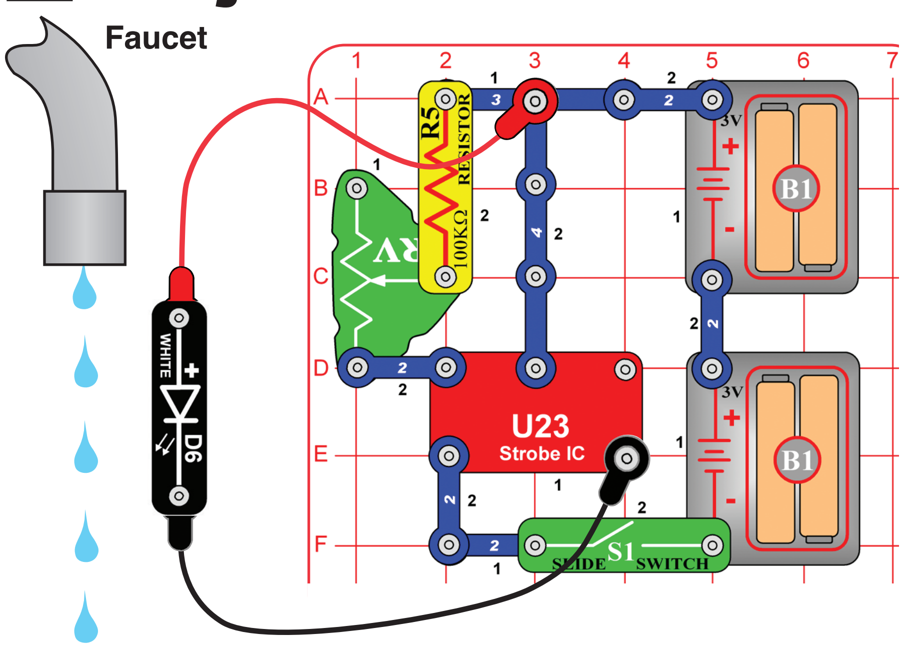
Use the preceding circuit but replace the 5.1kΩ resistor (R3) with the speaker (SP). Now you also hear the sound change as you adjust the lever on RV.

## Project 29 Double Adjustable Strobe

Replace the speaker with one of the LEDs (D1, D6, or D8). The LED is a strobe light, changing much faster than the LED in the color organ.

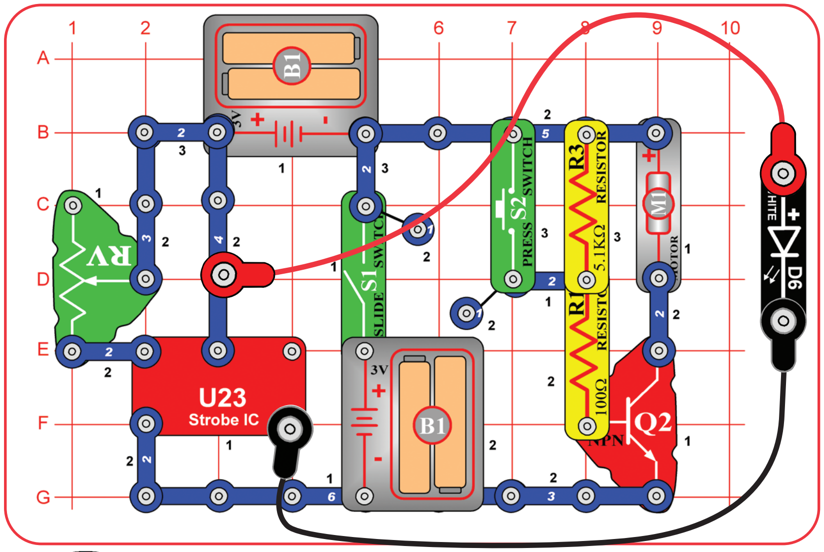
Here the color organ light changes colors in sync with the strobe IC (U23), but at a much slower rate.

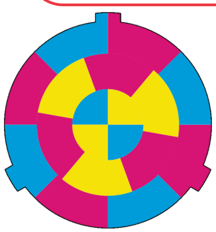
# Project 30 Suspended Raindrops

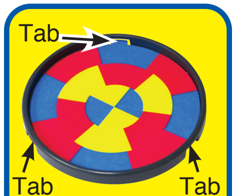



Build the circuit as shown. Connect the white LED (D6) to the red & black jumper wires. Turn on the slide switch (S1). Go to a water faucet and adjust the faucet so water is dripping at a steady rate. Dim the room lights and hold the white LED so it shines on the dripping water. Try to set the lever on the adjustable resistor (RV) so that the dipping water drops appear suspended in mid-air. You may need to adjust the drip rate on the faucet to make this work. You may get better results if you replace the 100kΩ resistor (R5) with the 5.1kΩ resistor (R3). Also, try setting the strobe rate to minimum and adjusting the drip rate.

# ☐ Project 31






Slide tabs into slots.

Place disc holder onto the motor as shown.

Hold white LED (D6) over disc as shown.

**OPTIONAL (Adult supervision required)**

The disc holder rests on the motor top loosely and vibrates, making the disc pattern blurry even when the RV setting makes the pattern "stop". The disc patterns will appear clearer if you permanently mount the disc holder to the motor top. This set contains a spare motor top, which can be used for this. This requires removing the motor top from the motor whenever you want to switch from using the disc holder to using the glow fan, so is optional, and requires adult supervision.

If you want to do this, pry the motor top off the motor shaft using a screwdriver.

Lay the spare motor top in the disc holder upside down, and bond together with glue (glue not included).

After the glue dries, push the modified disc holder on the motor shaft and install a disc cutout. When you want to return to using the glow fan, replace the motor top disc holder with the normal motor top.



# Strobe Effects

Build the circuit as shown. Take the colored disc shown and install it into the disc holder, then place the disc holder on the motor (M1). Connect the white LED (D6) to the red & black jumper wires.

For best effects, do this in a dimly lit room. Turn on the slide switch (S1). Push the press switch (S2) until the motor spins continuously (if it stops after you release the press switch, replace your batteries). Hold the white LED upside down over the disc holder so it shines on the spinning disc, and move the lever on the adjustable resistor (RV) slowly while watching the pattern on the spinning disc.

The motor spins the disc so fast that it looks like a blur. However, as you slowly adjust RV the pattern on the disc appears to slow down, stop, and reverse direction. Patterns close to the disc center may be moving at different speeds, or in different directions, from patterns farther from the center! Some patterns may become clear while others are still blurred.

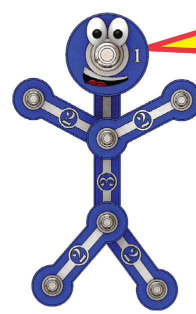
If the motor does not continue spinning after you release S2, then replace your batteries. If it still won't keep spinning then replace the 5.1kΩ resistor (R3) with a 3-snap wire.

## ☐ Project 32 Slow Strobe Effects

Use the preceding circuit, but replace the 3-snap on the adjustable resistor (RV) with the 100kΩ resistor (R5). The circuit works the same, but the strobe rate is much slower (now you can see the LED flashing), so the strobe effects are different. Slowly adjust the setting on RV as before, and watch the patterns on the spinning disc.

**Note:** In rare cases the LED may not flash at all settings on RV. If this happens, move the RV lever to the side near the strobe IC, turn the slide switch off and on to reset the circuit, and only move the RV lever over a small range.

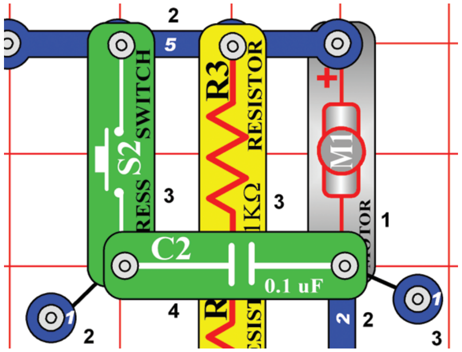
Bonus for owners of other Snap Circuits® sets: If you have a second 100kΩ resistor (from model SC-100 / 300 / 500 / 750 or other sets), place it directly over the R5 that replaced the 3-snap in the above circuit (and place a 1-snap under one side of the additional R5). Stacking the two 100kΩ resistors together creates a "medium" range of strobe speeds, in between the speeds created with the 3-snap and single 100kΩ. Adjust the RV setting and watch the strobe effects as before.



How does this work? The strobe IC is making the white LED flash so fast that your eyes think it is on continuously. RV sets the flash rate, and at some settings the LED flashes are synchronized with speed of the patterns spinning on the disc, making them appear visible instead of blurred.

When the disc pattern is totally blurred, it will appear as purple, orange, and light green. Combining equal amounts of red & blue makes purple, red & yellow makes orange, and yellow & blue makes green.

# ☐ Project 33 Stable Strobe Effects



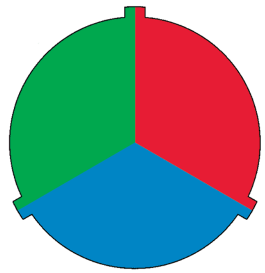

Use the circuits from projects 31 and 32, but add the 0.1μF capacitor (C2) next to the motor, as shown here. Set the strobe speed so the patterns are visible, and see if they look less blurred than before.

The 0.1μF capacitor has no electrical effect,but it helps to hold the motor in place better and reduce vibrations. Less motor vibration makes the disc holder more stable, and so makes the patterns a little clearer. See if you can notice a difference.

