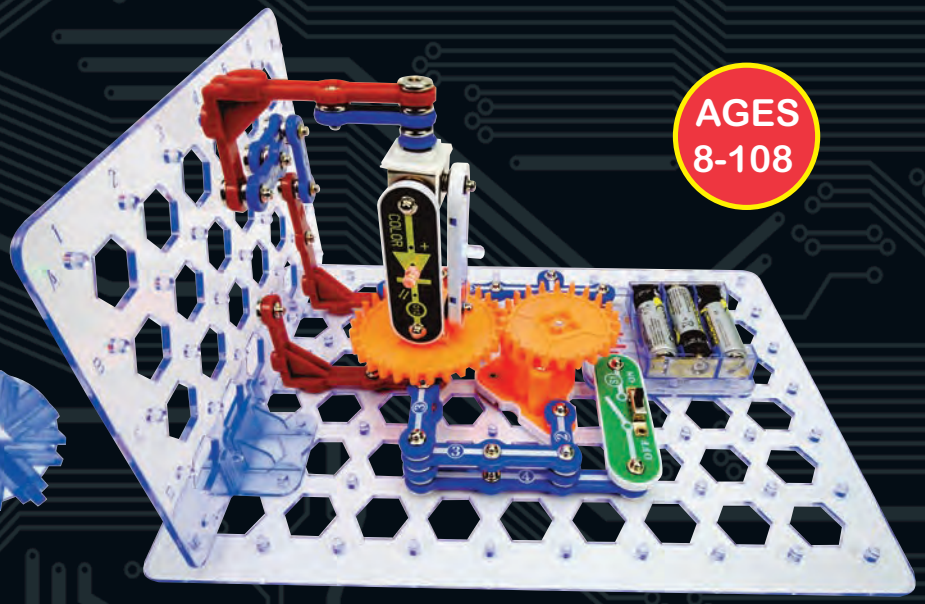
Snap Circuits 3D M.E.G.

Instruction Manual

MAGNETICS - ELECTRONICS - GEARS

Project 40



AGES 8-108

Project 36

Projects 1 - 163

753135

U.S. Patents: 7,144,255; 7,273,377, & patents pending

Table of Contents

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 U.S. government requirements and CAN ICES-3 (B)/NMB-3 (B).

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.

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 11 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.

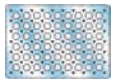
CAUTION: High intensity light. Do not look directly at the white LED (D6).

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 connect batteries or battery holders in parallel.
- Do not mix old and new batteries.
- 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

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	❒ 4		Base Grid Support		6SCBGSUP
❒ 6	2	2-Snap Wire		6SC02	❒ 1		Illusion Cards		6SCCARD1
❒ 3	3	3-Snap Wire		6SC03	❒ 1		Compass		6SCCOM
❒ 1	4	4-Snap Wire		6SC04	❒ 1	D9	Blue LED		6SCD9
❒ 1	5	5-Snap Wire		6SC05	❒ 1	D11	Blink Red LED		6SCD11
❒ 1	6	6-Snap Wire		6SC06	❒ 1	D12	Color2 LED		6SCD12
❒ 2		3D Snap		6SC3DSNAP	❒ 1		EGG		6SCEGG
❒ 1	B3	Battery Holder - uses three (3) 1.5V type “AA” (not Included)		6SCB3	❒ 1		Mounting Base		6SCFMB
❒ 1		Base Grid (11.0” x 7.7”)		6SCBG	❒ 1		Fiber Optic Festive Tree		6SCFT2
❒ 3		Base Grid Mini (7.7” x 5.5”)		6SCBGM	❒ 1		Small Gear (22T)		6SCGEAR5
❒ 1		Base Grid Mini 2-Side (7.7” x 5.5”)		6SCBGM2	❒ 1		Large Gear (30T)		6SCGEAR6

Parts List (Colors and styles may vary) Symbols and Numbers

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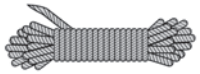
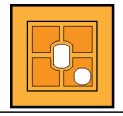
Qty.	ID	Name	Symbol	Part #	Qty.	ID	Name	Symbol	Part #
❒ 1		Jumper Wire (Black)		6SCJ1	❒ 1		Illusion Card Holder		6SCMBASE2
❒ 1		Jumper Wire (Red)		6SCJ2	❒ 1		Mirror Ball		6SCMIRBAL
❒ 2		Jumper Wire (Blue)		6SCJ4	❒ 1	S1	Slide Switch		6SCS1
❒ 1	L4	4.5V Lamp		6SCL4	❒ 1	S2	Press Switch		6SCS2
❒ 1		String		6SCM1S	❒ 1	S9	Reed Switch		6SCS9
❒ 1	M4	Clear Motor		6SCM4	❒ 1		Screw PM 3x8 mm		6SCSCREW3
❒ 1		Wind Fan		6SCM4B	❒ 6		Stabilizer		6SCSTAB
❒ 1	M9	Orange Motor		6SCM9	❒ 1	U32	Melody IC		6SCU32
❒ 1		Gear Insert		6SCM9B	❒ 4	V1	90° Vertical Snap Wire		6SCV1
❒ 1		Magnet		6SCMAGFF	❒ 2	V2	45° Vertical Snap Wire		6SCV2

You may order additional / replacement parts at our website: www.snapcircuits.net

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 slide switch, it is green and has the marking (S1) 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 (B3) and requires three (3) 1.5V "AA" batteries (not included).

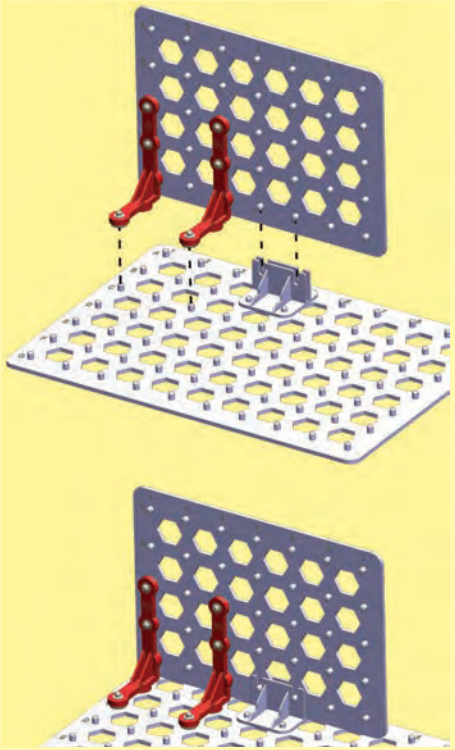
When installing a battery, be sure the spring is compressed straight back, and not bent up, down, or to one side.

One large and four smaller clear plastic base grids are 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 large base has rows labeled A-G and columns labeled 1-10, and the small base has rows labeled A-E and columns labeled 1-7. It should be obvious whether to use a small base grid or a large base grid. For small circuits that only need one grid, either size may be used.

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.

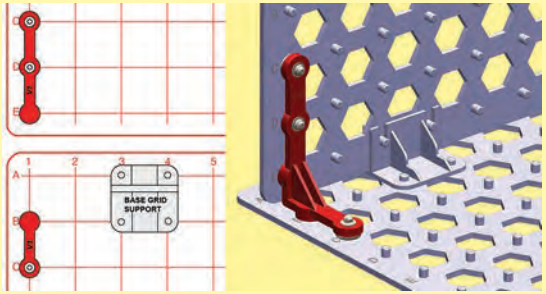
Some circuits use the jumper wires to make unusual connections. Just clip them to the metal snaps or as indicated.

When assembling the 3D circuits, the order in which parts are installed is important. In particular, the vertical snap wires (V1) need to be snapped onto the mini base grid first and then the mini base grid is slid into the base grid support as shown below. One of the small grids has pegs on both sides and six thru-snaps. Some projects will indicate that this grid must be (or must not be) used in a specific location, otherwise it may be used interchangeably with the other small grids.

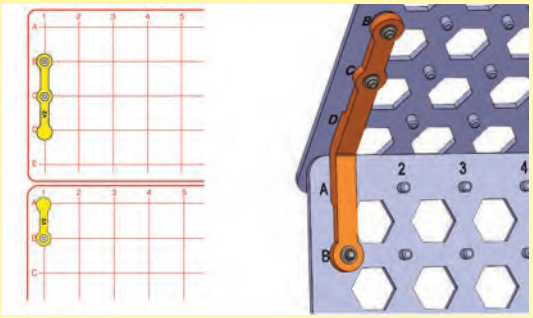


How to Use Snap Circuits®

Due to the complex nature of building 3D circuits, the circuit diagrams use special symbols that may need additional clarification. One such example is the symbol for the vertical snap wire (V1). It consists of two parts, the horizontal base and vertical stem. In the illustration below, the base is attached to the large base grid and the stem is attached to the mini base grid. The symbol makes V1 appear as two separate parts, but in reality the symbol is connected at the red circular ends.



The 45 degree vertical snap wire (V2) is similar to V1 but mounts at a 45 degree angle

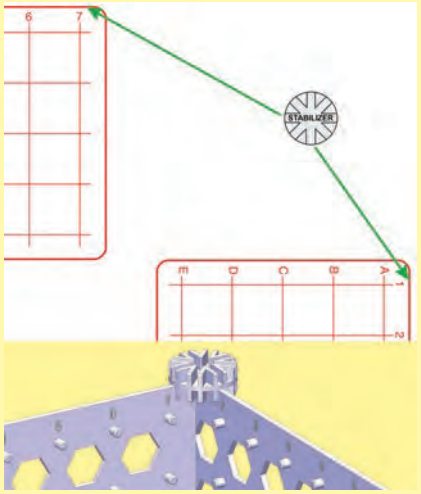


Another symbol of note is the base grid support. It is important to pay attention to the orientation of the part in the diagram since it is not symmetrical. The figure below shows the symbol with the narrow channel on top. This corresponds to the 3D rendering showing the base grid support orientation.

When inserting the base grid into the base grid support, it is a good idea to insert an area on the base grid that doesn't have raised letters or numbers. The raised text can interfere with the insertion or cause a tight fit between the base grid and base grid support.

To install the base grid support onto the base grid, align the holes of the support with the base grid pegs in the desired location on the base grid and press down firmly on the base grid support. Make sure that the base grid support is fully seated on the base grid.

The stabilizer is used to connect base grids on their corners or edges. With eight slots, the

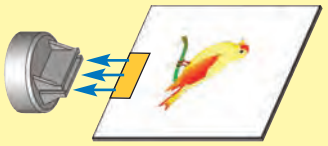


Note: Go to: **www.snapcircuits.net/sc3dmeg** for interactive 3D pictures to help with building the 3D circuits.

desired grooves in the stabilizer with the edges of the base grids and press down. The figure below shows how the stabilizer symbol is presented in the manual and the 3D rendering of the stabilizer mounted to two base grids.

Some projects use the illusion cards. Separate them (if they came together), push one into the Illusion card holder.

If at any point the illusion cards become to loose to stay in the card holder you can add a small strip of paper to insure the card fits snug in the holder.



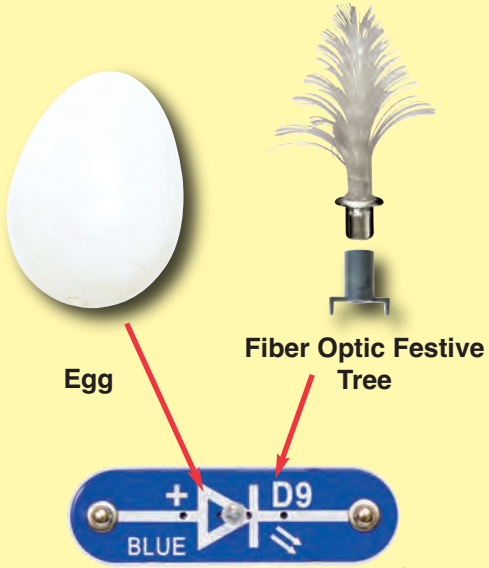
Then push the holder onto the shaft of the clear motor (M4).

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.

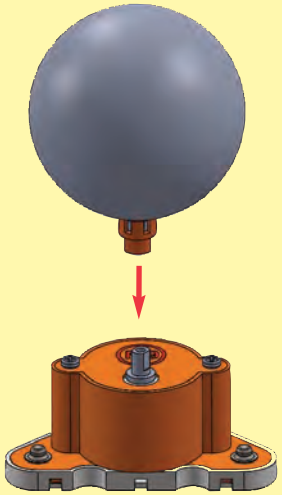
How to Use Snap Circuits®

The clear motor (M4) will often have the wind fan mounted on it; simply push the fan onto the shaft. To remove it, push up on it with a screwdriver or your thumbs, being careful not to break it.

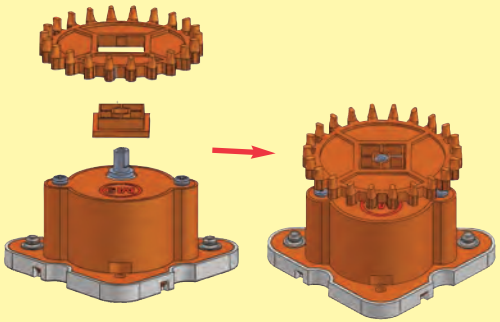
This set contains three LED attachments, which can be mounted on the LED modules (D9, D11, and D12) to enhance their light effects. The egg attachment is mounted directly on the LEDs, but the fiber optic festive tree must be mounted using the mounting base, as shown. This is described in the projects.



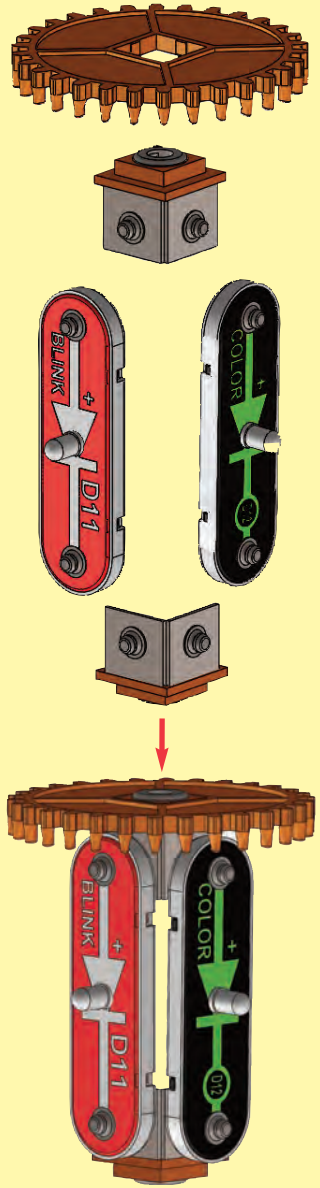
In some projects the mirror ball is placed on the orange motor (M9).



In some projects a gear is mounted on the orange motor using the gear insert.---



In some projects one or two components are attached to a gear using the 3D snaps

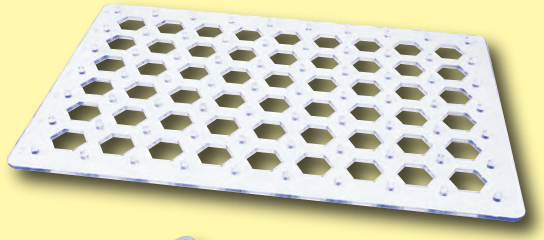


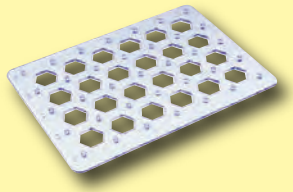
About Your Snap Circuits® Parts

(Part designs are subject to change without notice).

BASE GRID

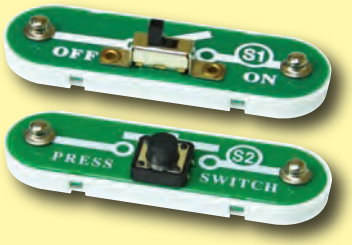
The **base grids** are platforms for mounting parts and wires. They function like the printed circuit boards used in most electronic products, or like how the walls are used for mounting the electrical wiring in your home. This set has two sizes, which can be placed together to form larger grids. One of the small grids has pegs on both sides and 6 thru-snaps, to allow assembly of circuits on both sides.





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.

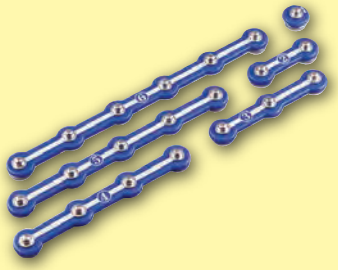


Slide & Press Switches (S1 & S2)

The **reed switch (S9)** is an electrical switch that can be controlled by a magnet. It has two metal contacts close together. The magnetic field from the magnet makes the contacts come together, completing a circuit just like other switches do.

REED SWITCH (S9)

SNAP WIRES, VERTICAL 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 **vertical snap wires (V1)** and **45 degree vertical snap wires (V2)** make connections between two dimensions, allowing electricity to go up a wall.

The **jumper wires** (red, black, & blue) 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 (B3)** 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 (B3)

About Your Snap Circuits® Parts

SOUND MODULE

The **melody IC (U32)** contains a specialized sound-generation integrated circuit (IC), a small speaker, and a few supporting components. The IC has a recording of the melody, which it makes into an electrical signal for the speaker. The speaker converts the signal into mechanical vibrations. The vibrations create variations in air pressure, which travel across the room. You "hear" sound when your ears feel these air pressure variations.

LAMP

A light bulb, such as in the **4.5V lamp (L4)**, contains a special thin high-resistance wire. When a lot of electricity flows through, this wire gets so hot it glows bright. Voltages above the bulb's rating can burn out the wire.

LEDs

The **blue, blink red, and color2 LEDs (D9, D11 & D12)** 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 brightness then increases. The blink red LED contains a microcircuit that turns it on and off. The color2 LED contains red, green, and blue LEDs, with a micro-circuit controlling them. A high current will burn out an LED, so the current must be limited by other components in the circuit (Snap Circuits® LEDs have internal resistors added, to protect them in case you make wiring mistakes). LEDs block electricity in the "reverse" direction.

MOTORS

The **clear motor (M4)** converts electricity into mechanical motion. An electric current through the motor will turn the shaft. It can also be used as a generator, since it produces an electric current when the shaft is turned.

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 are several coils of wire with many loops. If a large electric current flows through the loops, the magnetic effects become concentrated enough to move the coils. The motor has a magnet inside, so as the electricity moves the coils to align them with the permanent magnet, the shaft spins.

The **orange motor (M9)** is a motor with a built-in gearbox. The gearbox makes the shaft spin slower but with greater force. Do not try to spin its shaft manually to generate electricity because you may break it. The middle snap is only used for mechanical stability.

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).

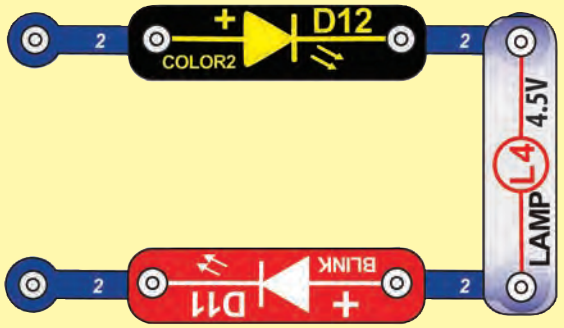
The "**power**" of electricity is a measure of how fast energy is moving through a wire. It is a combination of the voltage and current (Power = Voltage x Current). It is expressed in **watts** (W).

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).

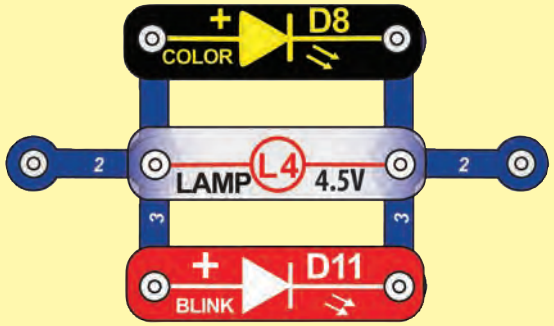
Nearly all of the electricity used in our world is produced at enormous generators driven by steam or water pressure. Wires are used to efficiently transport this energy to homes and businesses where it is used. Motors convert the electricity back into mechanical form to drive machinery and appliances. 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; lowest 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.

DOs 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 motor, melody IC, or LED (which has an internal protection resistor), 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 below) as this will damage components and/or quickly drain your batteries. **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 a motor, melody IC, or an LED (which has an internal protection resistor).

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

ALWAYS check your wiring before turning on a circuit.

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

NEVER leave a circuit unattended when it is turned on.

NEVER try to turn the shaft of the orange motor (M9) by hand or with tools, as this may break it.

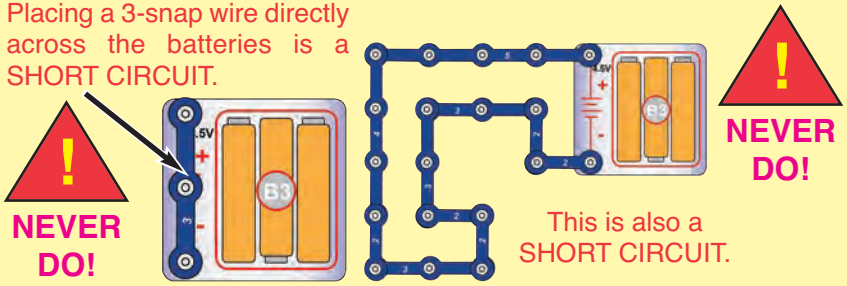
For all of the projects given in this book, the parts may be arranged in different ways without changing the circuit. For example, the order of parts connected in series or in parallel does not matter — what matters is how combinations of these sub-circuits are arranged together.

3D Construction: Motors or other parts that produce motion (which you may have from other snap Circuits® sets) should only be mounted overhead or on walls with great care, as the vibrations they produce could cause them to fall. The circuits in this set have been checked with the parts shown in them.

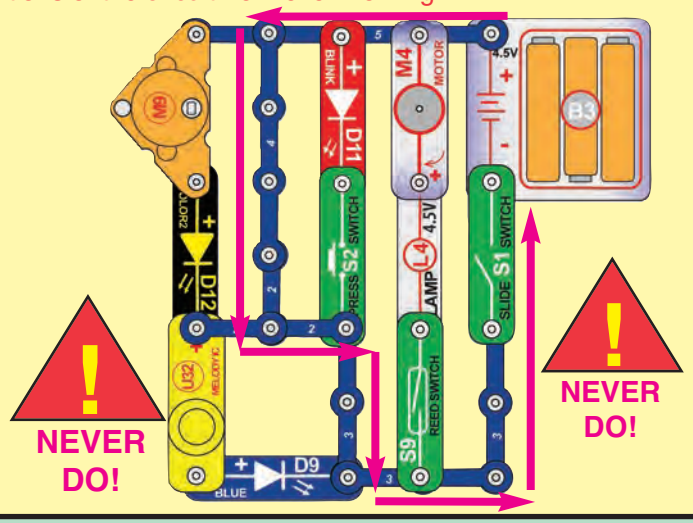
Warning to Snap Circuits® owners: Do not connect additional voltage sources from other sets, or you may damage your parts. Contact ELENCO® if you have questions or need guidance.

Examples of SHORT CIRCUITS - NEVER DO THESE!!!

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



You are encouraged to tell us about new programs and circuits you create. If they are unique, we will post them with your name and state on our website at: **www.snapcircuits.net/learning_center/kids_creation**. Send your suggestions to ELENCO®: **elenco@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.snapcircuits.net/learning_center/kids_creation** or through the **www.snapcircuits.net** website.

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

Advanced Troubleshooting (Adult supervision recommended)

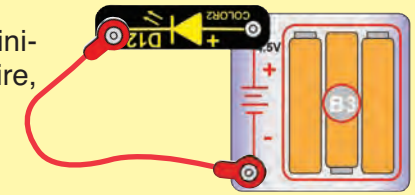
Elenco® is not responsible for parts damaged due to incorrect wiring.

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

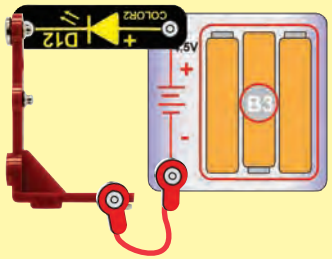
1. **Lamp (L4), blue LED (D9), blink red LED (D11), color2 LED (D12), melody IC (U32), and battery holder (B3):** Place batteries in holder. Place the lamp directly across the battery holder, it should light. Place the LEDs (D9, D11, & D12) directly across the battery holder one at a time (LED + to battery +), the LED should light (D11 should be blinking, and D12 should slowly change colors). Place the melody IC directly across the battery holder (+ to +), it should play a tune. If none work, then replace your batteries and repeat, if still bad then the battery holder is damaged.

2. **Clear motor (M4) and orange motor (M9):** Place the clear motor directly across the battery holder, the shaft should spin (you can place the green fan on the shaft so the spinning is easy to see). Place the orange motor directly across the battery holder (note that the middle snap on the motor is not used), the shaft should spin.

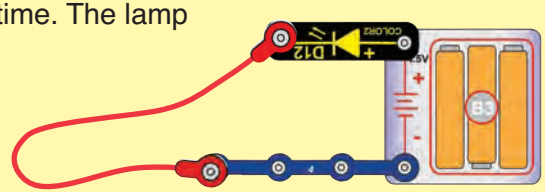
3. **Jumper wires:** Use this mini-circuit to test each jumper wire, the lamp should light.



4. **Vertical snap wires (V1) and 45 degree vertical snap wires (V2):** Use this mini-circuit to test each of the vertical snap wires (V1 & V2), one at a time. The lamp should light.



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



6. **Slide switch (S1), press switch (S2), and reed switch (S9):** Build project 1; if the color2 LED (D12) doesn't light then the slide switch is bad. Replace the slide switch with the press switch to test it. Replace the press switch with the reed switch and hold the magnet near it to test it, there should be a magnet position that turns on the LED, or the reed switch is bad.

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Project Listings

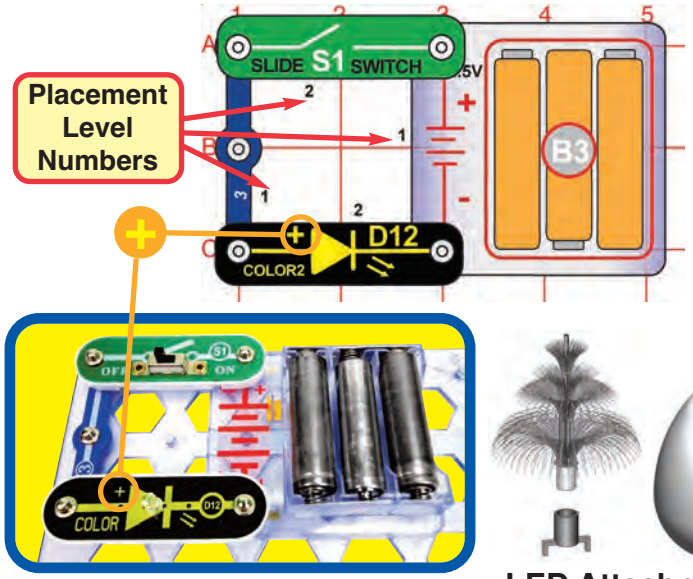
Project Listings

Project 1 Color Light

Snap Circuits® uses electronic blocks that snap onto a clear plastic base grid to build different circuits. These blocks have different colors and numbers on them so you can easily identify them. This set contains both large (11" x 7.7") and small (7.7" x 5.5") base grids; you may use either size for this small circuit.

Build the circuit shown on the left by placing all the parts with a black **1** next to them on the base grid first. Then, assemble parts marked with a **2**. Install three (3) "AA" batteries (not included) into the battery holder (B3) if you have not done so already; be sure the battery springs are compressed straight back, and not bent up, down, or to one side.

Turn on the slide switch (S1), and enjoy the light show from the color2 LED (D12). For best effects, place one of the LED attachments (fiber optic festive tree or egg), and dim the room lights. The fiber optic festive tree must be used with its mounting base.



LED Attachments

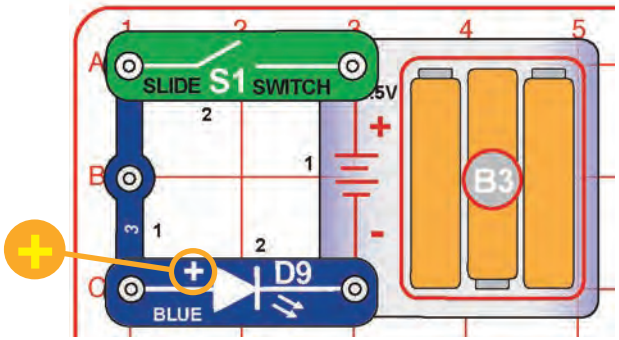
NOTE: this circuit (and many others in this book) have an LED being used without a resistor or other component to limit the electric current through it. Normally this could damage an LED but your Snap Circuits® LEDs include internal protection resistors, and will not be damaged. Be careful if you later use other electrical sets with unprotected LEDs.The festive tree and egg may also be used with other Snap Circuits® LEDs from different sets.

Snappy says when you turn on the slide switch, electricity flows from the batteries, through the color LED and back to the battery through the switch. If the switch is off, the flow of electricity is blocked, and the color2 LED won't light.

LEDs are light emitting diodes, which convert electrical energy into light. The color of the light depends on the characteristics of the material used in them. The color2 LED actually contains separate red, green, and blue lights, with a micro-circuit controlling them; the colors can be combined to produce yellow, cyan, purple, and white.

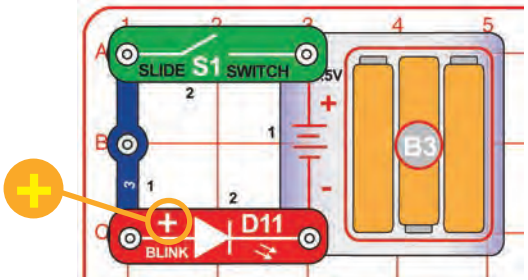
Project 2 Blue Light

Modify the preceding circuit by replacing the color2 LED (D12) with the blue LED (D9), as shown. The blue LED is brighter, but does not change colors.



Project 3 Red Light

Modify the preceding circuit by replacing the blue LED (D9) with the blink red LED (D11), as shown. The blink red LED flashes about once a second.



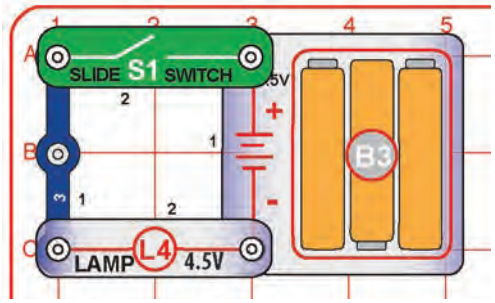
Project 4

Lamp Light

Modify the preceding circuit to be this one. Turn on the slide switch (S1) to light the lamp (L4).

The lamp (L4) converts electricity into light. It is an incandescent light bulb, just like other incandescent bulbs in homes except smaller. In an incandescent bulb electricity heats up a high-resistance wire until it glows, producing light. Incandescent light bulbs are very inefficient, converting less than 5% of the electricity used into light, with the rest becoming heat.

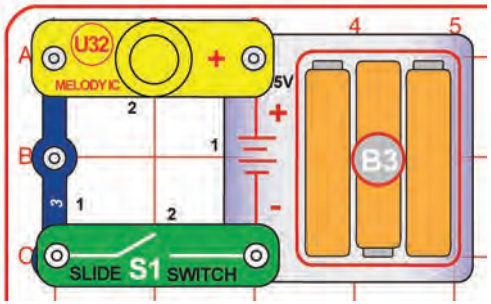
LEDs are much more efficient than incandescent light bulbs, and are increasingly being used for home lighting and flashlights.



Project 5

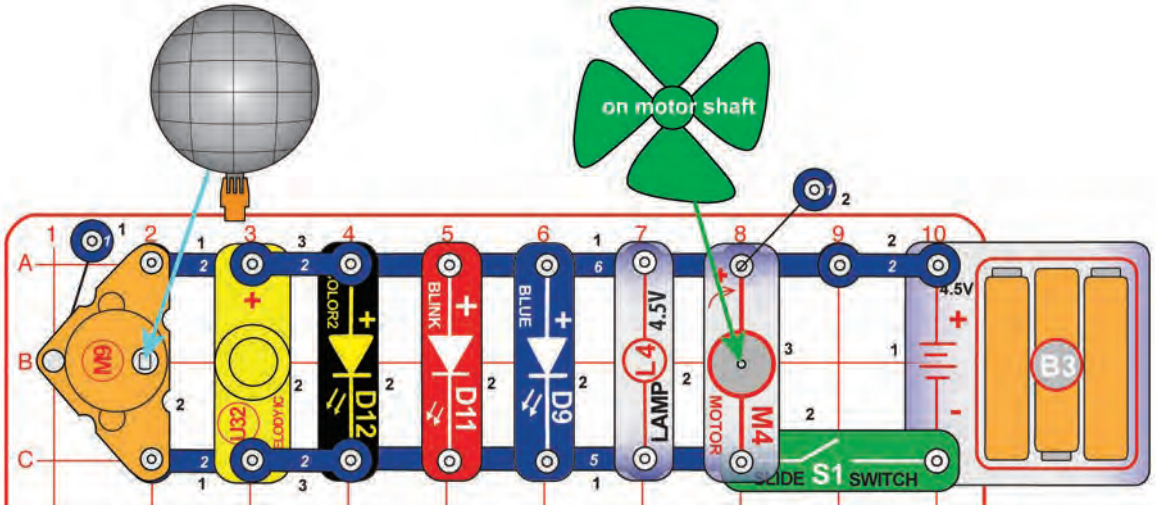
Play a Melody

Build this circuit, then turn on the slide switch (S1) to play a melody with the melody IC (U32).



Project 6

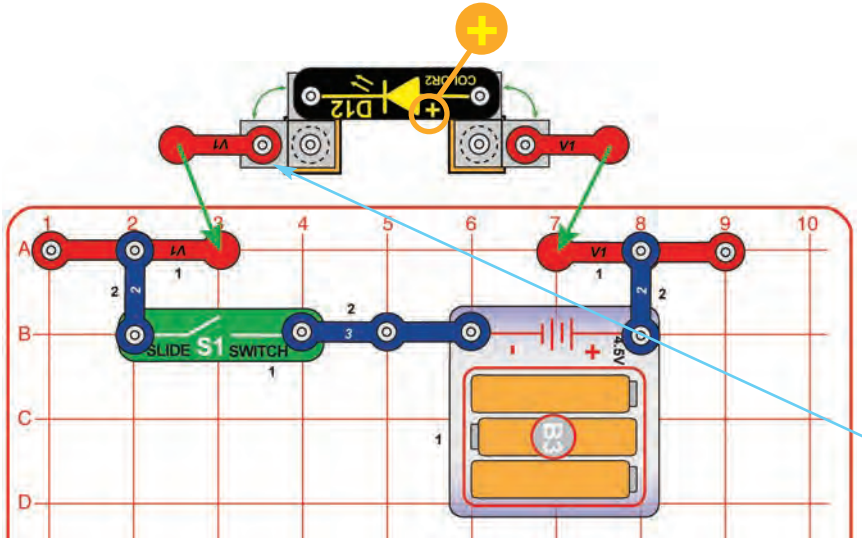
Fun Seven



This circuit has four lights, 2 motors, and music. Lights, sound, & motions!

Build the circuit shown, and place the fiber optic festive tree in its mounting base and on the blink red LED (D11). Turn on the slide switch (S1) and enjoy the show.

Project 7 Rotation Light

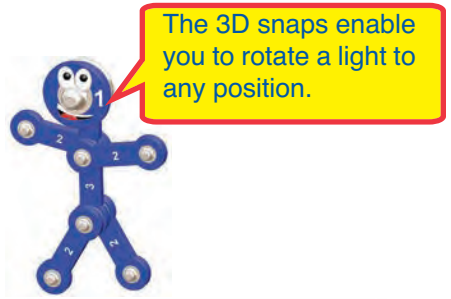


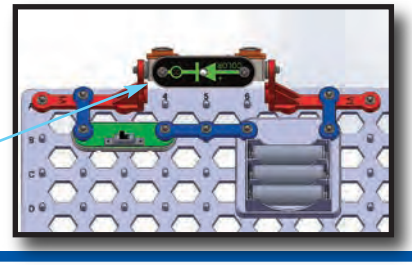
Build the circuit as shown; it has two 3D snaps mounted on two 90 degree vertical snap wires (V1), and then the color2 LED (D12) is mounted on the 3D snaps.

Turn on the circuit and the color2 LED lights. Rotate the LED to any position.

You can replace the color2 LED with the blue LED (D9), blink red LED (D11), or lamp (L4).

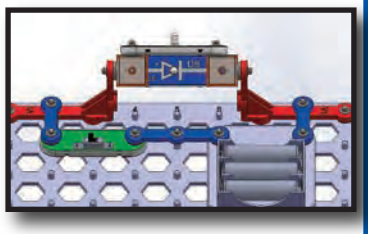
Note: if the LED assembly fit seems loose, add a 1-snap wire between one of the 3D snaps and a V1.





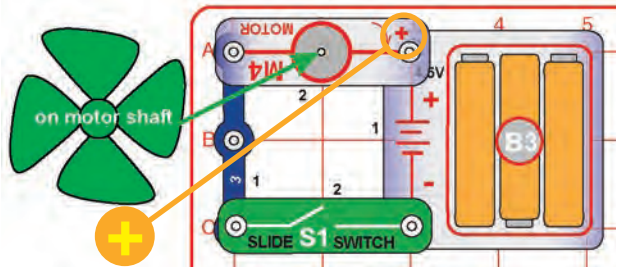
Project 8 Rotation Lights

Use the preceding circuit but add a second light (blue LED (D9), blink red LED (D11), or lamp (L4)) to the female snaps on the 3D snaps, as shown. The "+" side of the LEDs should be oriented to the right.