When the disc pattern is totally blurred, it appears to be white. Combining equal amounts of red, green, and blue makes white. The LED in the color organ IC combines red, green, and blue lights to make white.

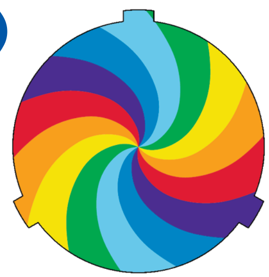
## ☐ Project 34 Strobe Effects (II)

Replace the disc in the disc holder with the one shown here, and repeat projects 31-33. Observe the strobe effects. To remove a disc from the holder, use your fingernail, or use a pencil to push it up from beneath one of the tabs.



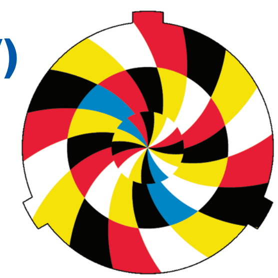
## ☐ Project 35 Strobe Effects (III)

Replace the disc in the disc holder with the one shown here, and repeat projects 31-33. Observe the strobe effects. At some RV settings, the rainbow of colors comes into view.



## ☐ Project 36 Strobe Effects (IV)

Replace the disc in the disc holder with the one shown here, and repeat projects 31-33. Observe the strobe effects. With this pattern, some areas may appear to be moving at different speeds or directions. Sometimes you can see all the colors on the disc, but sometimes you can see all the colors except blue, which is hidden.

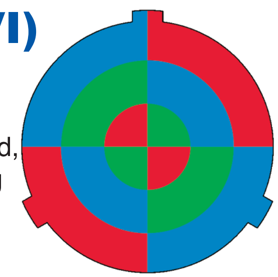


## ☐ Project 37 Strobe Effects (V)

Replace the disc in the disc holder with the one shown here, and repeat projects 31-33. Observe the strobe effects. This unusual pattern produces several amazing displays at different RV settings.

## ☐ Project 38 Strobe Effects (VI)

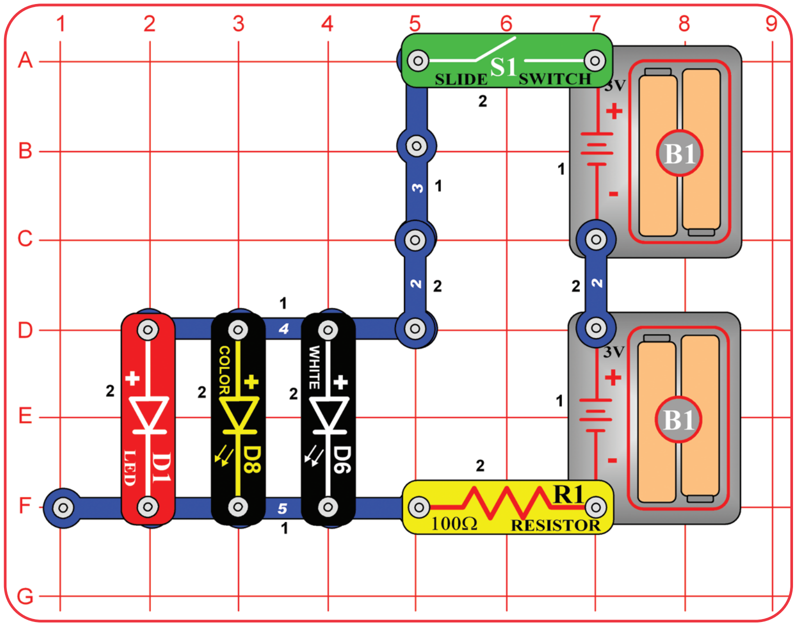
Replace the disc in the disc holder with the one shown here, and repeat projects 31-33. Observe the strobe effects. When the disc pattern is totally blurred, it will appear as purple, cyan, and yellow. Combining equal amounts of red & blue makes purple, green & blue makes cyan, and red & green makes yellow.



## ☐ Project 39 Make Your Own Strobe Effects

Draw your own patterns on paper or cardboard, then cut them to the same size as our discs. You can also draw patterns on the backs of our discs. Put them on the disc holder and repeat projects 31-33. Have a contest with your friends to see who can make the most interesting strobe effects! You can also find lots of fun patterns and visual illusions by doing a search on the internet. There is no limit to what you can do!

# ☐ Project 40



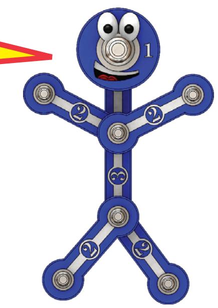

# LEDs Together

Turn on the slide switch (S1), and compare the brightness of the three LEDs.

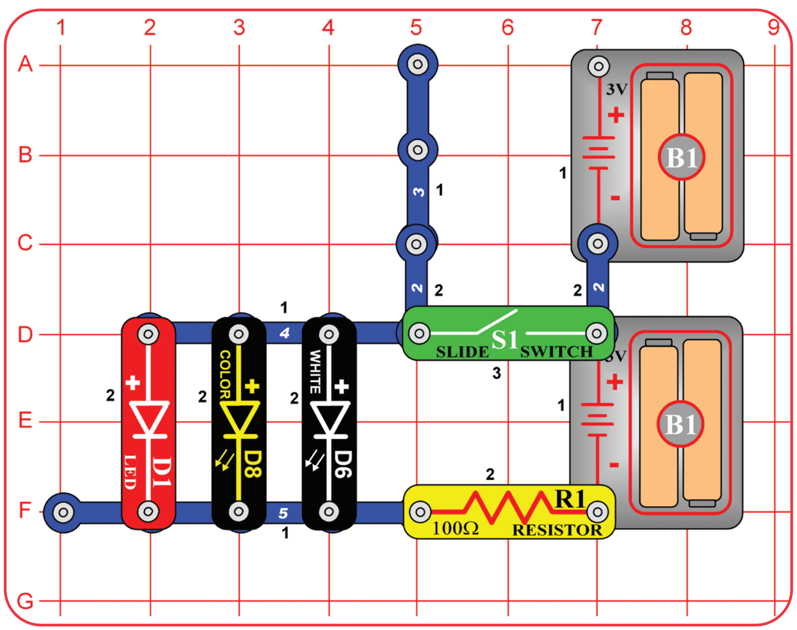
Next, remove any of the LEDs and see how the brightness of the others changes.

The voltage needed for an LED to turn on depends on the light color. Red light needs the least, green needs more, but blue and white need the most. The color LED (D8) contains red, green, and blue LEDs.

The R1 resistor reduces the voltage available to the LEDs. The LED brightness varies because some of the LEDs need more voltage than is available. The red LED (D1) will dominate the other colors because it turns on more easily.



# ☐ Project 41

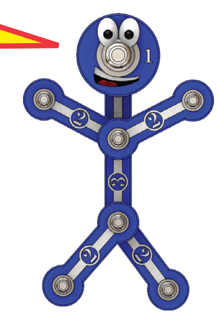



# LEDs Together (II)

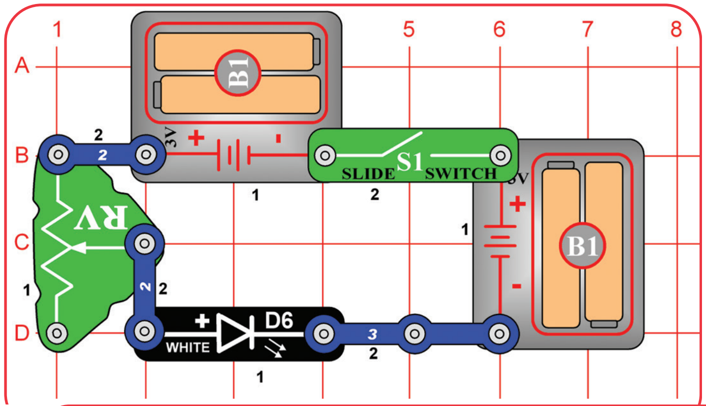
Modify the preceding circuit by moving the slide switch (S1) to the location shown here. Compare the brightness of the LEDs. Some LEDs may not turn on.

Next, remove any of the LEDs and see how the brightness of the others changes.

This circuit reduces the voltage to the circuit, because only one set of batteries is connected. The limited battery voltage is split between the R1 resistor and the LEDs. The remaining voltage across the LEDs is enough to activate the red LEDs, but may not be enough to activate the other colors. With the reduced voltage, the red LED will dominate even more than in the preceding circuit.



# Project 42




# Brightness Control

Build the circuit and turn on the slide switch (S1). Move the lever on the adjustable resistor (RV) to vary the brightness of the light from the white LED (D6). If desired, you may place any of the LED attachments (tower, egg, or fiber optic tree) on the LED.

## Project 43 Resistors

Use the preceding circuit, but replace the 3-snap with one of the yellow resistors in this set (R1, R3, or R5). Observe how each changes the LED brightness at different settings for the adjustable resistor.

## Project 44 Resistors & LEDs

Use the two preceding circuits, but replace the white LED (D6) with the red LED (D1) or color LED (D8). Vary the adjustable resistor lever and change the yellow resistors to see how the light varies with each LED.

Resistors are used to control or limit the flow of electricity in a circuit. Higher resistor values reduce the flow of electricity in a circuit.