Project 9 Fan

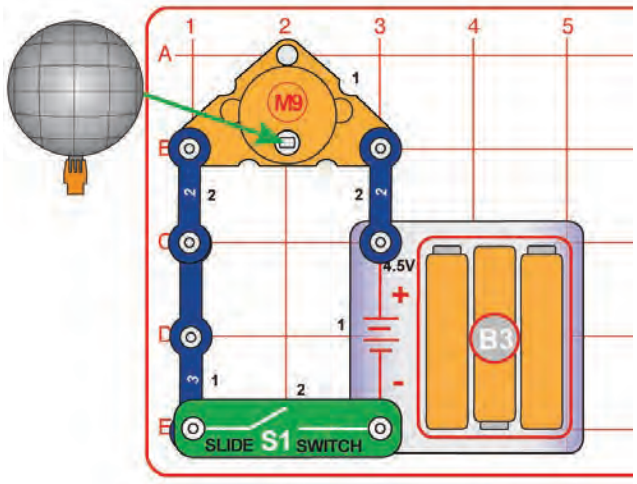
Build the circuit and place the wind fan on the clear motor (M4). Turn on the slide switch (S1) to spin the fan. Place your hand near the fan without touching it, and you can feel air being blown up towards you.



Project 10 Suction Fan

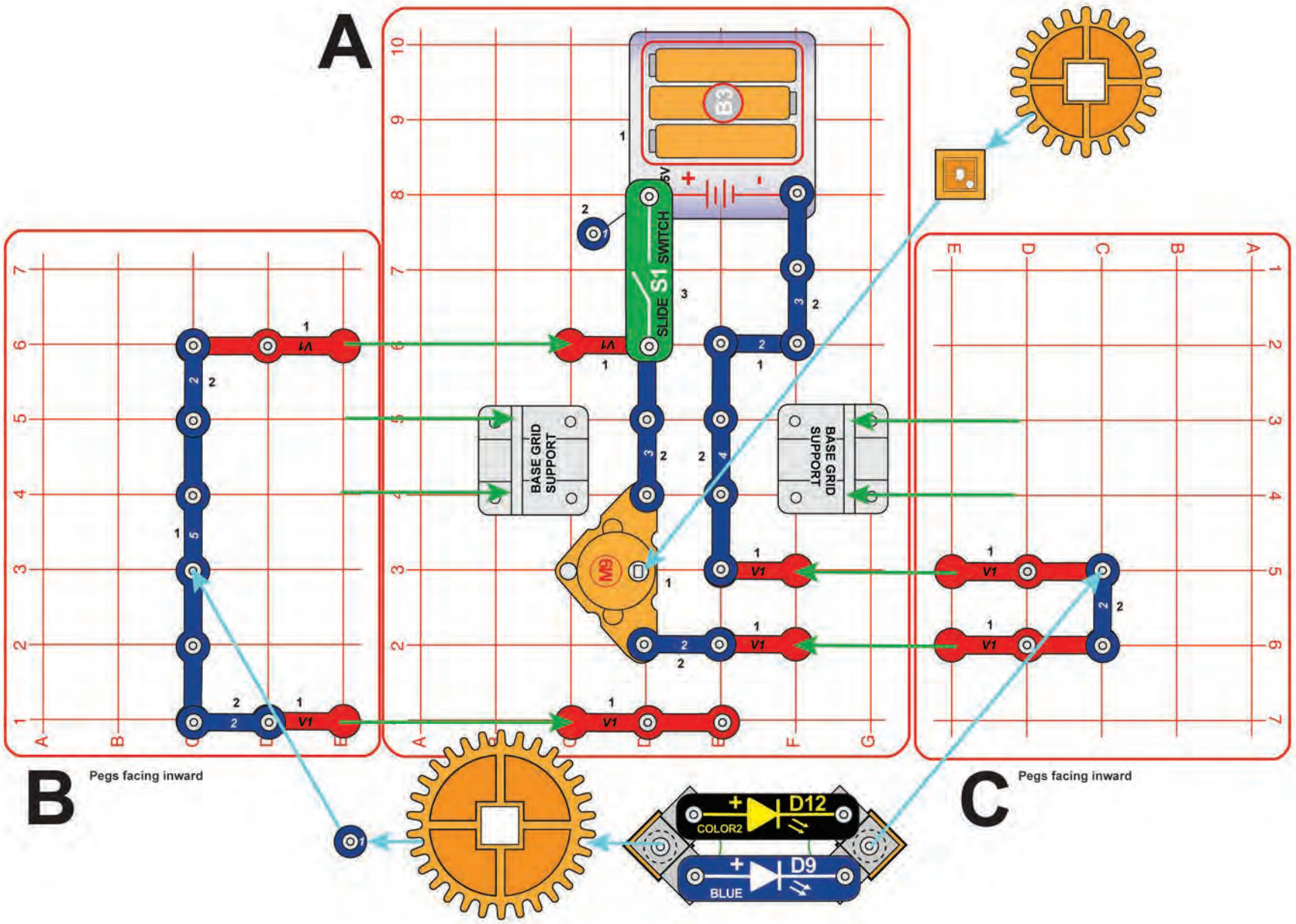
Use the preceding circuit but reverse the clear motor (M4). Now the fan sucks air downward.

Project 11 Mirror Ball



Build the circuit and place the mirror ball on the orange motor (M9). Turn on the slide switch (S1) to spin the mirror ball.

Project 12 Spinning Horizontal Lights



Assembly (adult supervision recommended):

1. Place base grid supports and orange motor (M9) on base grid A. Place the small gear on the gear insert and mount on the orange motor. The teeth on the gear should face up.

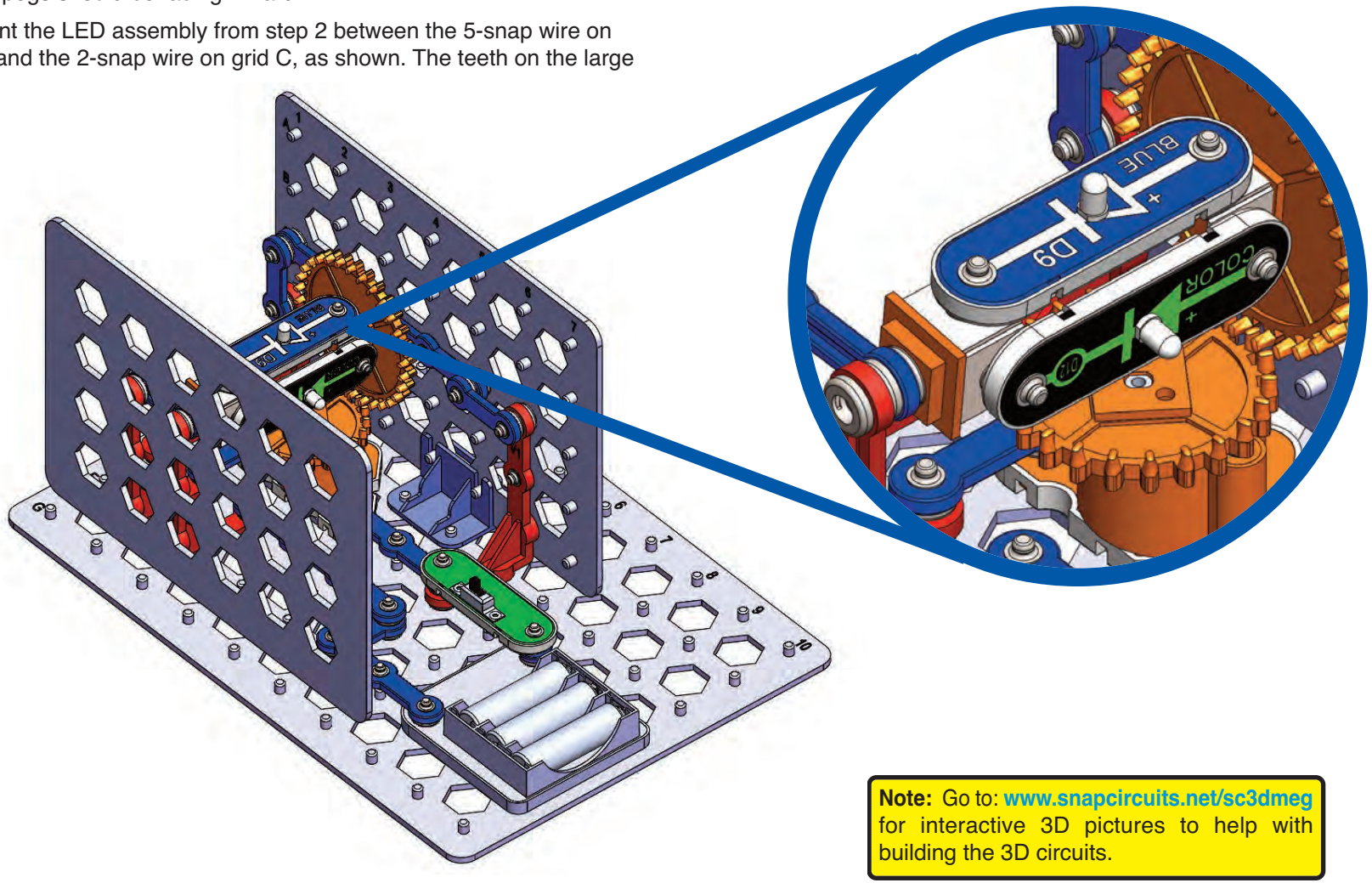
2. Mount the blue & color2 LEDs (D9 & D12) to the 3D snaps, and attach the large gear and a 1-snap wire, as shown. The teeth on the gear should face the LEDs, and the "+" side of the LEDs should be towards the gear.

3. Mount parts on grids B & C, and install in base grid supports in grid A. The pegs should be facing inward.

4. Mount the LED assembly from step 2 between the 5-snap wire on grid B and the 2-snap wire on grid C, as shown. The teeth on the large and small gears should align.

5. Place remaining parts on grid A.

Turn on the slide switch (S1). The color2 and blue LEDs should light, and be rotated by the gears.
Note: If the gears do not rotate properly, you may get better performance if you spread the tops of the mini base grids apart. You can do this by adding another base grid as a "roof" and securing with 4 stabilizers, as done in project 20.



Note: Go to: **www.snapcircuits.net/sc3dmeg** for interactive 3D pictures to help with building the 3D circuits.

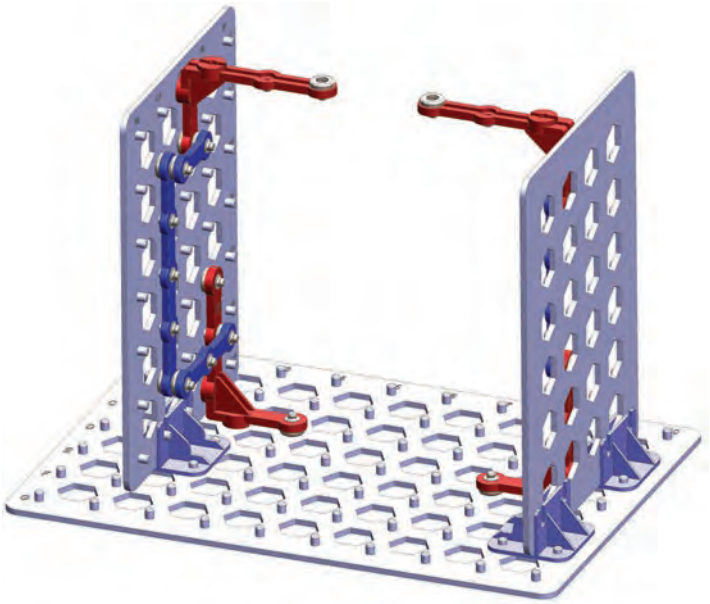
☐ Project 13 Ceiling Light

Think of this circuit as a room with a ceiling light fixture.

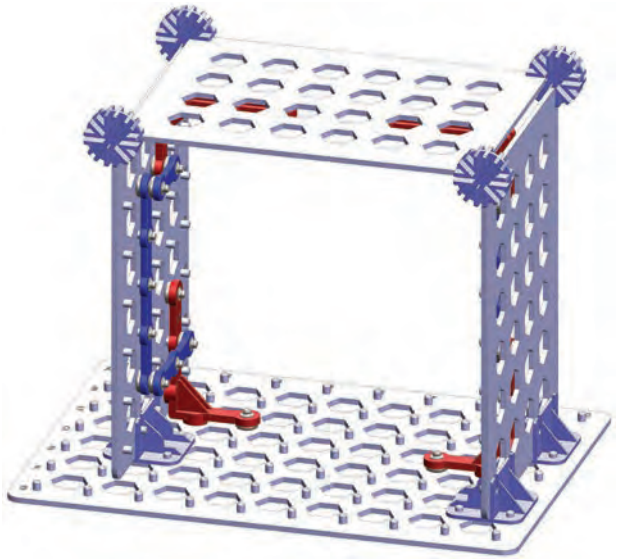
Note: Go to: **www.snapcircuits.net/sc3dmeg** for interactive 3D pictures to help with building the 3D circuits.

Assembly (adult supervision recommended):

1. Place base grid supports on base grid A.
2. Place parts on base grids B, & D, and install into base grid supports on grid A. The pegs should be facing inward.

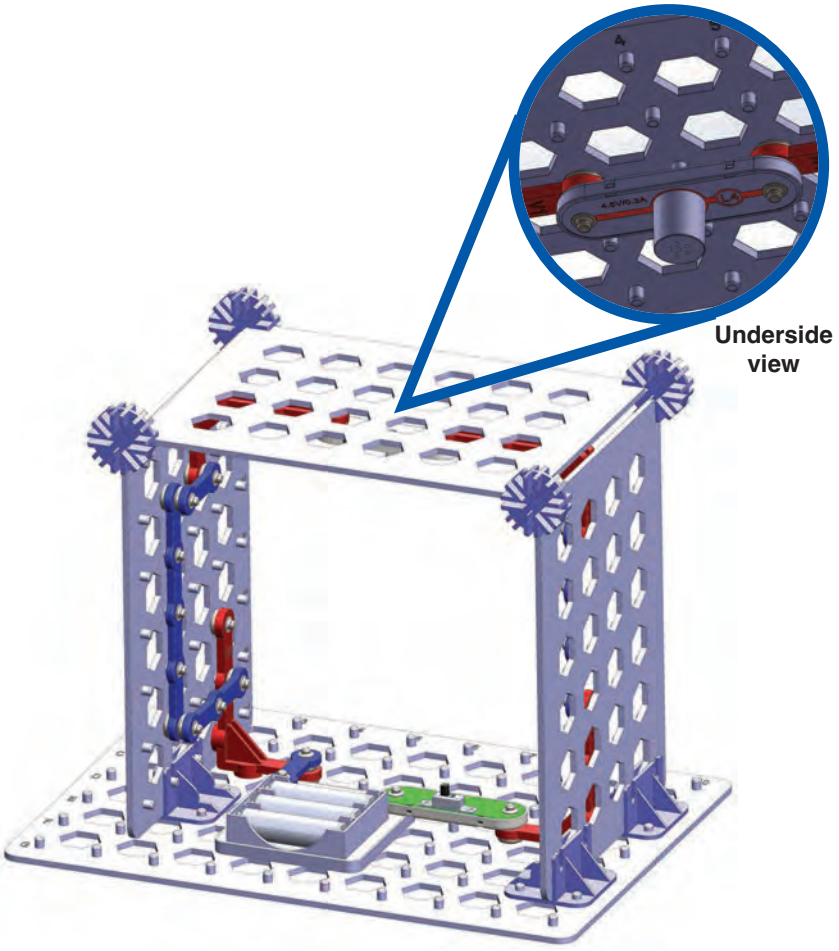


3. Mount grid C on top of grids B & D using 4 stabilizers, attaching the 2 90 degree vertical snap wires (V1) as you do it.



4. Place the remaining parts on grids A & C.

Turn on the slide switch (S1) to light the 4.5 Lamp (L4).



LEDs are increasingly being used for room lighting.

Project 14
Efficient Ceiling Light

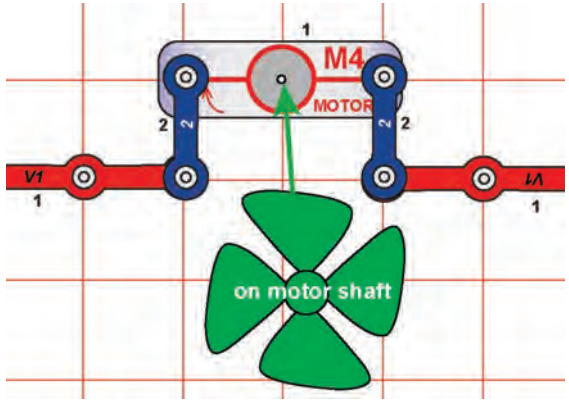
Use the preceding circuit, but carefully replace the lamp (L4) with the blue or color2 LED (D9 or D12, "+" to the right).

Project 15
Ceiling Speaker

Use the preceding circuit, but carefully replace the LED with the melody IC (U32, "+" to the right).

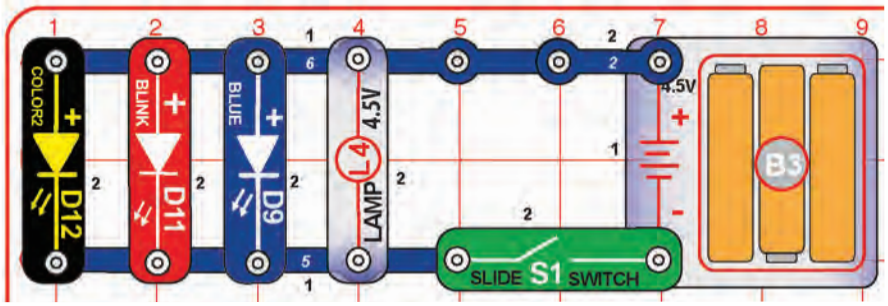
Project 16 Ceiling Fan

Use the preceding circuit, but replace the melody IC with the clear motor, wind fan, and two 2-snap wires, mounted as shown here.



The added 2-snaps help to secure the clear motor to the ceiling, otherwise the vibration it produces might cause it to come loose and fall.

Project 17 Four Lights



Build the circuit shown and turn on the slide switch (S1). For best effects, place one of the LED attachments (fiber optic festive tree or egg), and dim the room lights. The fiber optic festive tree must be used with its mounting base.

Project 18
Lights & Sound

Use the preceding circuit but replace one of the lights with the melody IC (U32, "+" towards the 6-snap wire).

Project 19
Lights & Motion

Use either of the preceding circuits but replace one of the lights with the clear motor (M4), and place the green fan on the motor. Don't place the motor next to the melody IC (U32), and be sure that the fan won't hit any of the LED attachments.

Project 20 Festive House

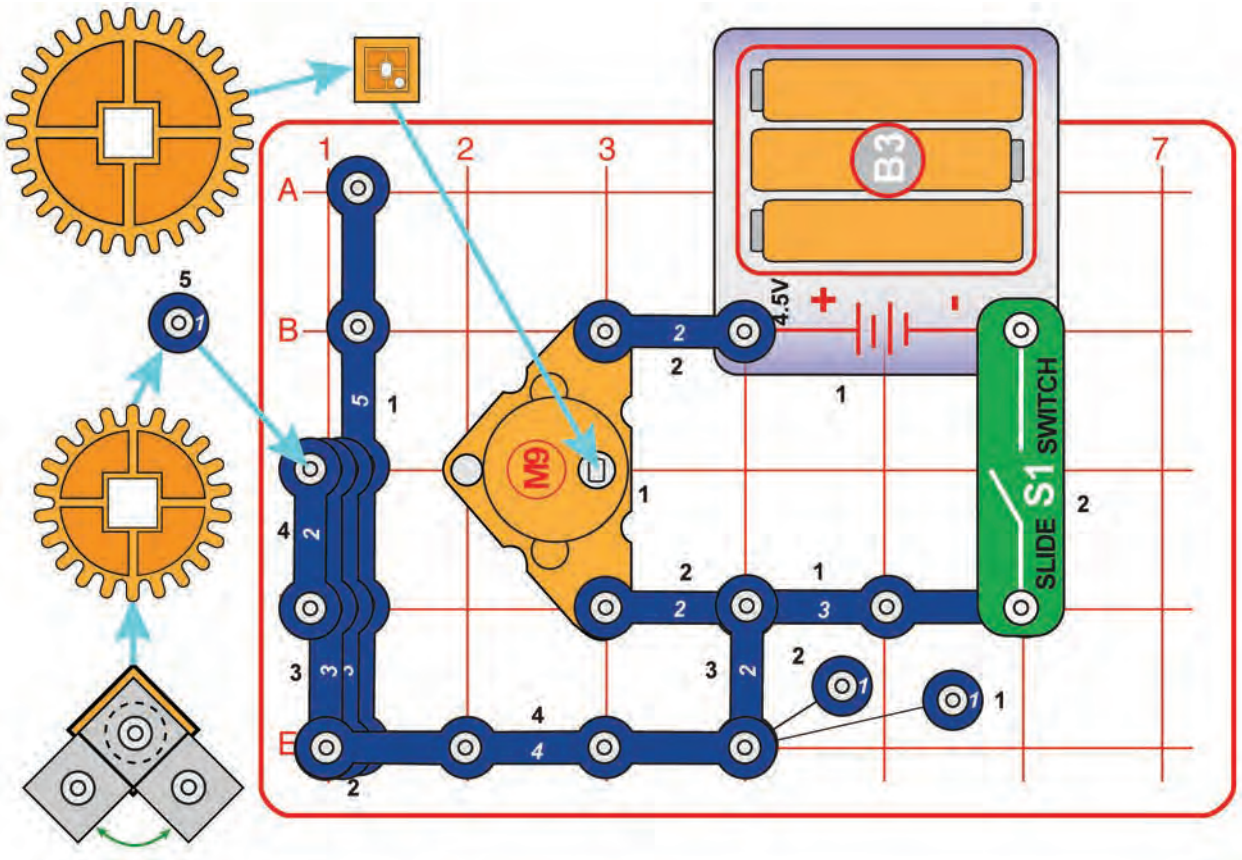
Assembly:

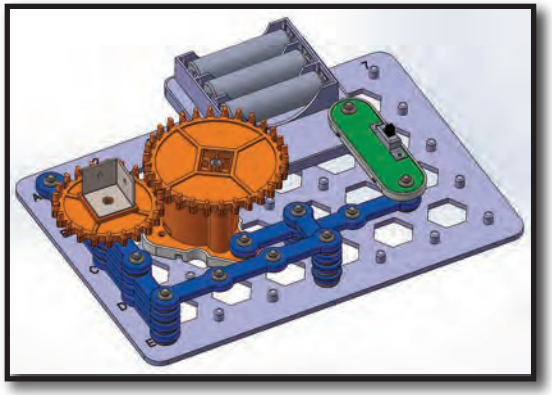
1. Place base grid supports on base grid A.
2. Install grids B & D into base grid supports on grid A. The pegs can be pointed in either direction.
3. Mount grid C on top of grids B & D using 4 stabilizers.
4. Place the remaining parts on grid A. Place the fiber optic festive tree on the color2 LED (D12) using the mounting base.

Turn on the slide switch (S1) to light the color2 LED and play a tune on the melody if (U32). This circuit looks best in a dark room. The melody IC may be removed if desired.

Project 21

Gears





Build the circuit as shown. The large gear is placed on the gear insert and mounted on the orange motor (M9), and the small gear is placed on a 3D snap which is mounted on a stack of snap wires (a 5-snap on level 1, 3-snaps on levels 2 and 3, a 2-snap on level 4, and a 1-snap on level 5). The teeth should be pointed up on both gears. Turn on the slide switch (S1) to spin the gears.

Gears can be used to make things spin faster or slower. When one gear has more teeth than another, it will spin slower. Using gears to reduce rotation speed also increases the turning force, allowing it to overcome more friction. Using gears also changes the direction of rotation.

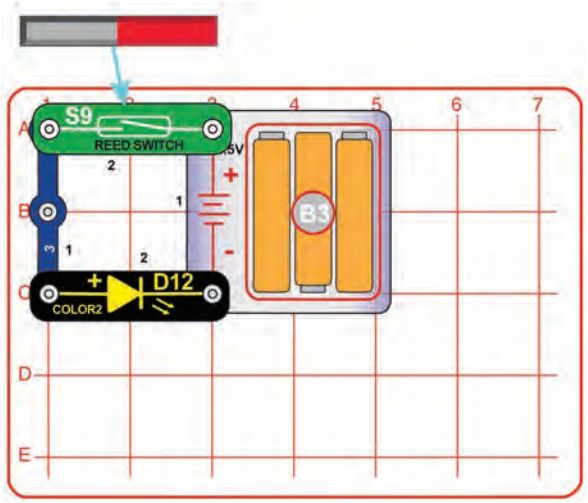
Inside the orange motor (M9) is a motor spinning very fast, but with little force (too little to spin both orange gears). Several small internal gears connect the internal motor to the metal shaft that you see; these reduce the rotation speed, give the shaft enough force to spin the orange gears, and also make it easier to control.

Project 22
Inverse Gear Ratio

Use the preceding circuit but swap the locations of the large and small gears. Now the 3D snap spins more slowly.

Project 23

Reed Switch



Build the circuit, and hold the magnet next to the reed switch (S9) to turn on the color2 LED (D12). Move the magnet around to turn the switch and LED on and off.

If you listen closely you may hear the reed switch turning on or off. You can replace the color2 LED with the lamp (L4) or the other LEDs (D9 or D11).

The reed switch (S9) is an electrical switch that can be controlled by a magnet. It has two metal contacts close together. The magnetic field from the magnet makes the contacts come together, completing a circuit just like a switch does. If you look at the reed switch contacts with a magnifying glass then you may be able to see them move slightly when the magnet turns the reed switch on and off.

Project 24

Magnet Controlled Sound

Use the preceding circuit but replace the color2 LED (D12) with the melody IC (U32, "+" on left). Use the magnet to activate the reed switch and play a tune.

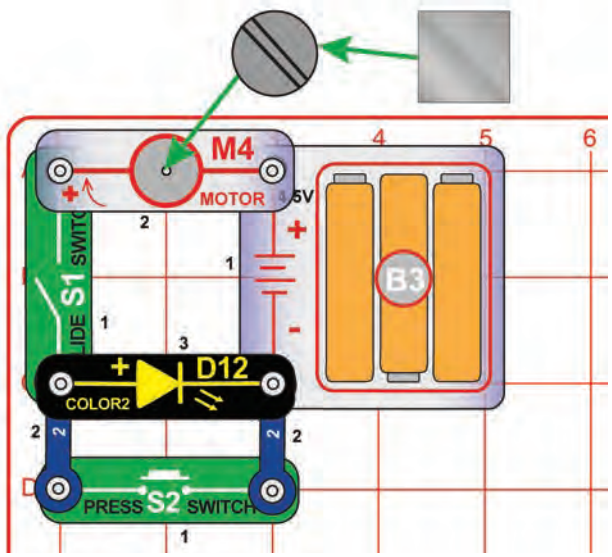
Project 25

Magnet Controlled Motor

Use the preceding circuit but replace the melody IC (U32) with the clear motor (M4) with green fan, or the orange motor (M9, use a 1-snap wire to support its 3rd snap) with the mirror ball. Use the magnet to activate the reed switch and spin the motor.

Project 26

An Optical Illusion



Build the circuit, and place one of the illusion cards in the illusion card holder, and place it on the clear motor (M4). Turn on the slide switch (S1), then push the press switch (S2). The motor should be spinning the illusion card, making the pictures on each side appear to blend together.

The motor speed will vary a little depending on the color of the color2 LED (D12) light. Push the press switch again if you want to speed up the motor.

If the illusion card comes out at high speed then insert a small piece of paper into the cardholder with the illusion card to make it fit more snugly. see on page 6.

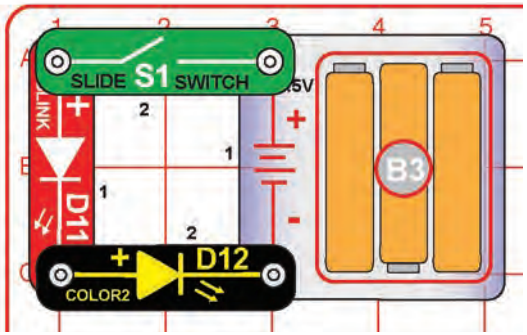
Project 27

More Optical Illusions

Use the preceding circuit but try the other 3 illusion cards. Also try replacing the color2 LED (D12) with the blink red LED (D11) for different effects. If you have a color LED (D8) from another Snap Circuits® set, then you can use it in place of the LED in this circuit. D8 changes the motor speed in bursts, giving some different effects.

Project 28 Funky Blinking Lights

Build the circuit and turn on the slide switch (S1). The LEDs (D11 & D12) are blinking.



Notice that when the blink red LED (D11) is on, the brightness of the color2 LED (D12) is lower, because the voltage from the batteries is divided between the two LEDs. When the blink red LED is off, the color2 LED gets the full battery voltage, and gets brighter.

Project 29 Funky Sounds

Use the preceding circuit but replace the color2 LED (D12) with the melody IC (U32, "+" on left).

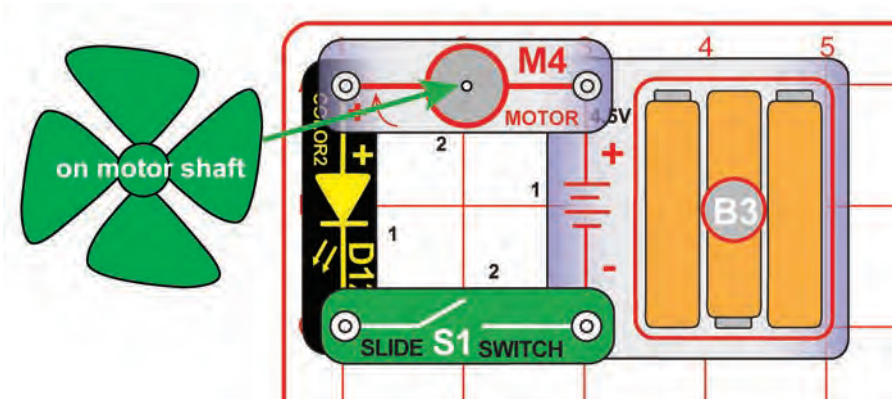
Project 30 Low Funky Sounds

Use the preceding circuit but replace the blink red LED (D11) with the color2 LED (D12). The sound will vary depending on the color of the color2 LED, but will not be very loud and sometimes there may be no sound at all.

Project 31 Variable Speed Fan

Build the circuit, place the wind fan on the motor (M4), and turn on the slide switch (S1). The fan speed varies a little depending on the color of the color2 LED (D12). If the fan does not start spinning then give it a push.

The clear motor (M4) and color2 LED (D12) are connected in series, so the voltage from the batteries is divided between them. The electricity used by the color2 LED varies a little depending on the color of light it is producing. When the color2 LED uses more electricity, there is less electricity for the motor, and the motor slows down.

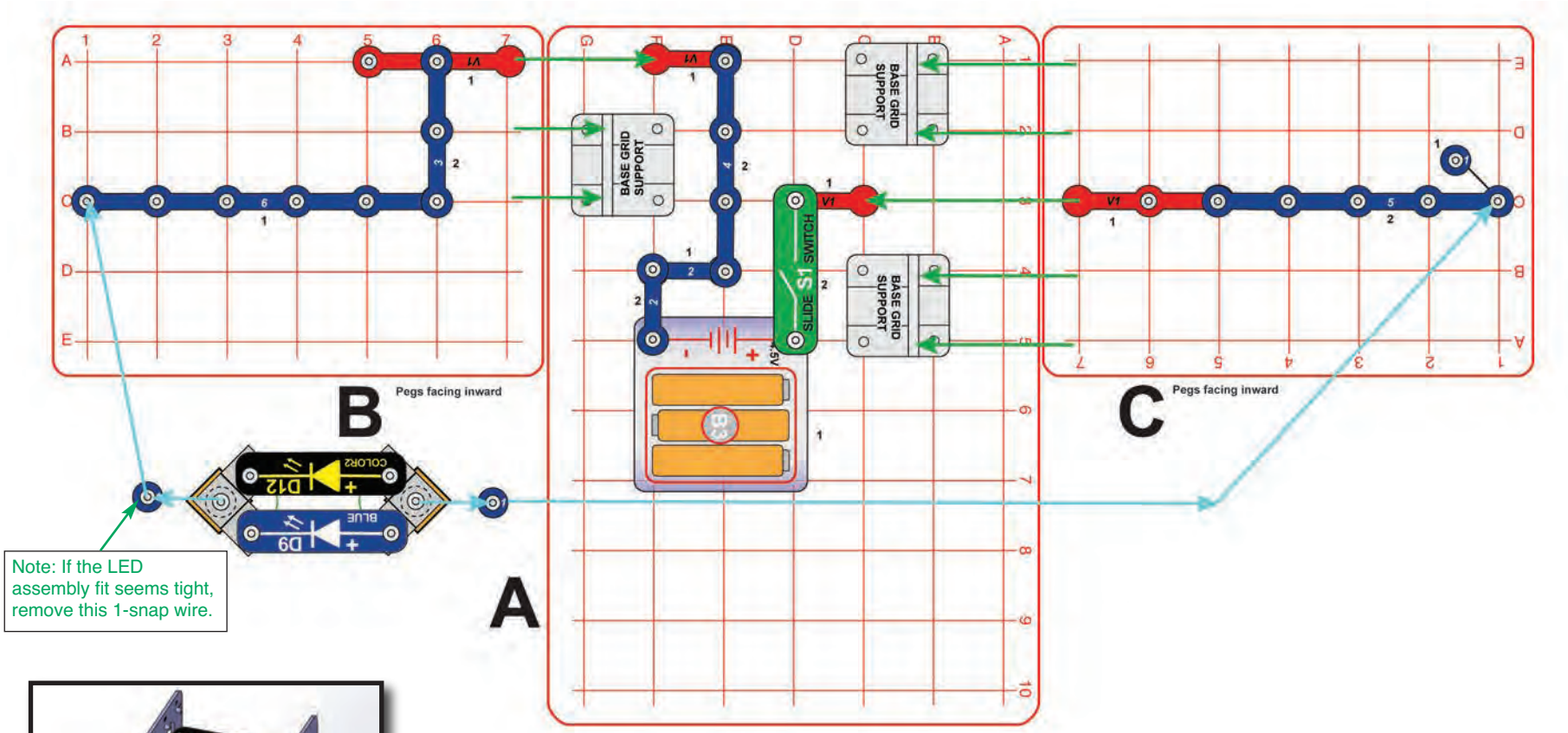


Project 32 New Speed Fan

Use the preceding circuit but replace the color2 LED (D12) with the blue (D9) or the blink red LED (D11).

The clear motor (M4) does not spin at full speed because the LED is connected in series with it. With the blink red LED, the motor speeds up a little when the LED is off, but it is hard to see the difference.

Project 33 Any Angle LEDs



Assembly (adult supervision recommended):

1. Place base grid supports on base grid A.

2. Mount parts on grids B & C, and install in base grid supports in grid A. The pegs should be facing inward.

3. Place remaining parts on grid A.

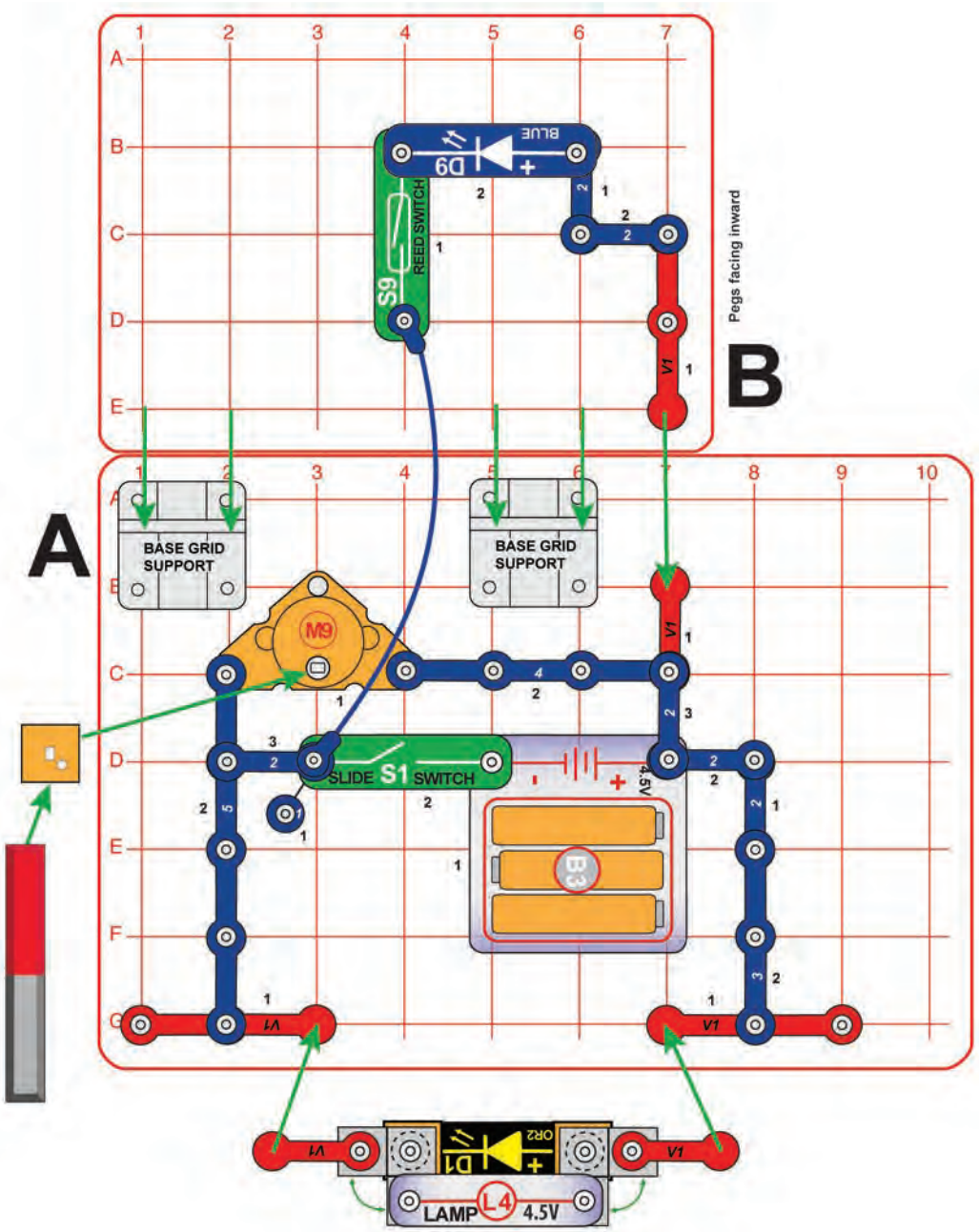
4. Mount the blue & color2 LEDs (D9 & D12) to the 3D snaps, connect 1-snap wires on both sides, and attach to the parts on grids B & C, as shown. The "+" side of the LEDs should be towards grid C.