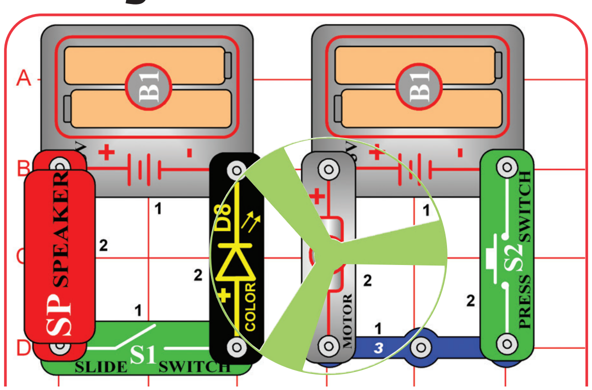
In this circuit, the adjustable resistor is used to adjust the LED brightness, to limit the current so the batteries last longer, and to protect the LED from being damaged by the batteries.

What is Resistance? Take your hands and rub them together very fast. Your hands should feel warm. The friction between your hands converts your effort into heat. Resistance is the electrical friction between an electric current and the material it is flowing through.

The adjustable resistor can be set for as low as 200Ω, or as high as 50,000Ω (50kΩ).

The R1 resistor (100Ω) will have little effect, since it will be dominated by the adjustable resistor. Resistor R5 (100kΩ) is a high resistance, which greatly restricts the flow of electricity, so the LED will be very dim or off. Resistor R3 (5.1kΩ) will be in between those.

# Project 45

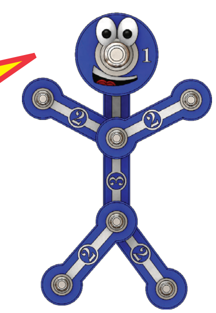



# Light Up the Fan

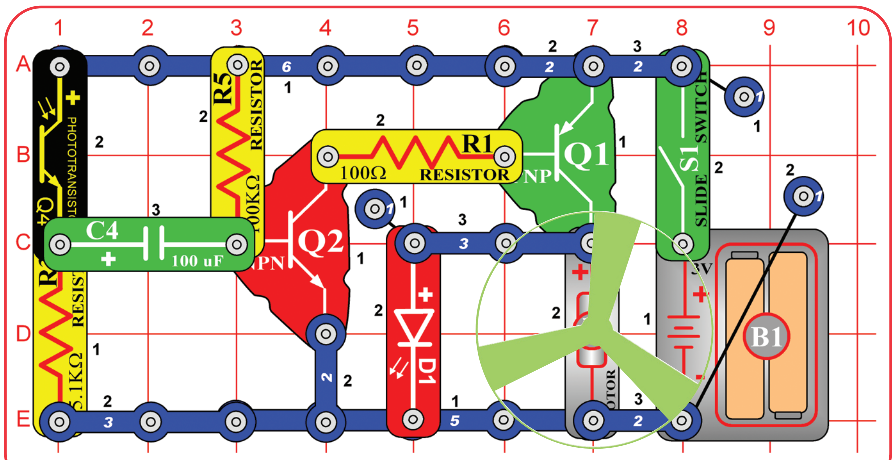
Build the circuit as shown, place the glow fan on the motor (M1), and turn on the slide switch (S1). Place the circuit in a dark room and push the press switch (S2) to spin the fan. The color LED (D8) lights up the spinning fan.

The circuit with the color LED is not electrically connected to the circuit with the motor. This was done because the motor produces electrical pulses as it spins, and these pulses can confuse the color LED.

**WARNING:** Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.



# Project 46 — Delayed Photo Speed Control




Turn on the switch (S1), the motor (M1) spins. As you move your hand over the phototransistor (Q4), the motor slows. Cover the phototransistor with your hand. The motor slows down and may stop, but will speed up in a few seconds. Also try shining a flashlight into the phototransistor.

**WARNING:** Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

## ☐ Project 47 Delayed Speed Control

Use the preceding circuit, but replace the 100μF capacitor (C4) with the much smaller 0.1μF capacitor (C2). Now varying the light to the phototransistor has only a small effect on the motor speed.

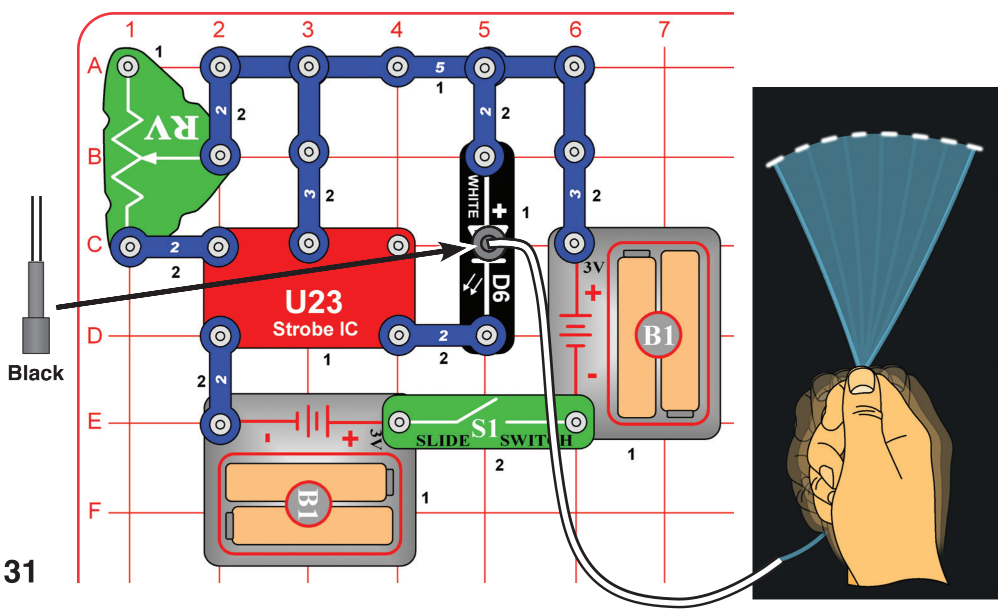
## ☐ Project 48 Delayed Speed Control (II)

Use the circuit from project 46, but swap the locations of the phototransistor (Q4) and 5.1kΩ resistor (R3); put "+" on Q4 towards C4. Now increasing the light to the phototransistor slows down the motor, instead of speeding it up.

## ☐ Project 49 Audio Delayed Speed Control

Use the circuit from project 46, but replace the phototransistor (Q4) with the microphone (X1, "+" on top). Clap, talk loudly, or blow into the microphone to change the motor speed.

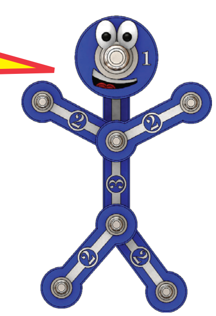
# Project 50 — Persistence of Vision



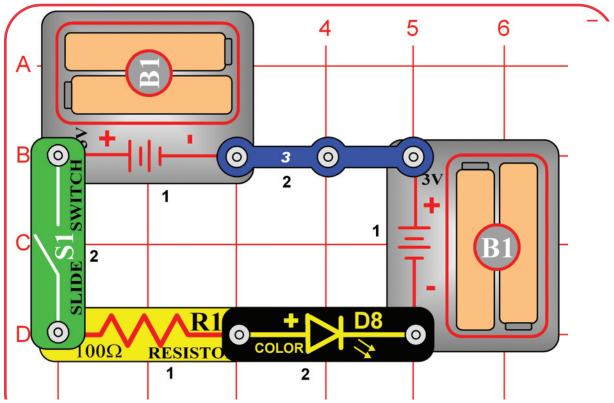

Build the circuit as shown. Place the black fiber optic cable holder on the white LED (D6) and insert the fiber cable into the black holder as far as it will go. Turn on the slide switch (S1). Take the circuit into a dark room and wave the cable around while watching the loose end. Try it with the lever on the adjustable resistor (RV) at different settings. The light coming out the loose end of the fiber optic cable will separate into short segments or dashes of light.

"Persistence of Vision" works because the light is changing faster than your eyes can adjust. Your eyes continue seeing what they have just seen.

In a movie theater, film frames are flashed on the screen at a fast rate (usually 24 per second). A timing mechanism makes a light bulb flash just as the center of the frame is passing in front of it. Your eyes see this fast series of flashes as a continuous movie.



# ☐ Project 51




Prismatic film separates light into different colors. White light is a combination of all colors.

Semi-transparent materials scatter the light without completely blocking it, so a wide area of the liquid or material is lit up by the light. This happens in the egg and tower LED attachments.

# Prismatic Film

This is the same circuit as project 1, but you will view it differently. Turn on the switch (S1), and view the LED through the prismatic film (the clear slide). Prismatic film makes interesting light effects.

Replace the color LED (D8) with the white LED (D6) and red LED (D1); view them through the prismatic film.

## ☐ Project 52 Look at the Lights

View different light sources in and around your home through the prismatic film.

## ☐ Project 53 Scattering Light

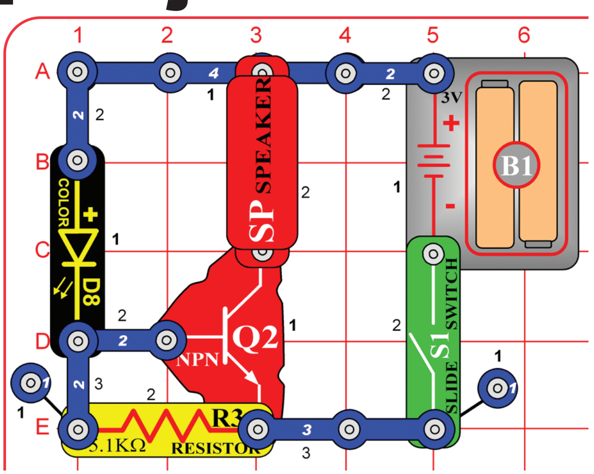
Use the project 51 circuit, but view the color LED through various semi-transparent liquids, glassware, and plastics. Juices, jello, and cloudy glass or plastic work well.

Replace the color LED with the white LED (D6). The white LED is brighter, but does not change color.

## ☐ Project 54 Color Fiber Light

Use the circuit from project 51, but place the clear cable holder on the color LED (D8), then place the fiber optic cable into the holder as far as it will go. Turn on the switch, then take the circuit into a dimly lit room and see the light coming out the open end of the cable. The light travels through the cable even as you bend it around.

# ☐ Project 55



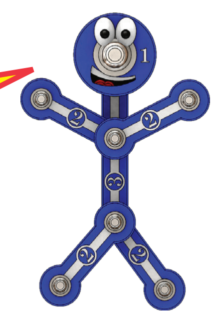

# Blinking Beeping

Build the circuit as shown and turn on the switch (S1). The color LED (D8) will be blinking and you hear beeping from the speaker. The sound will not be very loud.

## ☐ Project 56 Blinking Blinking

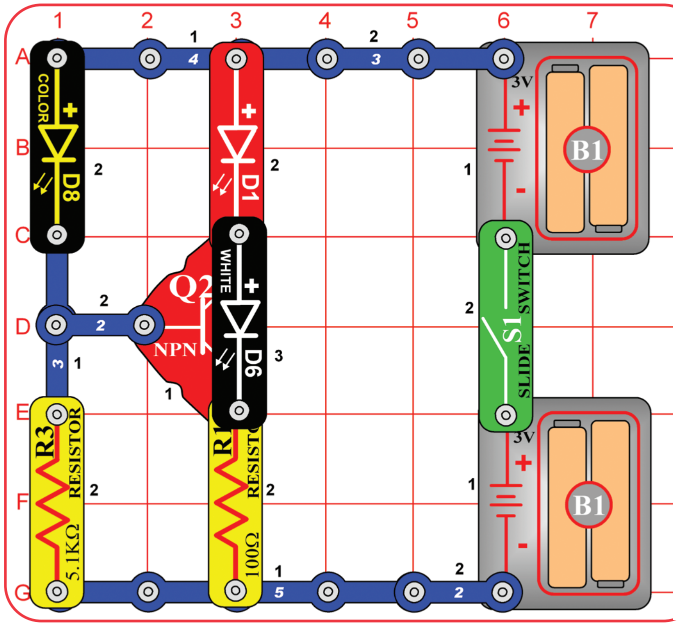
Use the preceding circuit, but replace the speaker with the red LED (D1). Now the red LED will also be blinking.

The color LED (D8) has a microcircuit that changes the light colors. As it does this, it changes the current through the circuit. The transistor (Q2) amplifies the changing current and uses it to control the speaker (SP).



# Project 57

# Triple Blinker

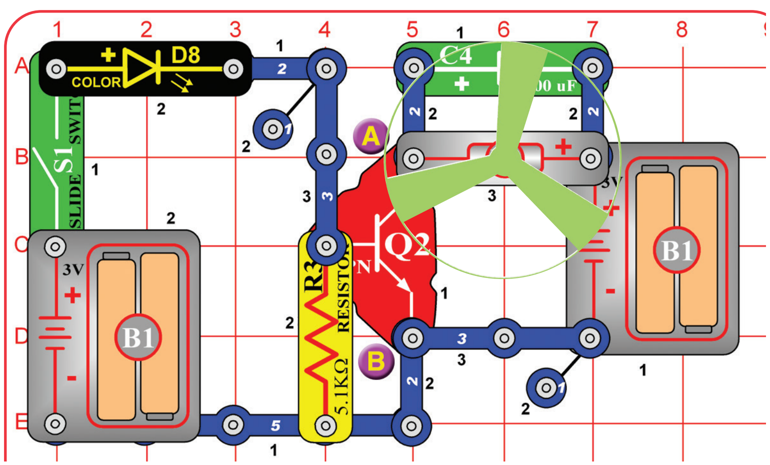


Build the circuit as shown and turn on the switch (S1). Three LEDs (D1, D6, and D8) will be blinking.

The red and white LEDs are controlled by the color LED using the transistor (Q2). If you remove the color LED from the circuit then the other LEDs will not blink.

# Project 58

# Funny Speed Motor



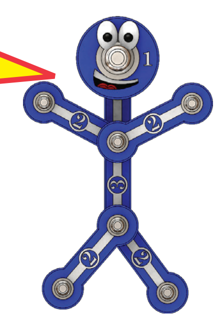
Build the circuit as shown and turn on the switch (S1). The color LED (D8) is blinking and the motor (M1) spins at different speeds. Try this circuit with the glow fan on the motor, and without the fan.

The motor is controlled by the color LED using the transistor (Q2). If you remove the color LED from the circuit then the motor will not spin.

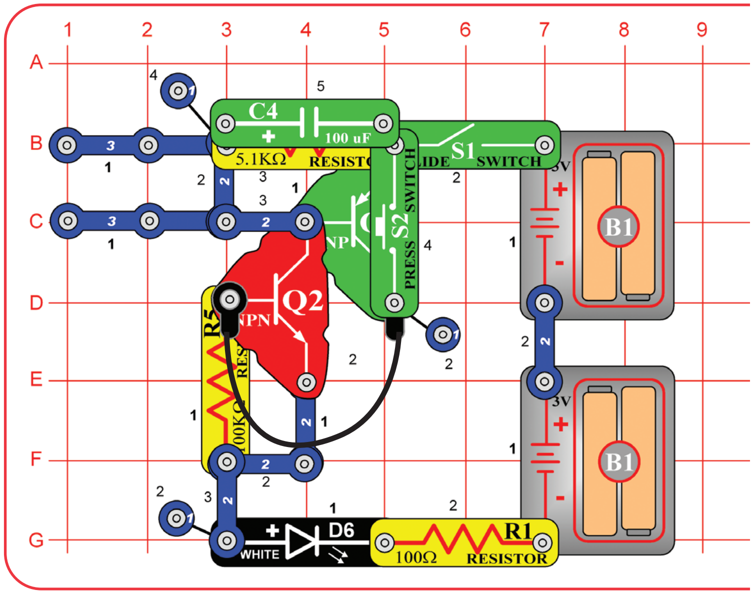
If desired add the red LED (D1) across points A & B ("+" to A). This adds another blinking light.

**WARNING:** Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

In this circuit the color LED is powered by one set of batteries, and the motor is powered by different set. This was done because the motor produces electrical pulses as it spins, and these pulses can confuse the color LED.



# Project 59




## Stuck On Light

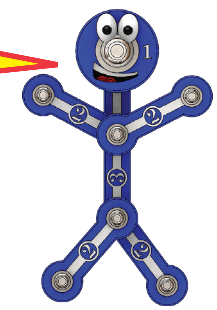
Build the circuit as shown, and note that several parts are stacked over others. Turn on the slide switch (S1); nothing happens.

Now push the press switch (S2); the white LED (D6) turns on and stays on. The white LED will stay on until you turn off the slide switch.

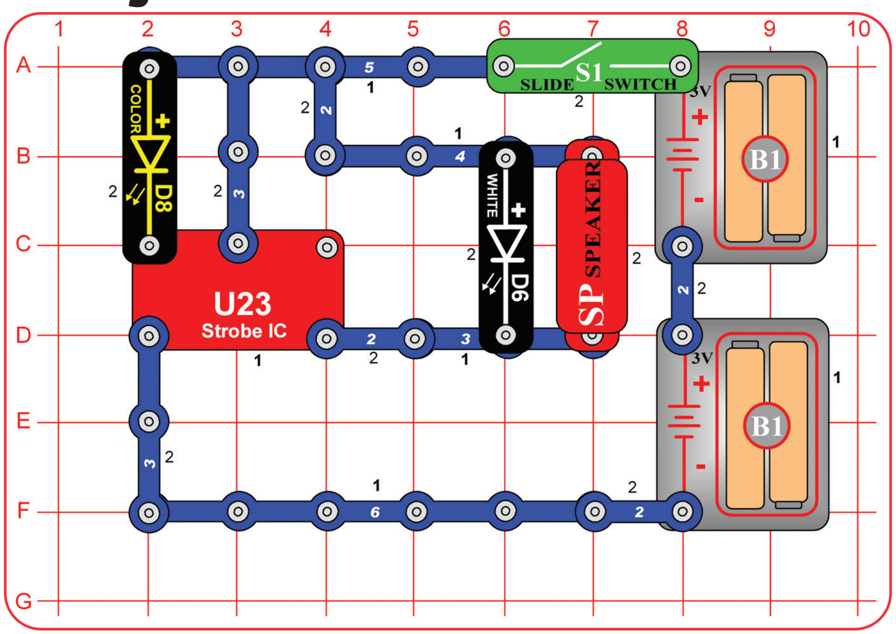
### Project 60 Stuck On Lights

Use the preceding circuit, but replace the 100Ω resistor (R1) with the color LED (D8) or the red LED (D1).

The two transistors act as an electronic device called an SCR (Silicon Controlled Rectifier). An SCR is a three-pin device that once its control pin is triggered, remains on until the current flow through it stops.



# Project 61




## Funky Light & Sound

Build the circuit as shown and turn on the switch (S1). The color LED (D8) is used to control the strobe IC (U23), producing unusual effects.