Turn on the slide switch (S1). The color2 and blue LEDs light; rotate them to any position. The circuit looks best in a dimly lit room.

Project 34 Any Angle LEDs Variants

Use the preceding circuit but replace the blue or color2 LEDs with the blink red LED (D11), lamp (L4), or melody IC (U32"+" on right). You may also remove one of the lights.

Project 35 Super Spinning Magnet



Assembly:

1. Place base grid supports on base grid A.

2. Mount parts on grid B (except the blue jumper wire), and install in base grid supports in grid A. The pegs should be facing inward.

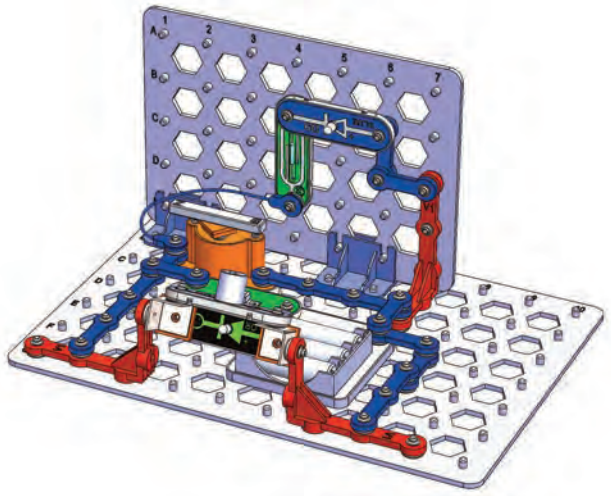
3. Place remaining parts on grid A, including the blue jumper wire. Note that the color LED (D12) and lamp (L4) are mounted on the 3D snaps, which are then mounted on the 90 degree vertical snap wires (V1).

4. Place the gear insert on the shaft of the orange motor (M9) and place the magnet on it, centered so it balances.

Turn on the slide switch (S1). The color2 LED (D12) and lamp (L4) light; rotate their position as desired. The orange motor spins the magnet, and the blue LED (D9) lights when the reed switch (S9) is triggered by the magnet.

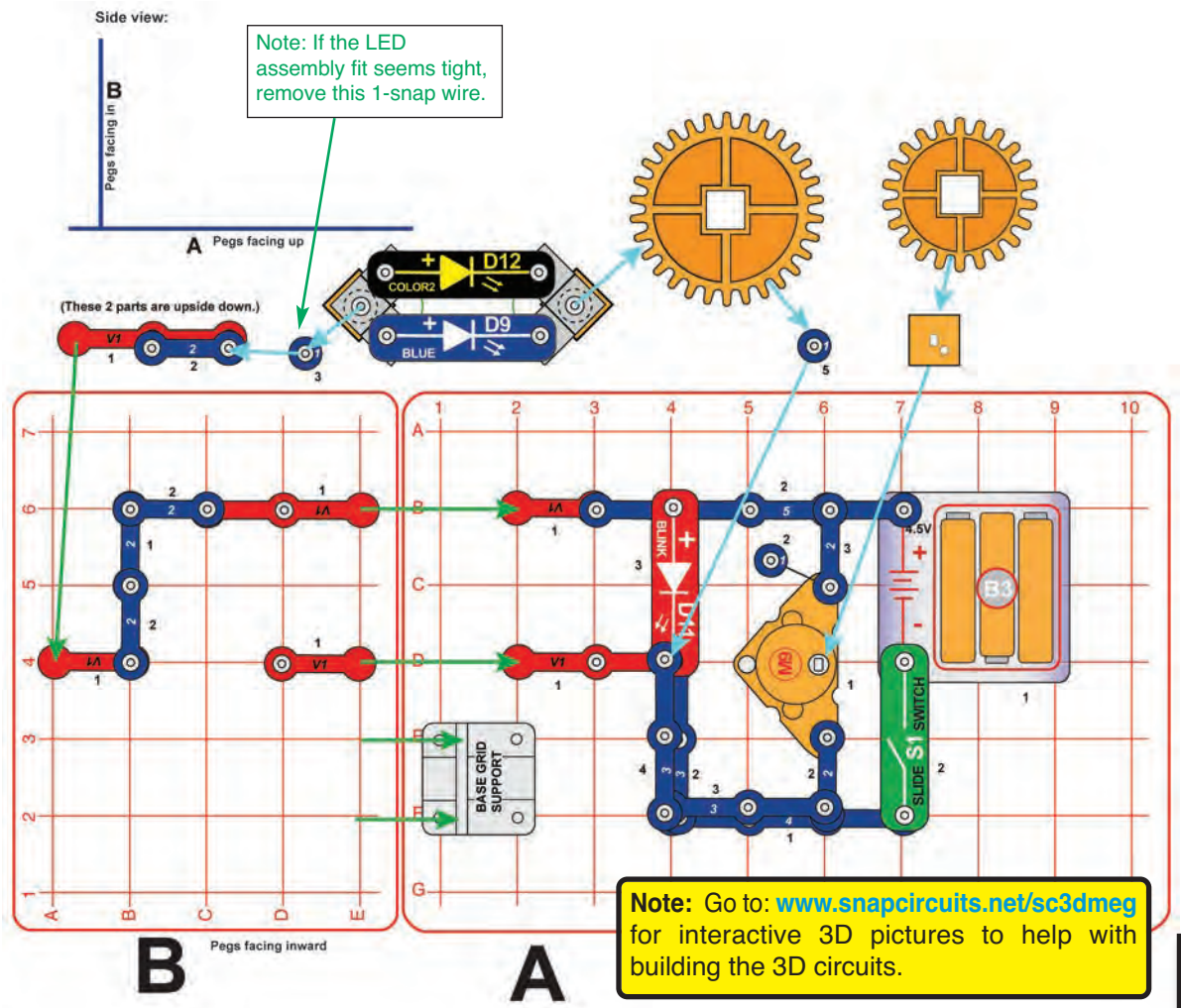
If desired, swap the locations of the LEDs and lamp, or replace one with the blink red LED (D11).

Note: if the LED assembly fit seems loose, add a 1-snap wire between one of the 3D snaps and a V1.



Project 36

Spinning Vertical Lights



Assembly (adult supervision recommended):

1. Place base grid support on base grid A.

2. Place parts on grid B, and install into base grid support on grid A. The pegs should be facing inward. Also attach the 2-snap wire to the 90 degree vertical snap wire (V1) that hangs off the top of grid B.

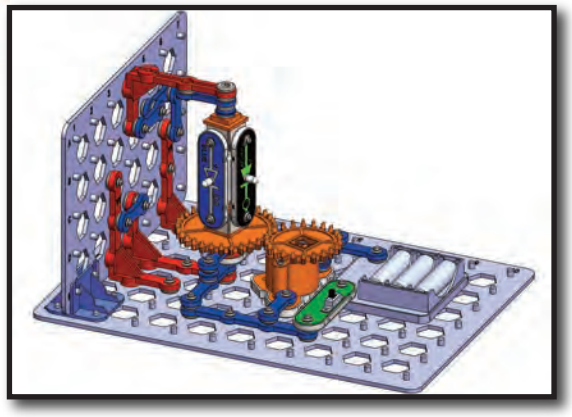
3. Mount the blue & color2 and LEDs (D9 & D12) to the 3D snaps, and attach the large gear and two 1-snap wires on opposite sides, as shown. The teeth on the gear should face the LEDs, and the "+" side of the LEDs should be away from the gear.

4. Place the remaining parts on grid A. Place the small gear in the gear insert and mount on the orange motor (M9); the teeth on the gear should face up.

5. Mount the LED assembly from step 3 between the 2-snap wire that hangs upside down and the 3-snap wire on level 4 on grid A, as shown. The teeth on the large and small gears should align.

Turn on the slide switch (S1). The color2 and blue LEDs should light, and be rotated by the gears. The blink red LED (D11) is blinking (and providing mechanical stability).

Note: Go to: **www.snapcircuits.net/sc3dmeg** for interactive 3D pictures to help with building the 3D circuits.



Project 37

Faster Spinning Vertical Lights

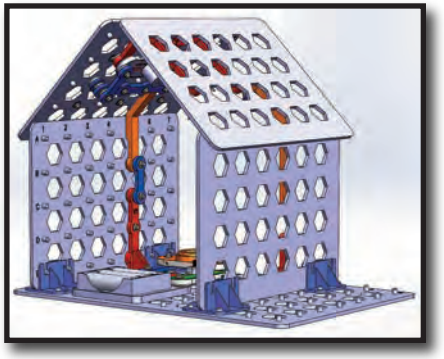
Use the preceding circuit, but carefully swap the gears, so that the larger gear is on the motor and the small gear is on the 3D snap. The LEDs spin faster now, but the circuit may fall apart too easily.

The circuit is more stable when the gears spin slowly.

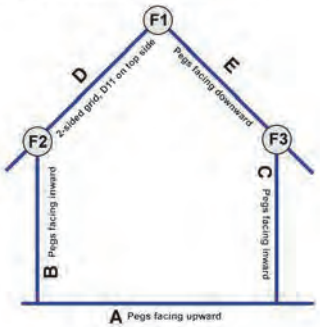
Project 38

Vaulted Ceiling House

Note: Go to: www.snapcircuits.net/sc3dmeg for interactive 3D pictures to help with building the 3D circuits.



Front-Side view:
Stabilizers are identified as F1-F3 and B1-B3 (Front 1-3 and Back 1-3), as shown on this drawing.

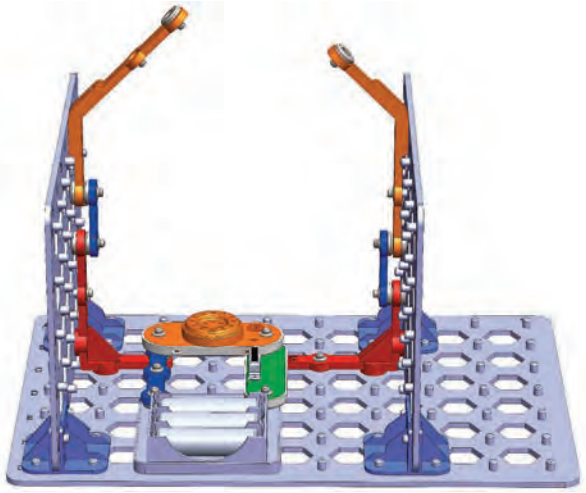


Assembly (adult supervision highly recommended):

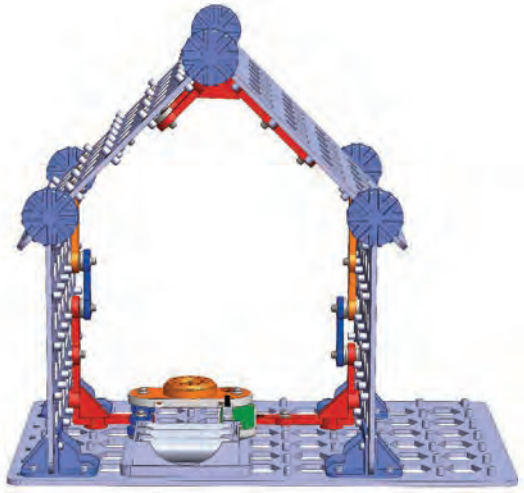
1. Place base grid supports on base grid A.

2. Mount parts on grids B & C and install in base grid supports in grid A. The pegs should be facing inward. Do not use the double-sided grid.

3. Place remaining parts on grid A.



4. Mount grids D & E at the angles shown and with pegs facing down, on top of grids B & C using six stabilizers, attaching the two angled snap wires (V2) and two 90 degree vertical snap wires (V1) as you do it. Note that grid D is the double-sided grid. Adjust the positions of the stabilizers as needed.

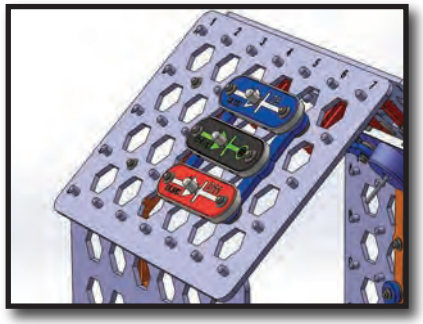


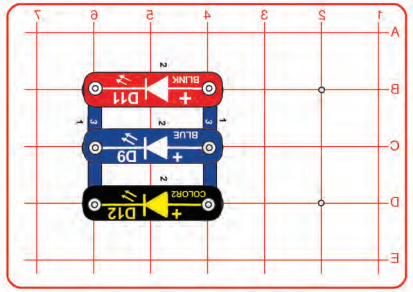
5. Add the remaining parts on grids D & E.

Turn on the slide switch (S1). The clear motor (M4) spins a ceiling fan, the melody IC (U32) plays a tune, and the lamp (L4) lights.

Project 39
Vaulted Ceiling House with Roof Lights

Use the preceding circuit, but carefully add parts on the top side of grid D, as shown. If desired place the LED attachments on the LEDs.

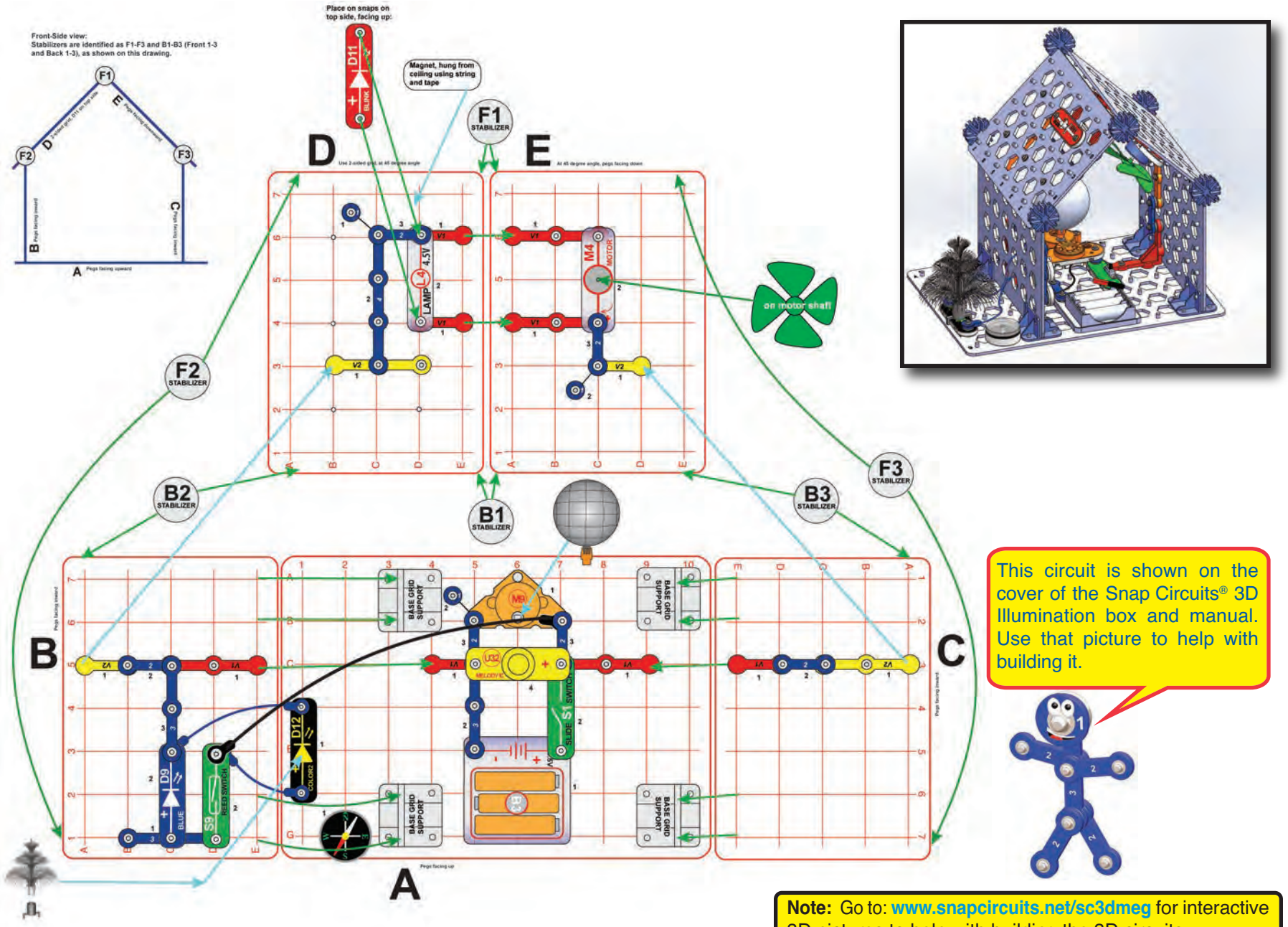




LED Attachments

Project 40

Box Cover Circuit



This circuit is shown on the cover of the Snap Circuits® 3D Illumination box and manual. Use that picture to help with building it.

Note: Go to: **www.snapcircuits.net/sc3dmeg** for interactive 3D pictures to help with building the 3D circuits.

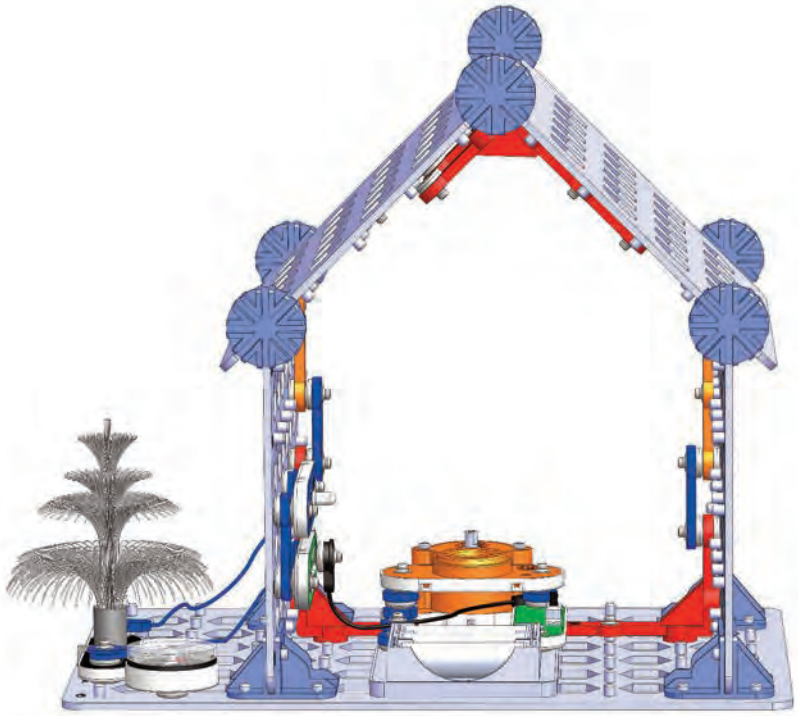
Assembly (adult supervision highly recommended):

1. Place base grid supports on base grid A.

2. Mount parts on grids B & C (for jumper wires, leave one end unconnected), and install in base grid supports in grid A. The pegs should be facing inward. Do not use the double-sided grid.