### Project 62 Light & Sound

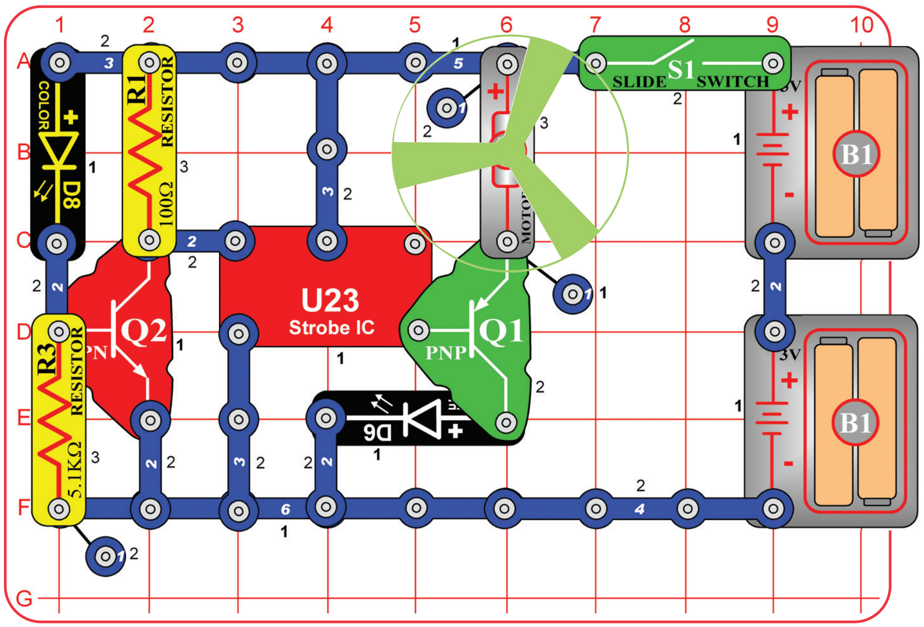
Use the preceding circuit, but replace the color LED (D8) with the 100kΩ resistor (R5) or the 5.1kΩ resistor (R3).

### Project 63 Light & Motion

Repeat projects 61 & 62 but replace the speaker with the motor (M1) and glow fan (motor "+" toward S1).

**WARNING:** Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

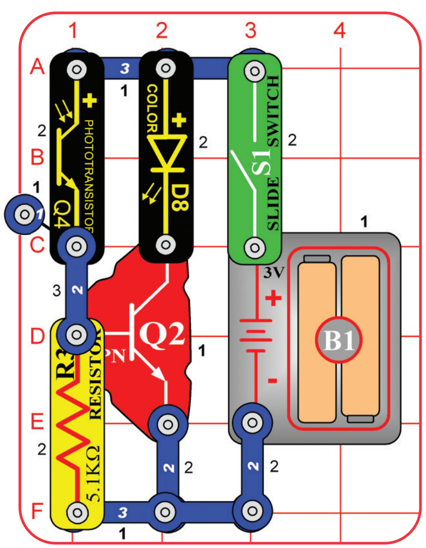
# ☐ Project 64 Blinking Step Motor




Build the circuit as shown and turn on the switch (S1). The color LED (D8) is used to control the strobe IC (U23), which turns on the motor (M1) in short bursts.

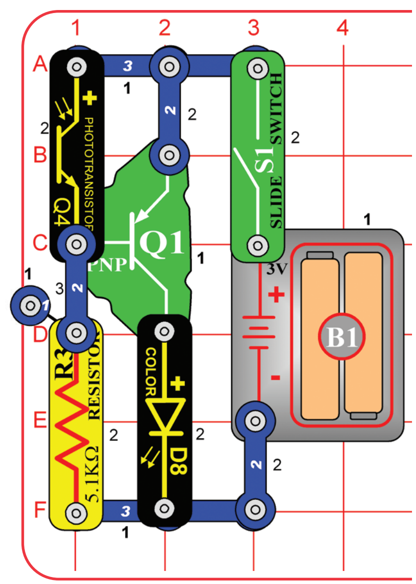
To have 3 LEDs, place the red LED (D1) directly over the white LED (D6).

# ☐ Project 65 Day Blinker




Build the circuit as shown and turn on the switch (S1). The color LED (D8) is on when there is light on the phototransistor (Q4). Shine light on or cover the phototransistor to turn the color LED on or off.

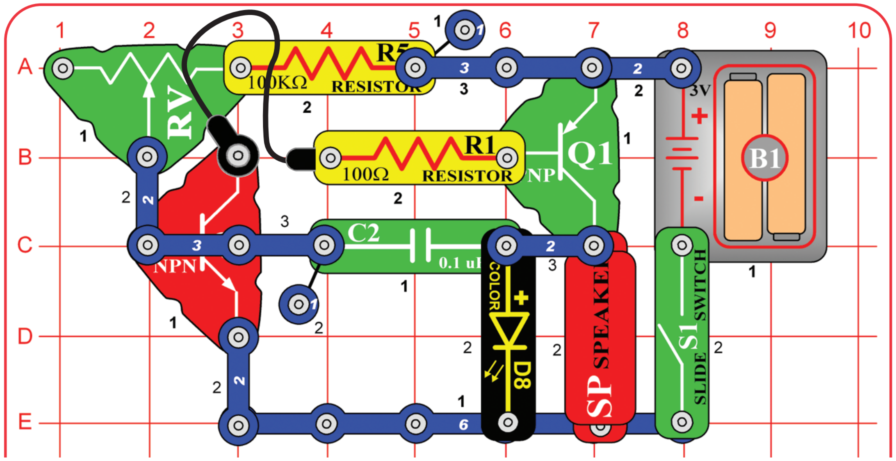
# ☐ Project 66 Night Blinker



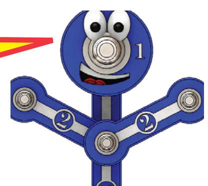

Build the circuit as shown and turn on the switch (S1). The color LED (D8) is off when there is light on the phototransistor (Q4). Cover or shine light on the phototransistor to turn the color LED on or off.

If the color LED comes on too easily, reduce the sensitivity by replacing the 5.1kΩ resistor (R3) with the 100kΩ resistor (R5).

# ☐ Project 67 — Buzzer




This circuit is an oscillator, which uses feedback to control the pitch of the sound.



Build the circuit as shown and turn on the switch (S1). Move the lever on the adjustable resistor (RV) to vary the pitch of the buzzing sound.

## ☐ Project 68 Higher Pitch Buzzer

Use the preceding circuit, but place the 5.1kΩ resistor directly over the 100kΩ resistor using a 1-snap. The pitch of the tone is higher now, but the circuit may not make noise on all settings for the adjustable resistor.

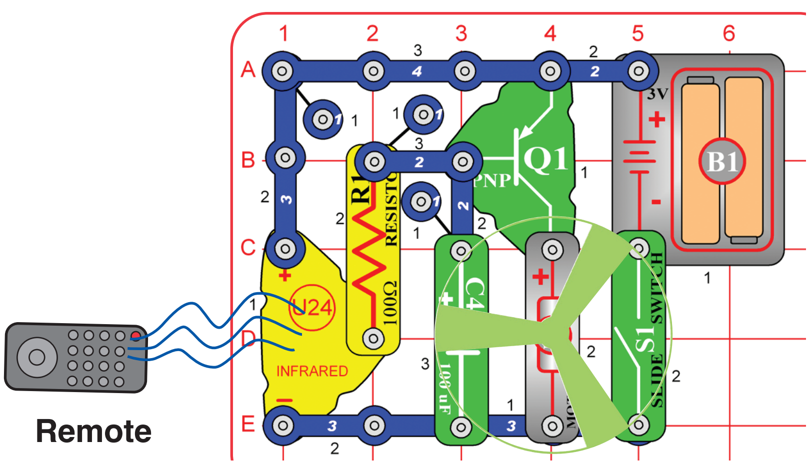
## ☐ Project 69 Photo Light & Motion

Use the circuits from projects 67-68, but add the phototransistor (Q4) across base grid locations B2-B4 (between RV and R1, "+" on the left), on level 3. Vary the amount of light on the phototransistor to change the sound, while also varying RV.

## ☐ Project 70 Slow Light & Motion

Use the circuits from projects 67-68, but replace the 0.1μF capacitor (C2) with the 100μF capacitor (C4), "+" to the right. Turn the switch on and patiently wait. The speaker will beep and the color LED (D8) will flash every 5-20 seconds, depending on the resistors.

# ☐ Project 71 — R/C Motor




You need an infrared remote control for this project, such as any TV/stereo/DVD remote control in your home.

Build the circuit and turn on the switch (S1). Point your remote control toward the infrared module (U24) and press any button to spin the motor (M1).

Next, remove the 100μF capacitor (C4). The circuit works the same, except now the motor moves in small steps.

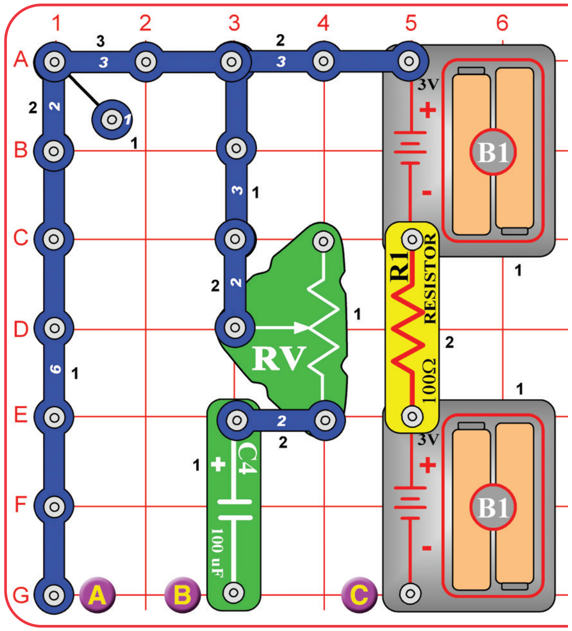
Sometimes this circuit may activate without a remote control, due to infrared in sunlight or some room lights. If this happens, try moving to a darker room.

**WARNING:** Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

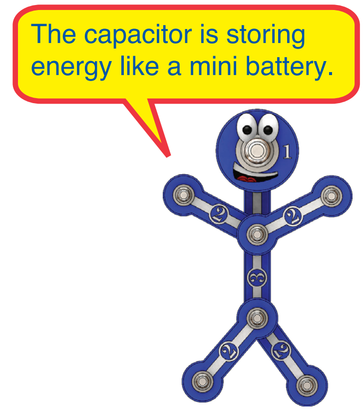
# ☐ Project 72

# Mini Battery

Build the circuit and set the lever on the adjustable resistor (RV) towards the 100µF capacitor (C4). Place the white LED (D6) across the points marked B & C; the LED lights briefly as the capacitor charges. Next, place the white LED across points A & B instead; now the LED lights briefly as the capacitor discharges. Move the white LED back to B & C and repeat. Use the lever on RV to vary the charge / discharge rate.



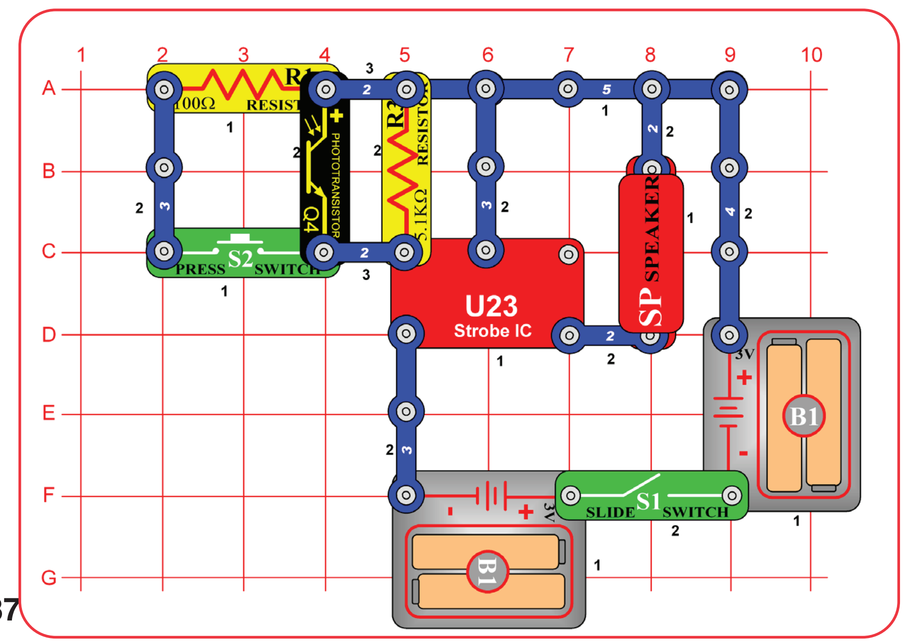




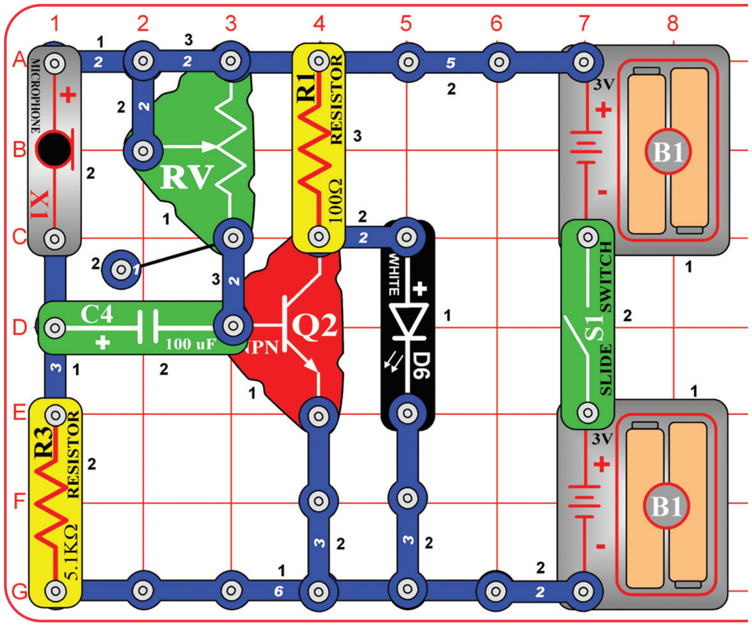

# ☐ Project 73

# Wacky Sound Control

Build the circuit and turn on the slide switch (S1). Vary the amount of light on the phototransistor (Q4) and push the press switch (S2) to change the sound.

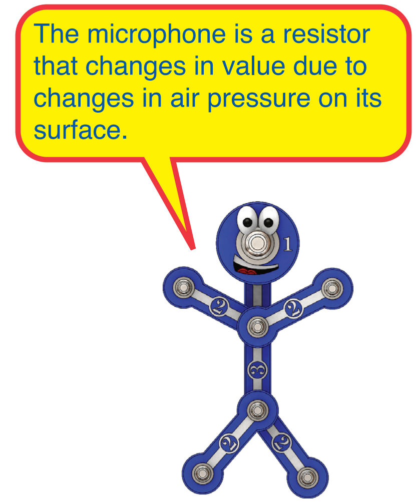


## ☐ Project 74

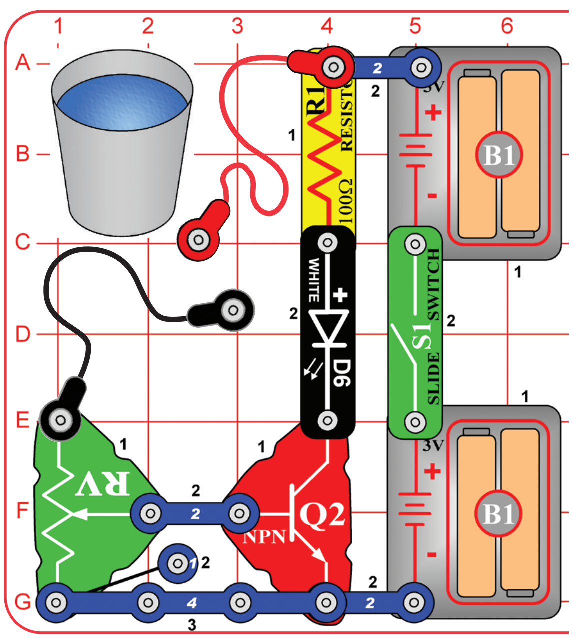



# Blow On the Light

Build the circuit and turn on the slide switch (S1). Set the lever on the adjustable resistor (RV) to the top. If the white LED (D6) is on, move the lever on RV until the LED just shuts off. Now blow on the microphone (X1) to turn the white LED on.




## ☐ Project 75




# Human & Liquid Light

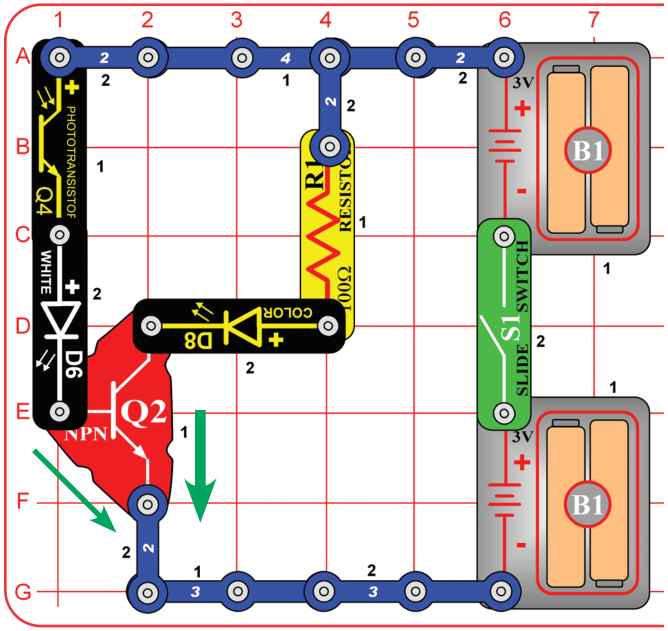
Build the circuit and turn on the switch (S1). Touch the metal in the jumper wire snaps with your fingers. Use the lever on the adjustable resistor (RV) to adjust the sensitivity of the circuit. You may see a difference in the light brightness just by pressing the contacts harder with your fingers.

Next, place the loose ends of the jumper wires in a cup of water, make sure the metal parts aren't touching each other. The water should change the light brightness. Readjust sensitivity using RV.

Now add salt to the water and stir to dissolve it. The light should be brighter, since salt water has less resistance than plain water. Readjust sensitivity using RV.

WARNING: Don't drink any water used here.

# Project 76




# Photo Current Amplifier

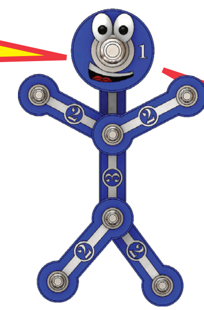
Build the circuit, turn on the switch (S1), and vary the amount of light on the phototransistor (Q4) using your hand. Compare the brightness of the white LED (D6) and color LED (D8).