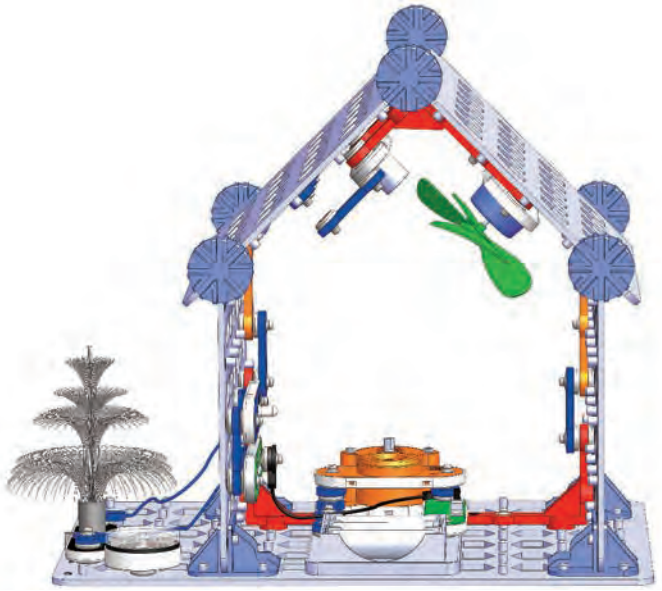
3. Place remaining parts on grid A, and finish connecting the jumper wires.

4. Mount grids D & E at the angles shown and with pegs facing down, on top of grids
B & C using six stabilizers, attaching the two angled snap wires (V2) and two 90 degree vertical snap wires (V1) as you do it. Note that grid D is the double-sided grid. Adjust the positions of the stabilizers as needed.

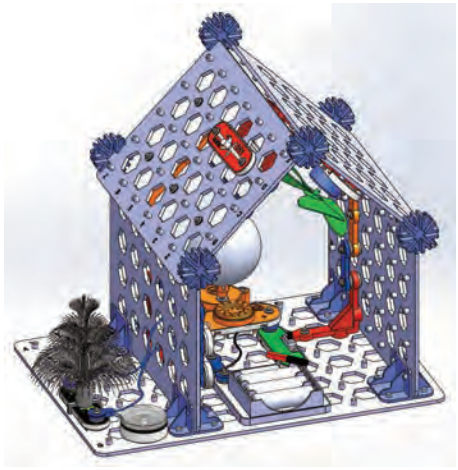


5. Add the remaining parts on grids D & E. Note that the blinking red LED is on the male-male snaps on grid D, facing up.

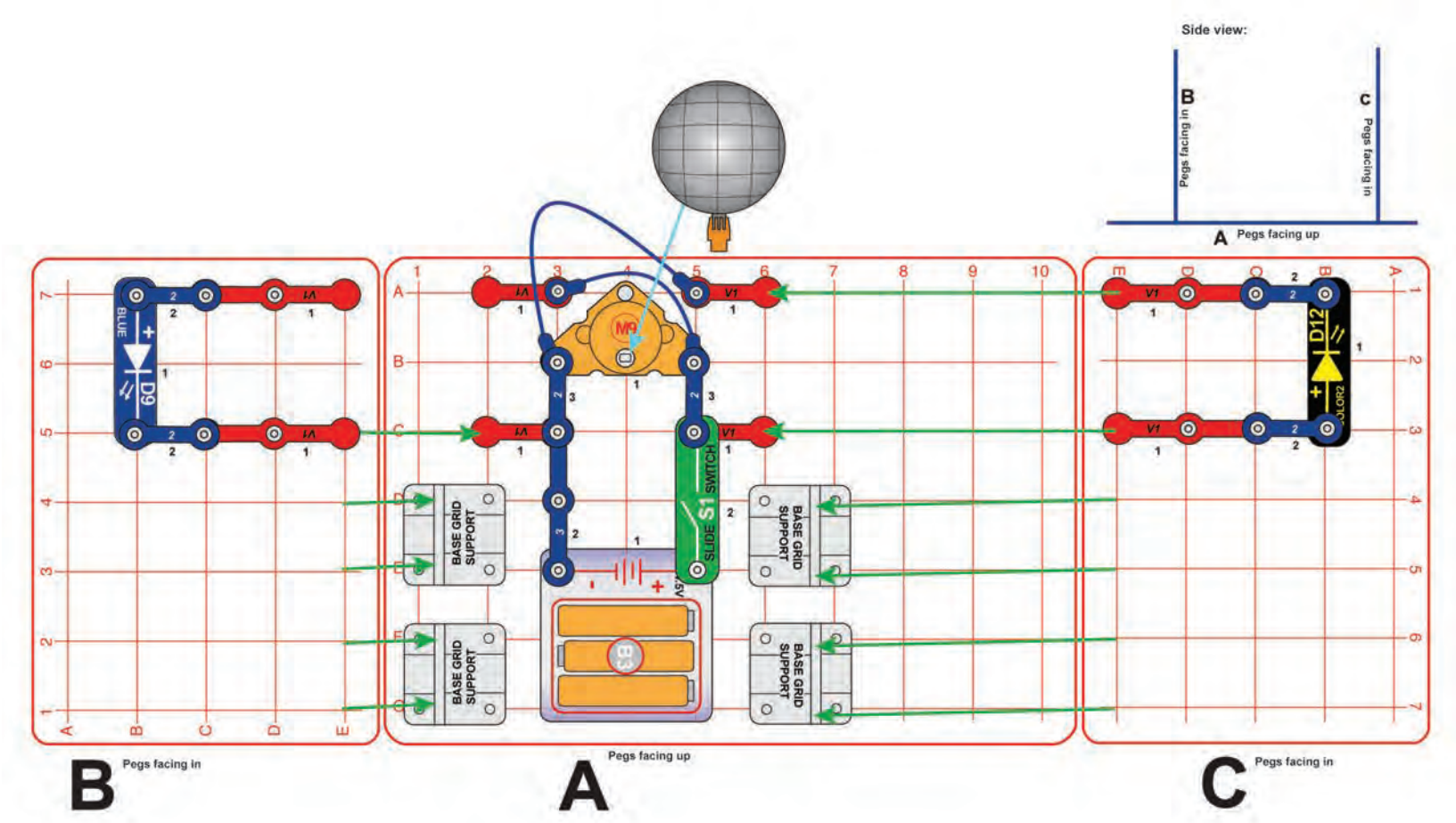
6. Tie string to the magnet and hang it from the ceiling so that it hangs level near the reed switch (S9). When the circuit is on, adjust the string so spinning the magnet with your finger lights the blue LED (D9), then secure the string with tape.

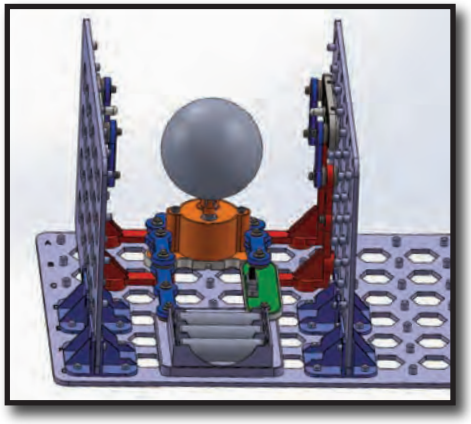


Turn on the slide switch (S1). The clear motor (M4) spins a ceiling fan, the lamp (L4) lights, the blink red LED (D11) lights, the color LED (D12) lights up the fiber optic festive tree, the orange motor (M9) spins the mirror ball, and the melody IC (U32) makes sound. Gently spin the magnet with your finger; the compass needle should follow it. Push the magnet near the reed switch (S9) and the blue LED (D9) lights.



Project 41 Disco Effects



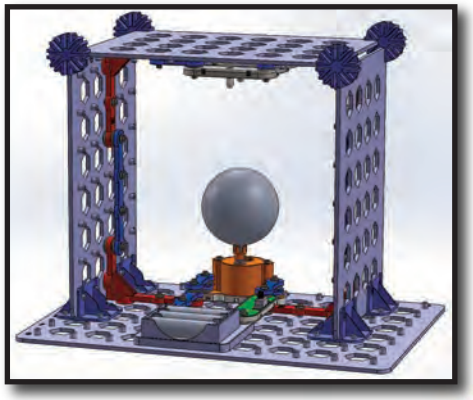


Assembly (adult supervision recommended):

1. Place base grid supports on base grid A.
2. Place parts on base grids B, & C, and install into base grid supports on grid A. The pegs should be facing inward.
3. Place the remaining parts on grid A.
4. Place the mirror ball on the orange motor (M9).

Turn on the slide switch (S1) to spin the mirror ball and light the LEDs (D9 and D12). Take the circuit into a dark room for best effects.

Project 42 Disco Effects (II)

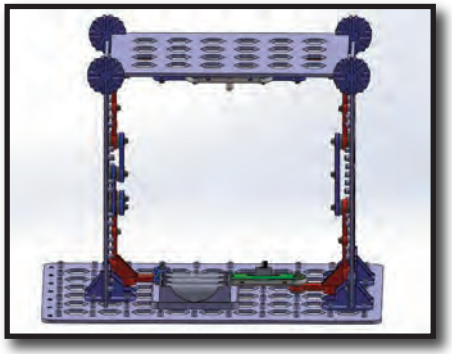


Assembly (adult supervision recommended):

1. Place base grid supports on base grid A.
2. Place parts on base grids B, & D, and install into base grid supports on grid A. The pegs should be facing inward.
3. Mount grid C on top of grids B & D using 4 stabilizers, attaching the 2 vertical snap wires (V1) as you do it.
4. Place the remaining parts on grids A & C. Note that grid C is upside down, so place the parts on it carefully. The mirror ball is placed on the orange motor (M9).

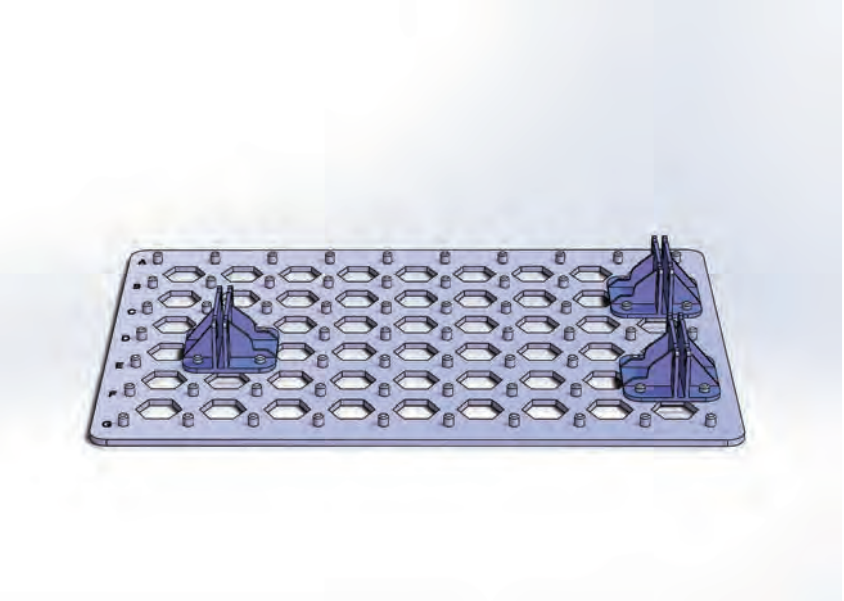
Turn on the slide switch (S1) to spin the mirror ball and light the LEDs (D9, D11, and D12). Take the circuit into a dark room for best effects.

Project 43 Overhead Lights

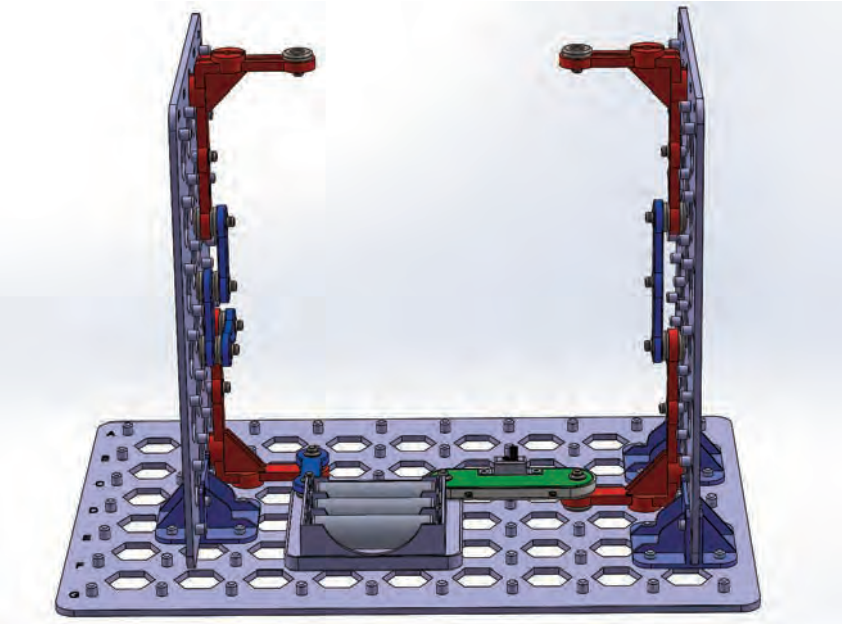


Assembly (adult supervision recommended):

1. Place base grid supports on base grid A.

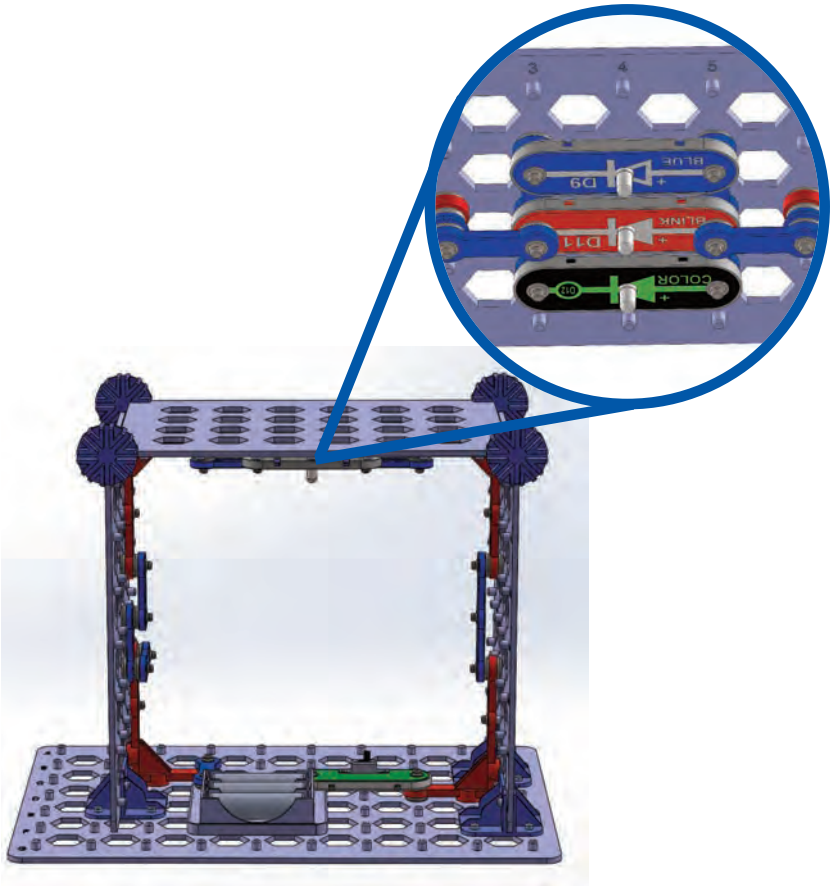


2. Place parts on base grids B, & D, and install into base grid supports on grid A. The pegs should be facing inward.



3. Mount grid C on top of grids B & D using 4 stabilizers, attaching the 2 vertical snap wires (V1) as you do it.
4. Place the remaining parts on grids A & C.

Turn on the slide switch (S1) to light the three LEDs.