Swap the locations of the white and color LEDs, and compare the brightness now.

## Project 77 LEDs & Transistors

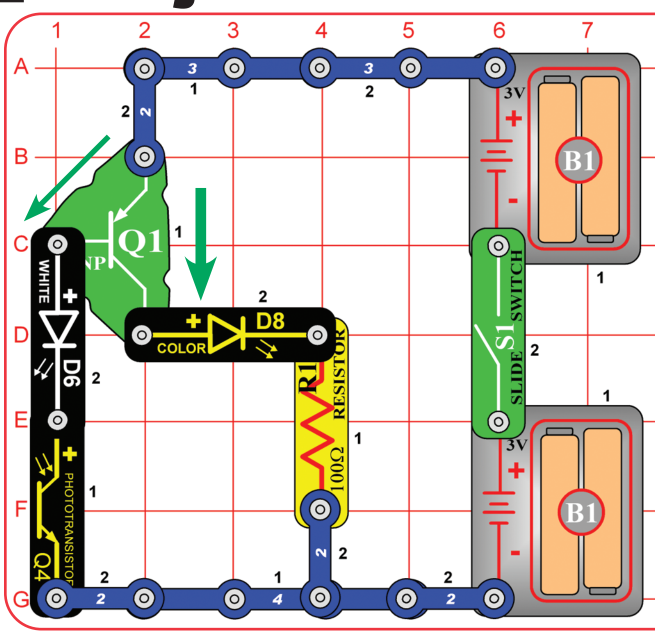
Use the preceding circuit but replace either LED (D6 or D8) with the red LED (D1). Compare all three LEDs, in both locations.

The NPN transistor (Q2) is a current amplifier. When a small current flows into Q2 through the left branch (through Q4), a larger current will flow into Q2 through the right branch (with R1). **Green arrows shown the current flow.** So the LED on the right side will be brighter than the LED on the left side. The current in the right branch might be 100 times larger than in the left branch.



LED brightness depends on the materials used, construction quality, and the current through it. The white LED is super-bright, the red LED is low-brightness, and the color LED is between the others.

# Project 78

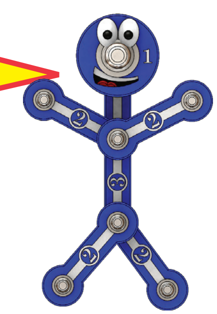



# PNP Amplifier

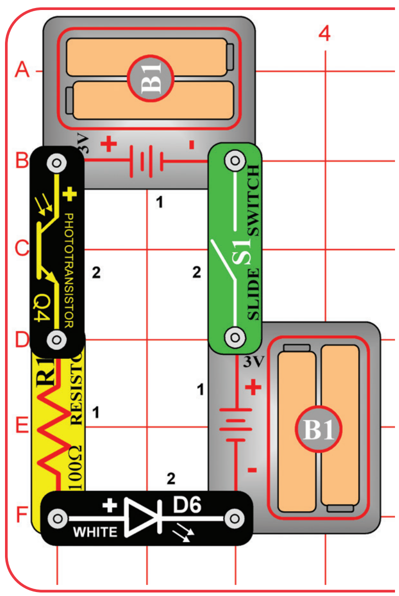
This circuit is just like the preceding one except it uses a different type of transistor. Build the circuit, turn on the switch (S1), and vary the amount of light on the phototransistor (Q4) using your hand. Compare the brightness of the white LED (D6) and color LED (D8).

Replace either LED (D6 or D8) with the red LED (D1). Compare all three LEDs, in both locations.

The PNP transistor (Q1) is just like the NPN transistor (Q2), except that the currents flow in opposite directions. **Green arrows shown the current flow.**



# ☐ Project 79
# Photo Light Control

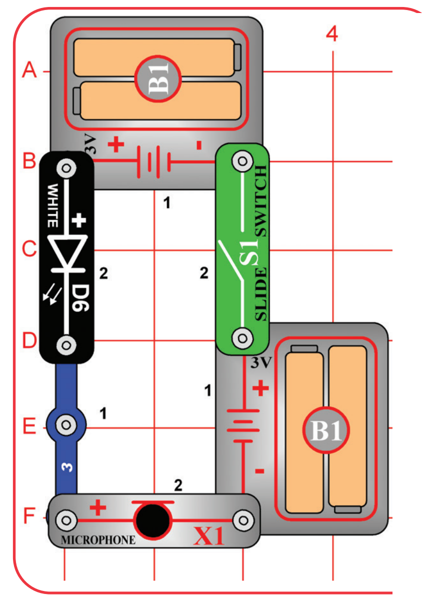



Turn on the switch (S1). Control the white LED (D6) brightness by varying the amount of light on the photo-transistor (Q4). Try holding the red, green, and blue filters over the phototransistor and see how they affect it.

Replace the white LED with the red LED (D1) or the color LED (D8) and compare them.

The phototransistor uses light to control electric current. As more light shines on the phototransistor, the current through it increases, making the LED brighter.

# ☐ Project 80
# Air Pressure Light Control

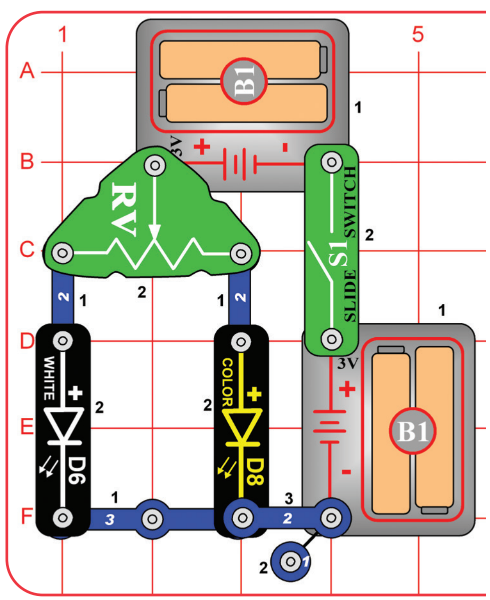



Blow on the microphone (X1). The white LED (D6) will flicker, because the resistance of the microphone changes when you blow on it.

Talking into the microphone also changes its resistance, but you will not be able to notice the difference here.

You can replace the white LED with the red LED (D1) or the color LED (D8), but they will not be very bright.

# ☐ Project 81
# Resistance Director



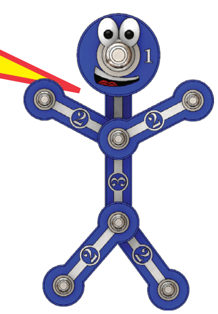

Move the lever on the adjustable resistor (RV) across its range and watch the brightness of the white and color LEDs (D6 & D8).

Replace either LED with the red LED (D1) and compare it too.

You can also replace one of the battery holders (B1) with a 3-snap wire, and compare the LED brightnesses at lower voltage.

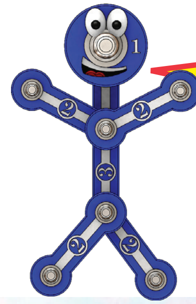
The adjustable resistor can be adjusted from about 200 ohms to about 50,000 ohms.

The white LED is a super-bright LED, so will be brighter than the others at comparable resistance.



# ☐ Project 82 3D Pictures

Look at the pictures here; they probably look blurry. Now place the red filter in front of your left eye and the blue filter in front of your right eye, and look at the pictures again. Now the pictures look clearer, and you can see them in three dimensions (3D).



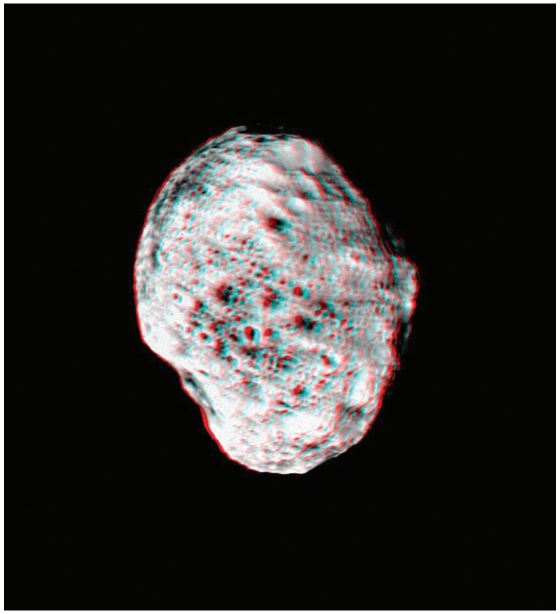
These pictures contain separate red & blue images, taken from slightly different viewpoints, combined together. When you view them through the red & blue filters, each eye sees only one image. Your brain combines the two images into the single picture that you "see", but the differences between the two images make the combined picture seem three-dimensional.