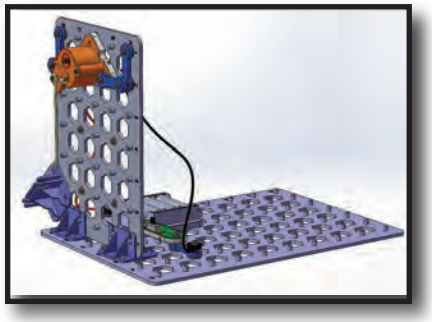


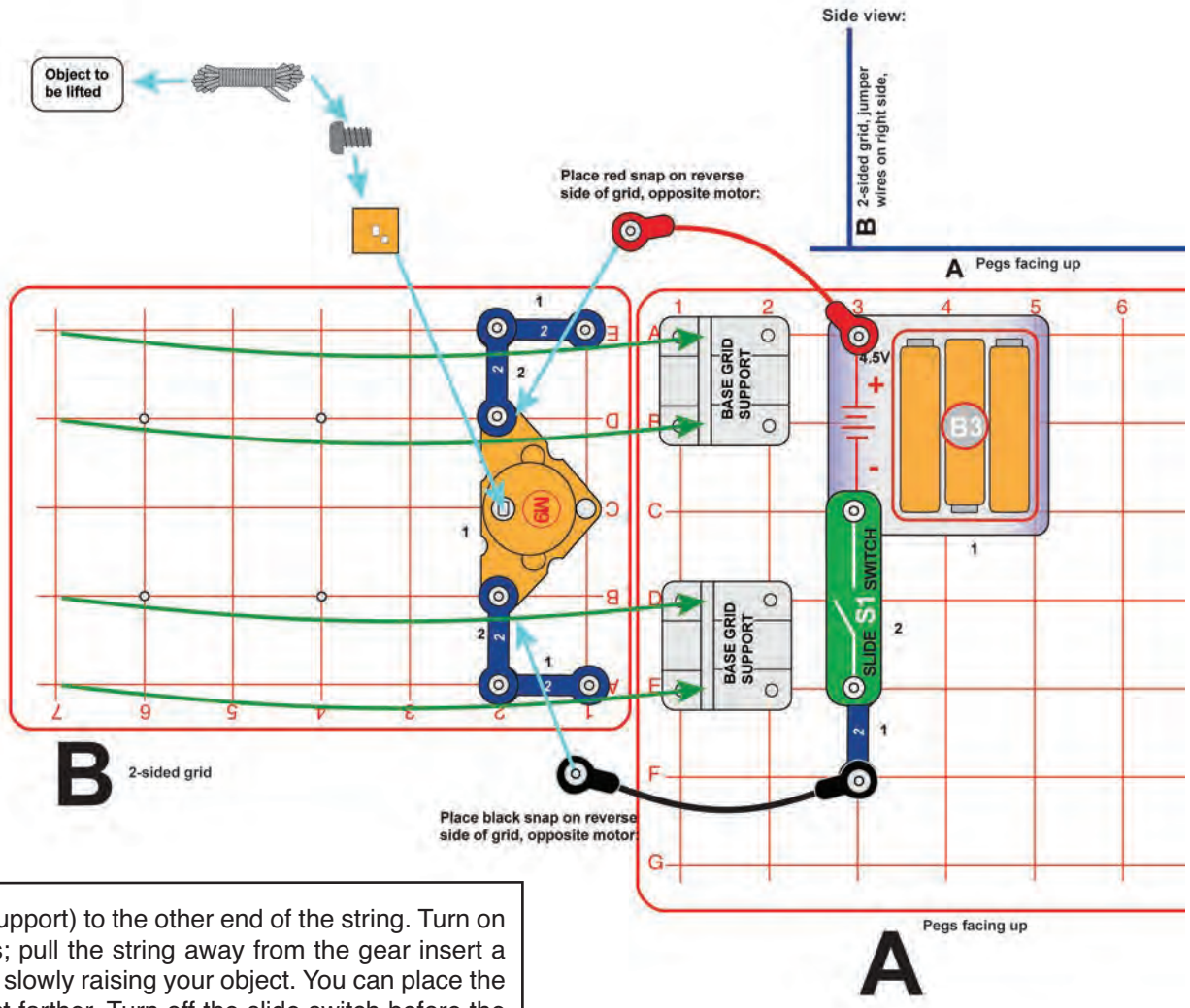
Project 44

Overhead Lights & More

Use the preceding circuit, but carefully replace the blink red LED (D11) with the clear motor (M4) with the green fan, or replace any of the LEDs (D9, D11, or D12) with the lamp (L4) or the melody IC (U32, “+” on right).

Project 45 Lifting





Assembly (adult supervision recommended):

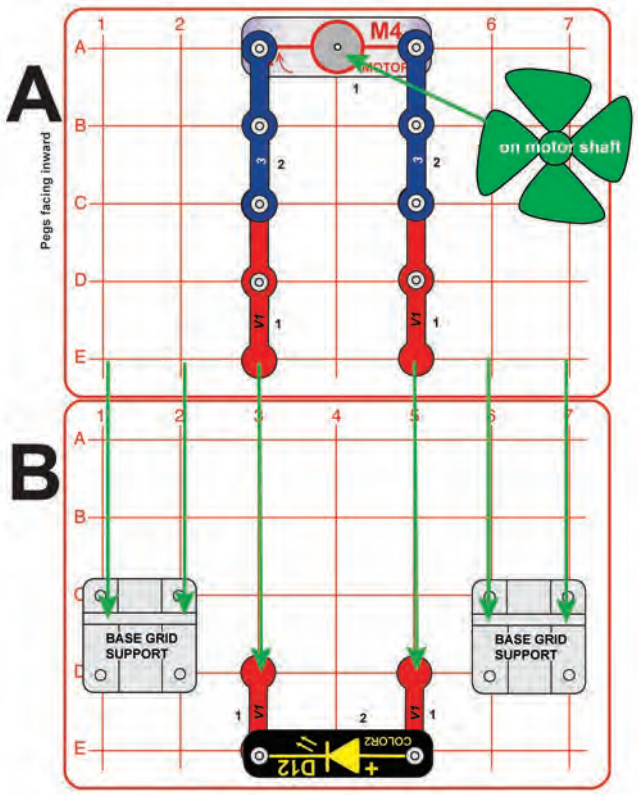
1. Place base grid supports on base grid A.
2. Tie one end of a piece of string to the hole in the gear insert, and place the gear insert on the orange motor (M9). Insert the screw into the orange motor shaft but do not screw it in very far.
3. Place parts on base grid B and install into base grid supports on grid A. Grid B should be the two-sided grid.
4. Place the remaining parts on grid A and connect the red and black jumper wires.

Tie a light object (such as an extra base grid support) to the other end of the string. Turn on the slide switch (S1). The orange motor spins; pull the string away from the gear insert a little so that the string winds around the screw, slowly raising your object. You can place the circuit near the edge of a table to lift the object farther. Turn off the slide switch before the lifted object reaches the slow motor and interferes with it.

Swap the connections of one end of the red and black jumper wires to make the orange motor turn in the opposite direction and lower the object.

Don't lift a heavy object or the orange motor may fall off the base grid.

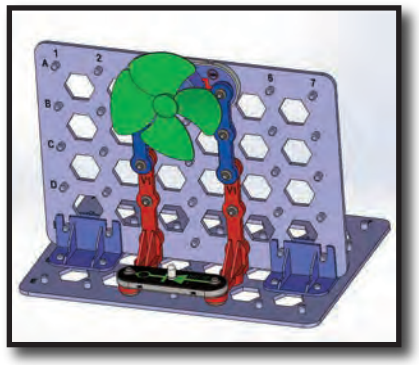
Project 46 Windmill



Assembly:

1. Place base grid supports on base grid B.
2. Place parts on grid A, and install into base grid supports on grid B.
3. Install remaining parts on grid B.

Blow on the fan to simulate a strong wind. If you blow hard enough then the color2 LED (D12) will light.

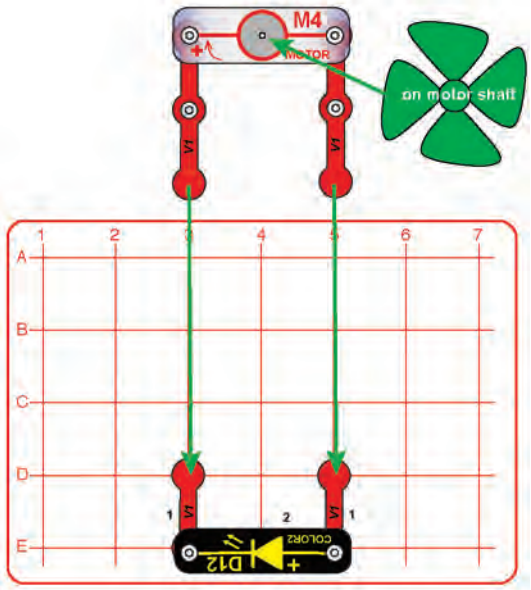


Here the clear motor (M4) is used as a generator, using mechanical motion to produce electricity. Commercial windmills have more efficient motors, better fan blade shapes, and low friction between their components, so they can produce electricity even in light winds.

Project 47 Mini Windmill

Modify the preceding circuit to be this one. Blow on the fan to simulate wind. If you blow hard enough then the color2 LED (D12) lights. See if it is easier to light the LED than with the previous circuit.

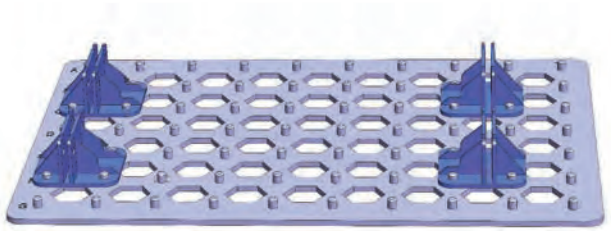
This circuit improves the air flow by removing the base grid from behind the fan, but may not be as stable.



Project 48 Tall Angled Roof House

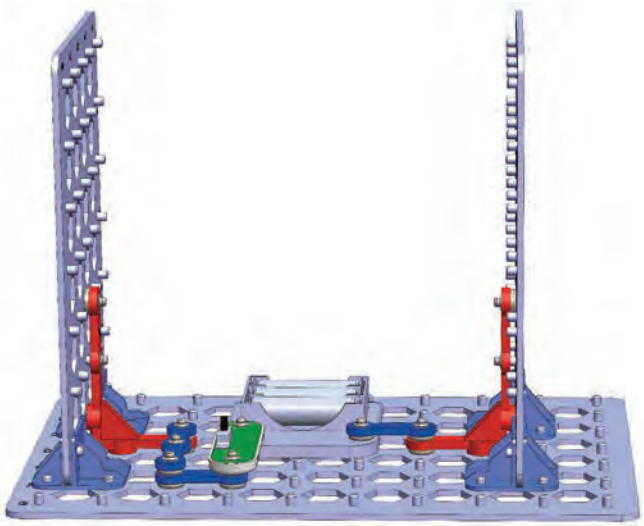
Assembly (adult supervision highly recommended):

1. Place base grid supports on base grid A.

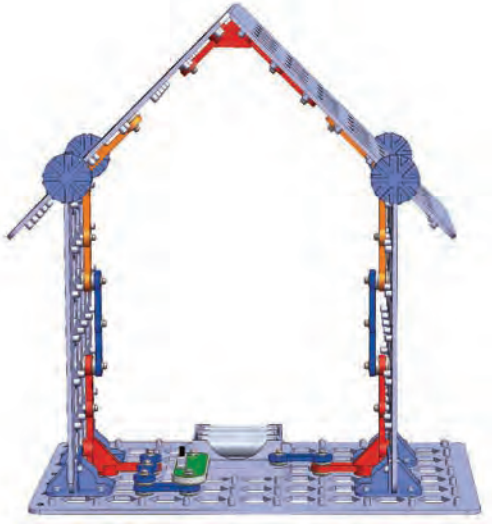


2. Place parts on base grids B & C, and install into base grid supports on grid A. The pegs should be facing inward. Do not use the double-sided grid.

3. Place remaining parts on grid A.

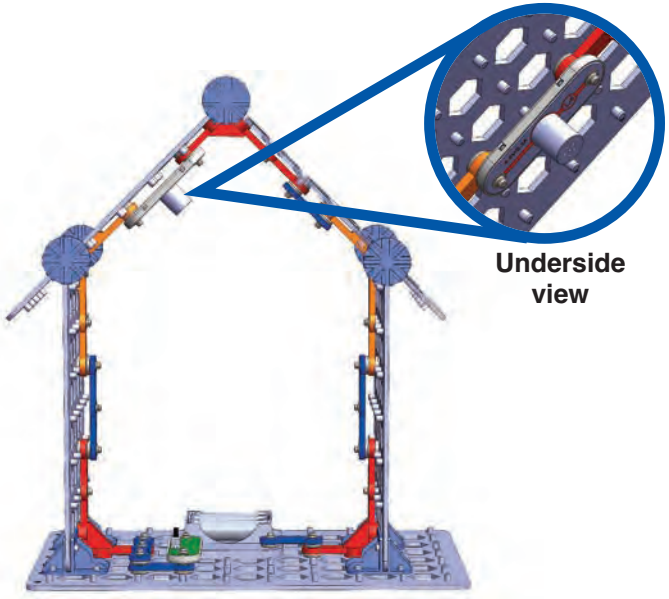


4. Mount grids D & E, at the angles shown and with pegs facing down, on top of grids B & C using 6 stabilizers, and attaching the 45 degree vertical snap wires (V2) from grids B & C and adding one 90 degree vertical snap wire (V1) as you do it. Note that grid D should be the double-sided grid. Adjust the positions of the stabilizers as needed.



5. Add the remaining parts on grids D & E.

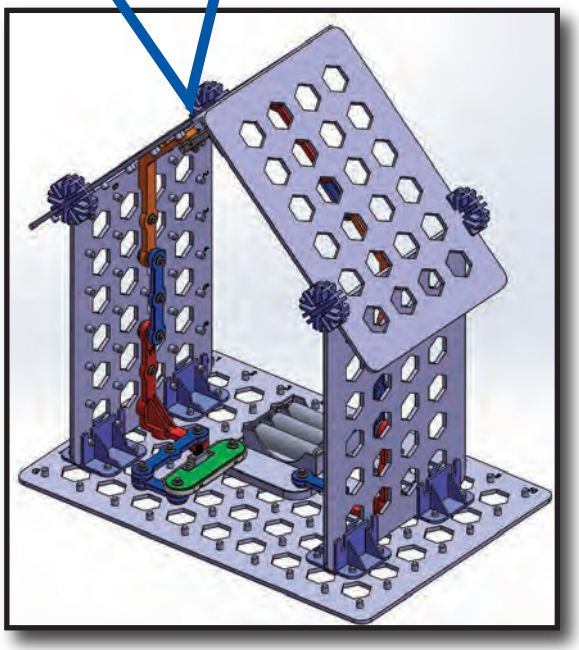
Turn on the slide switch (S1) to light the lamp (L4).



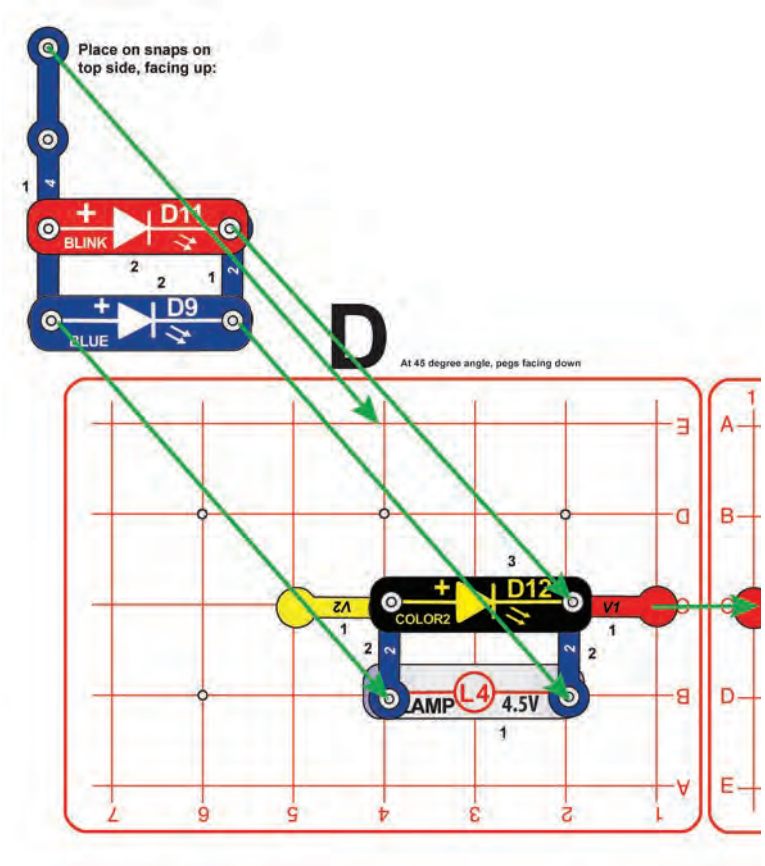
Project 49
Tall Angled Rood House Variants

Use the preceding circuit, but carefully replace the lamp (L4) with the melody IC (U32), clear motor (M4, with green fan), or one of the LEDs (D9, D11, or D12). The “+” side should be to the left.

Underside view



Project 50
Enhanced Tall Angled Roof House

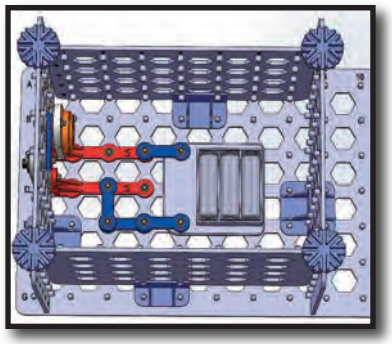


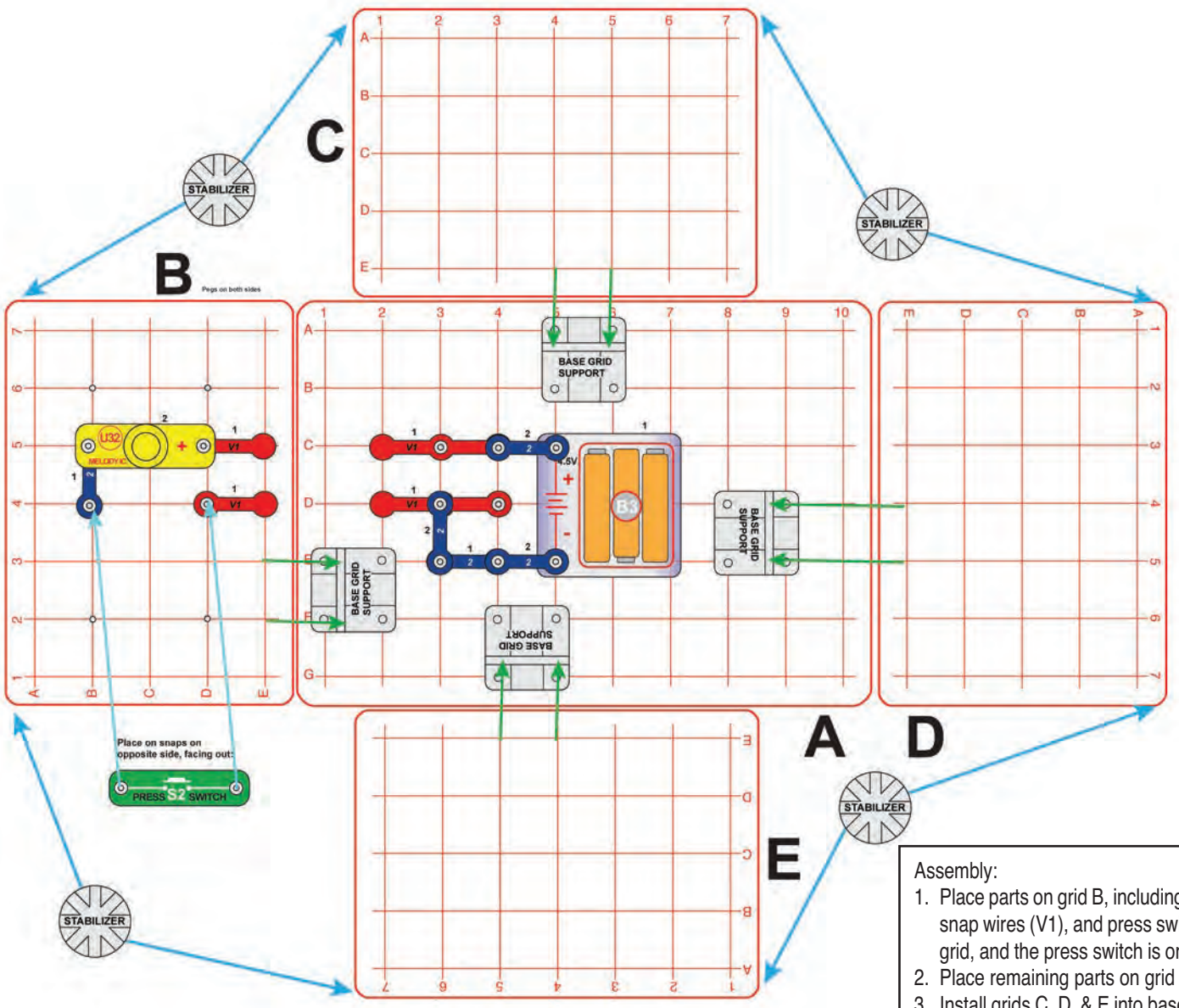
Use the preceding circuit, but carefully change the parts on grid D to match the circuit shown here.