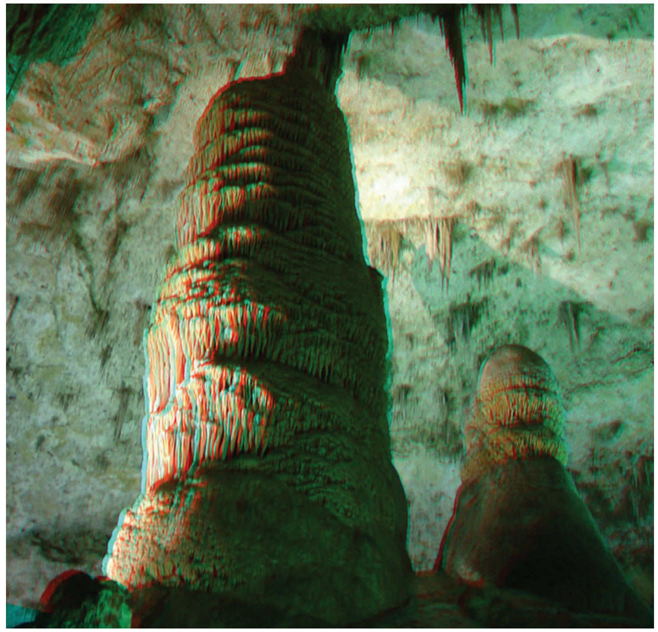
**How 3D works:**
Most people have two eyes, spaced about 2 inches apart. So each eye sees the world a little differently, and your brain uses the difference in views to calculate distance. For each object in view, the greater the difference between the two scenes, the closer it must be. If you close one eye, you will have a harder time judging distance – try catching a ball with just one eye! (Be sure to use a soft ball if you try playing catch with one eye.)

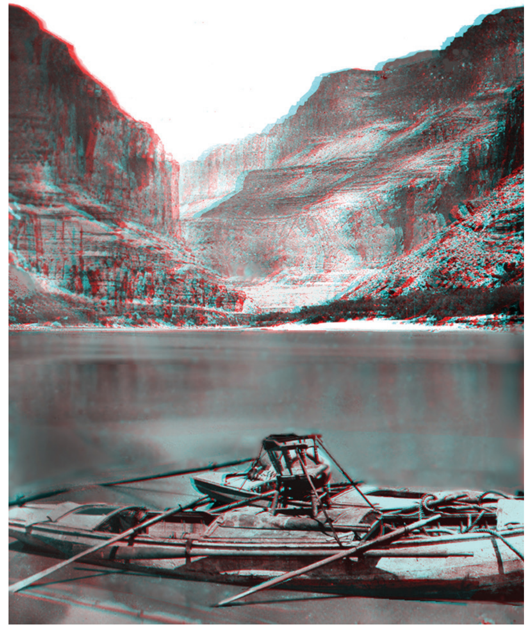
When you watch a 3D movie in a theater, you wear 3D glasses so that each eye will see a different image. The movie screen actually shows two images, and the glasses filter them so that only one image enters each eye. Most movie theaters use polarized images and glasses with polarized lenses, so that each eye sees a different image.

Another way to make 3D is using red & blue images, then view using glasses with red & blue filters, as you are doing in this project. Unfortunately this method does not give you the color quality that the polarization method has.

# 3D Pictures



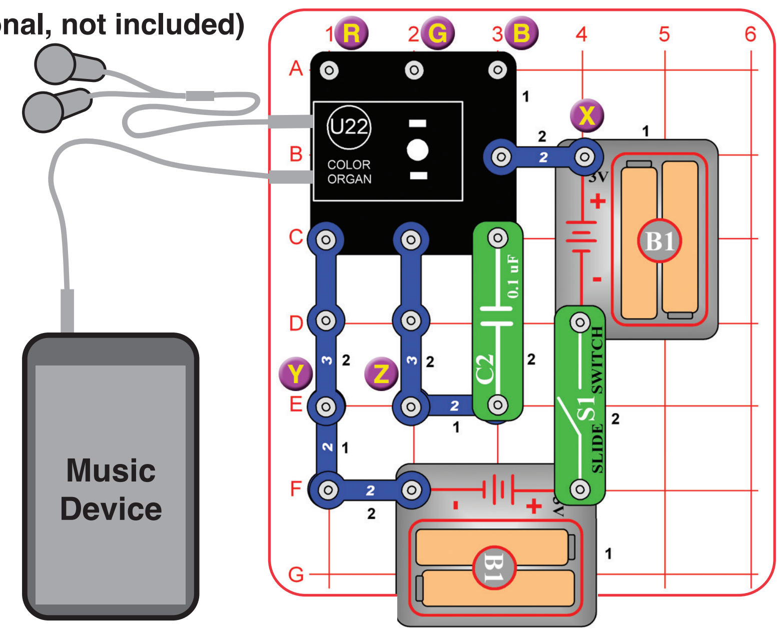




# ☐ Project 83

# Test the Color Organ

**Headphones & Device (Optional, not included)**




This project tests the features of the color organ (U22), and will be referenced by the Advanced Troubleshooting section on page 15.

A. Build the circuit, and turn on the switch (S1). The light on top of the color organ should be changing colors.

B. Remove the 0.1μF capacitor (C2), add a 2-snap across the points marked Y & Z, and reset the circuit by turning it off and on using the switch. Connect the red jumper wire between the point marked "X", and points marked "R", "G", or "B" in the drawing. Touching R should make the light red, G should make it green, and B should make it blue.

C. Remove the 2-snap that was added across points Y & Z. Connect a music device (not included) and headphones (optional, and not included) to the color organ as shown, and start music on it. Set the volume control on your music device so that the light on the color organ is changing (the light will not change if your volume is set too high or too low).

**Go to https://shop.elenco.com/consumers/snap-circuits-light.html to download projects 84-177 and *Bonus Projects 1-11!***

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**Important:** If any parts are missing or damaged, **DO NOT RETURN TO RETAILER**. Call toll-free at: (800) 533-2441 **or** e-mail us at: help@elenco.com.

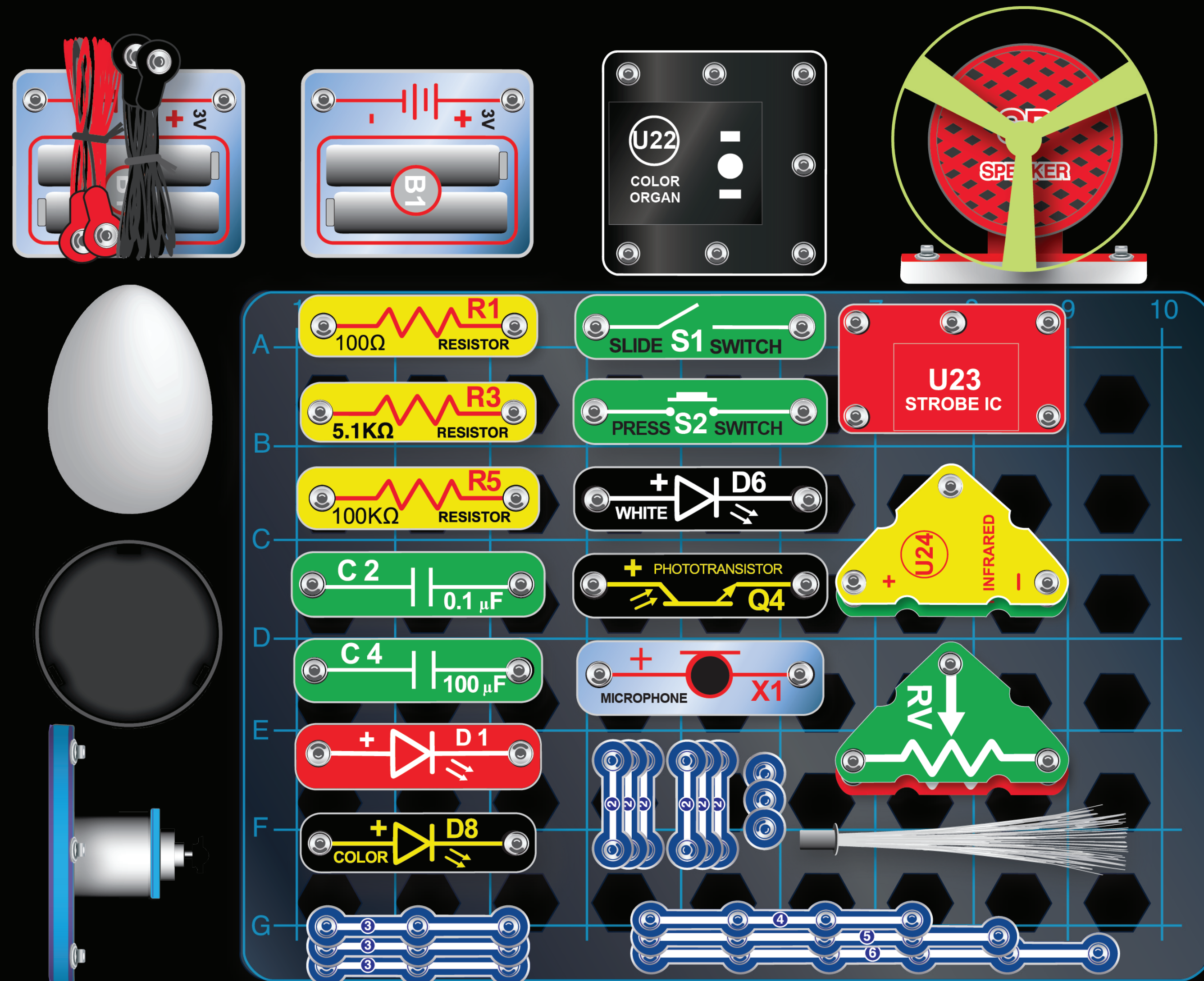
**Customer Service:** 150 Carpenter Ave. Wheeling, IL 60090 U.S.A.

**Note:** A complete parts list is on pages 2-3 in this manual.

Go to https://shop.elenco.com/consumers/snap-circuits-light.html to download projects 84-177 and ***Bonus Projects 1-11!***

# SCL-175 Snap Circuits® Light Parts Layout

1 Base Grid (7.7"x5.5") overlays some parts, and 6 other are below.



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