Project 51
Enhanced Tall Angled Roof House Variants

Use the preceding circuit, but carefully rearrange any of the lights, or replace them with the melody IC (U32) or clear motor (M4, with green fan). “+” side should always be on the left. Exception: do not replace the color2 LED (D12) with the clear motor, because vibration could cause the Motor to come loose and fall.

Project 52 House with Doorbell





Assembly:

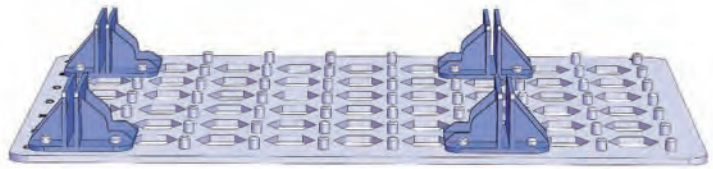
1. Place parts on grid B, including the base grid support, 90 degree vertical snap wires (V1), and press switch (S2). Note that grid B is the two-sided grid, and the press switch is on the reverse side. Install grid B on grid A.
2. Place remaining parts on grid A.
3. Install grids C, D, & E into base grid supports on grid A, and secure with 4 stabilizers.

Push the press switch to ring the doorbell. It sounds best if you press it for a few seconds.

Project 53 Festive House with Roof Lights

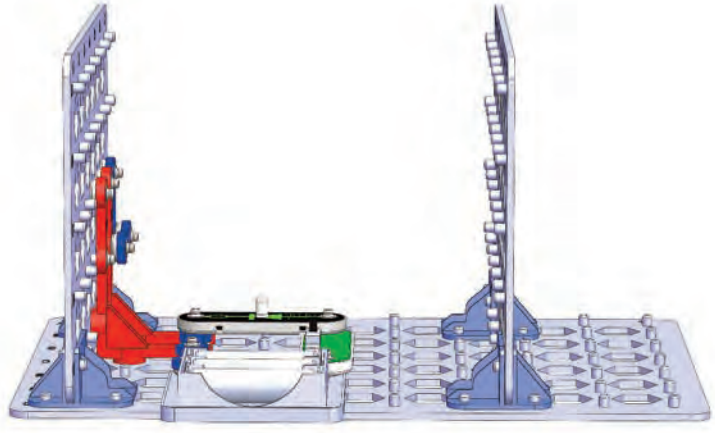
Assembly (adult supervision highly recommended):

1. Place base grid supports on base grid A.

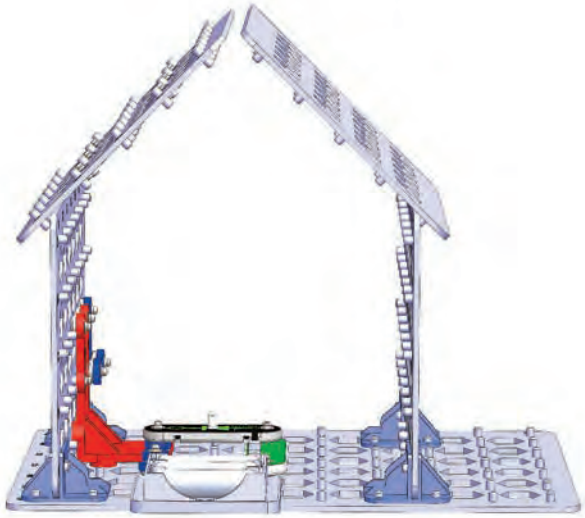


2. Mount parts on grids B and install in base grid supports in grid A. The pegs should be facing inward. Do not use the double-sided grid.

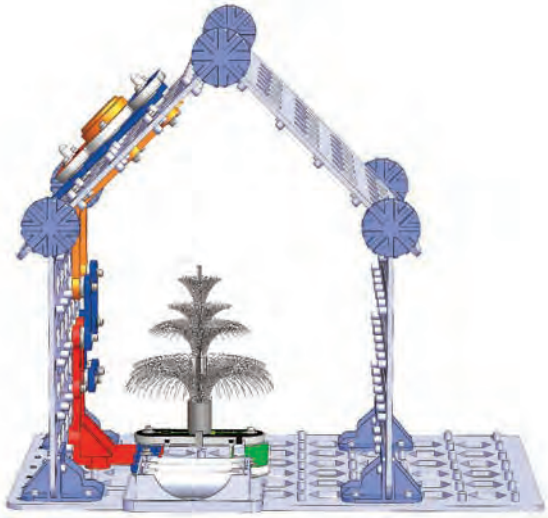
3. Place remaining parts on grid A.



4. Mount grids D & E at the angles shown and with pegs facing down, on top of grids



B & C using six stabilizers, attaching the two angled snap wires (V2) and two 90 degree vertical snap wires (V1) as you do it. Note that grid D is the



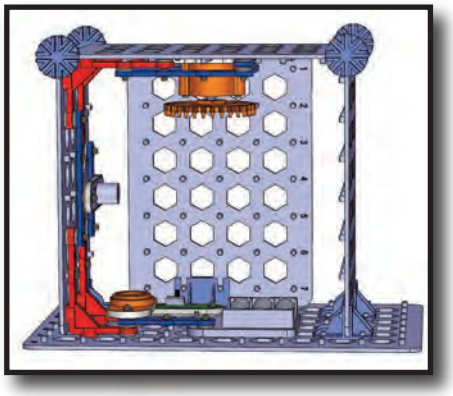
double-sided grid. Adjust the positions of the stabilizers as needed.

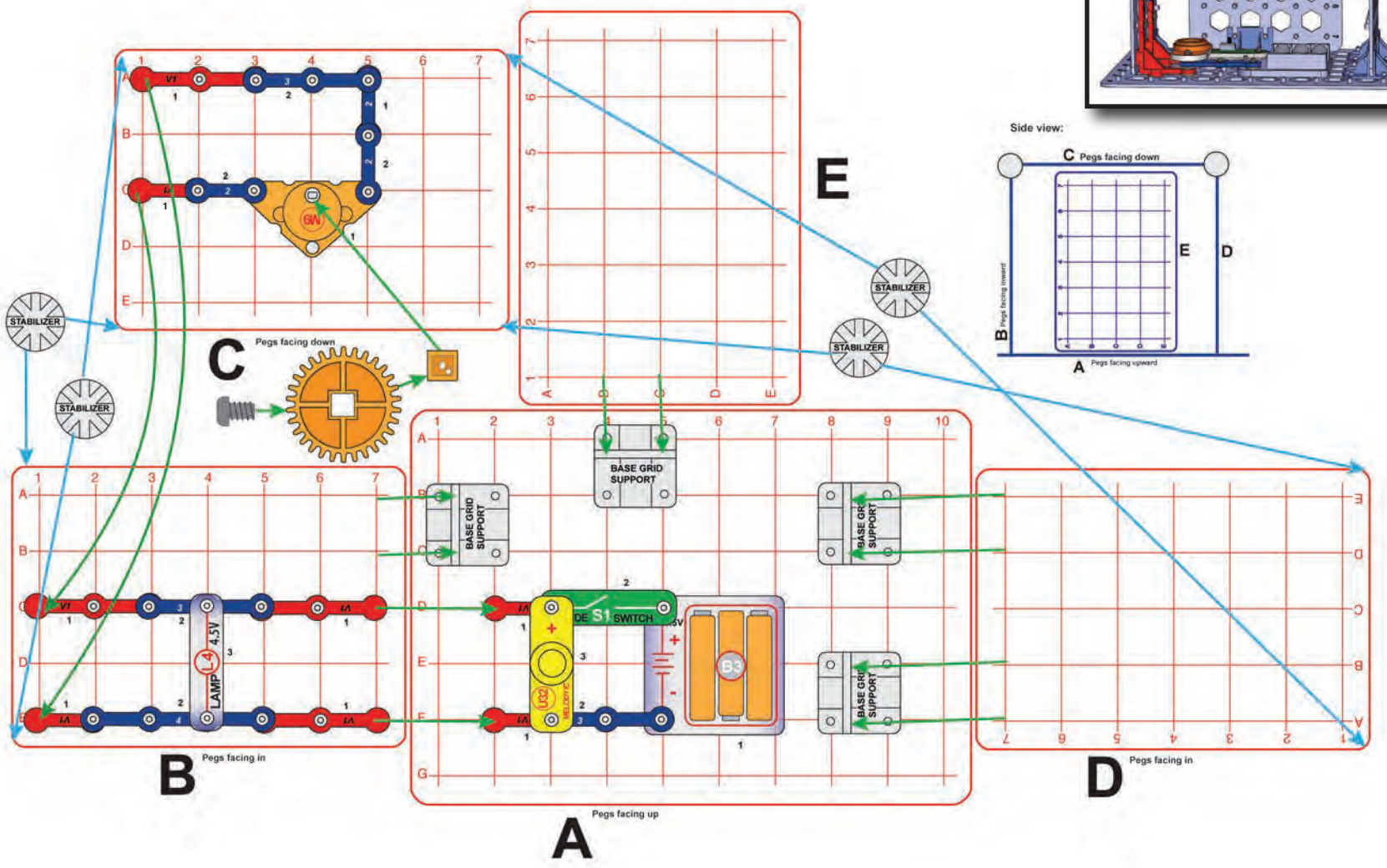
5. Add the remaining parts on grid D.

Turn on the slide switch (S1). The clear motor (M4) spins a ceiling fan, the melody IC (U32) plays a tune, and the lamp (L4) lights. This circuit looks best in a dark room.

☐ Project 54

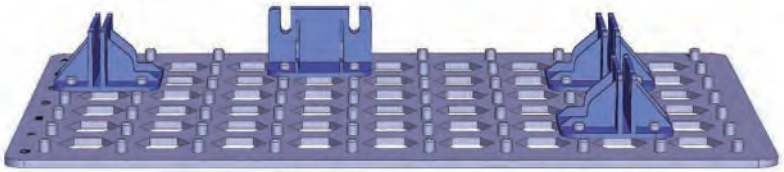
Chandelier Circuit



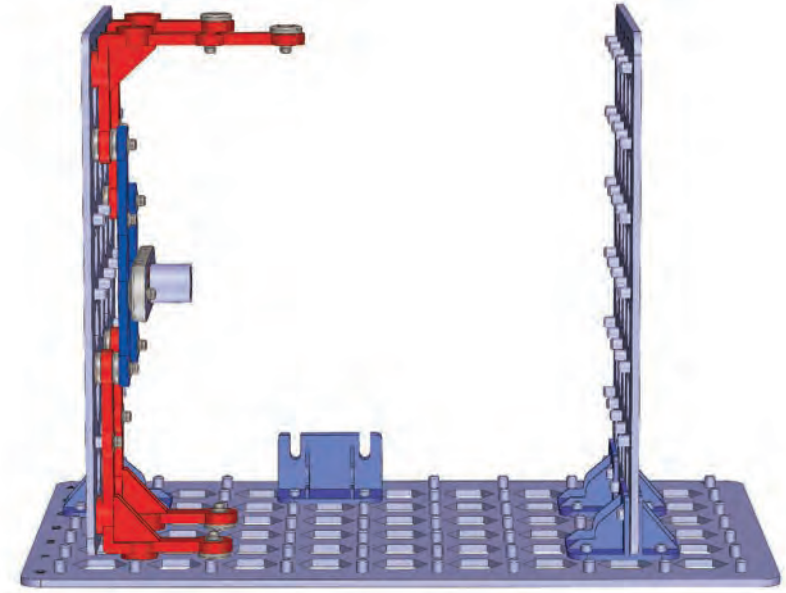


Assembly:

1. Place base grid supports on base grid A.

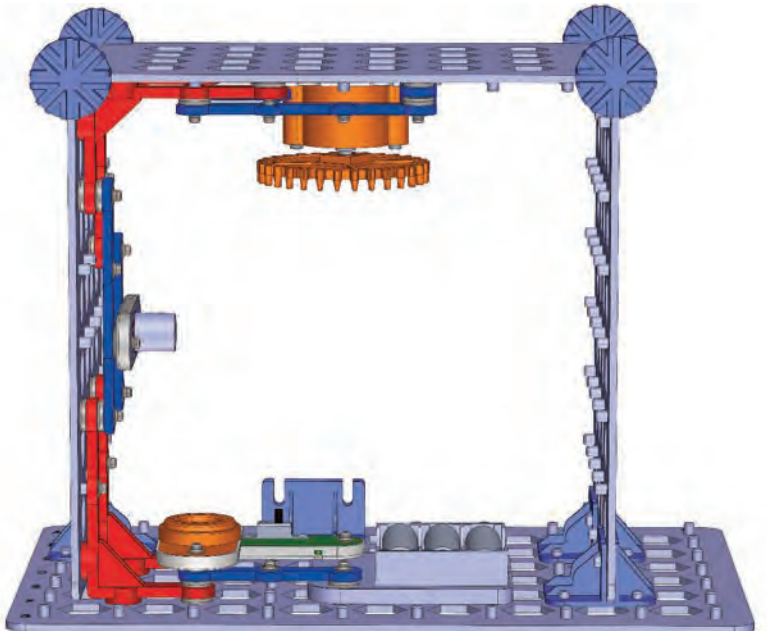


2. Place parts base grid B, then install grids B & D into base grid supports on grid A. The pegs on grid B must be pointed inward. Any of the mini grids can be the two-sided grid.



3. Attach the large gear to the gear insert, place it on the orange motor (M9) and secure it with the screw.
4. Place the orange motor on grid C, then mount grid C on top of grids B & D using 4 stabilizers.
5. Place the remaining parts on grids A & C.

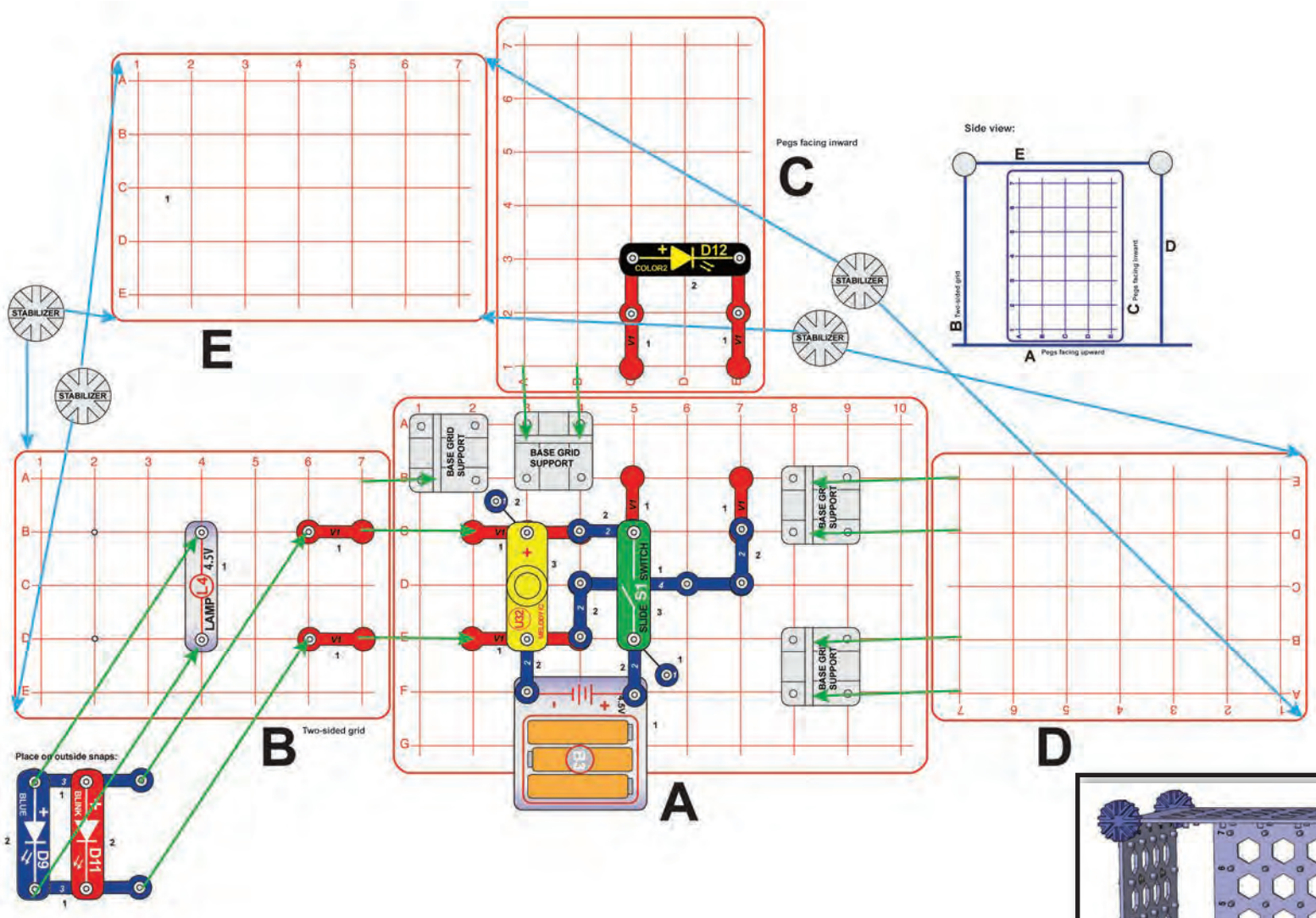
Turn on the slide switch (S1) to spin the large gear, light the lamp (L4), and play a melody.

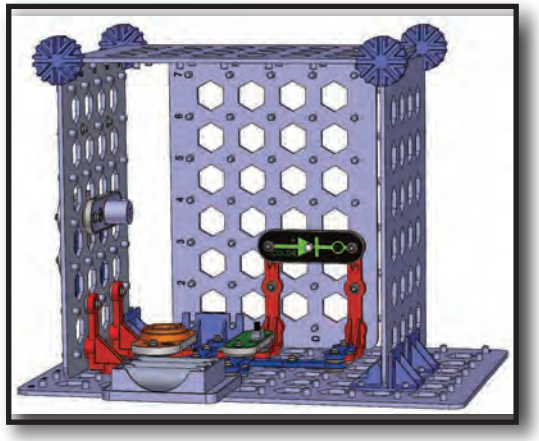


☐ Project 55 Quiet Chandelier Circuit

Use the preceding circuit, but remove the melody IC (U32), or replace it with one of the LEDs (D9, D11, or D12).

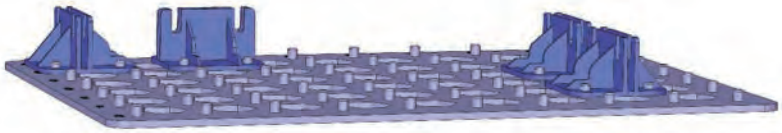
Project 56 Indoor & Outdoor Lights



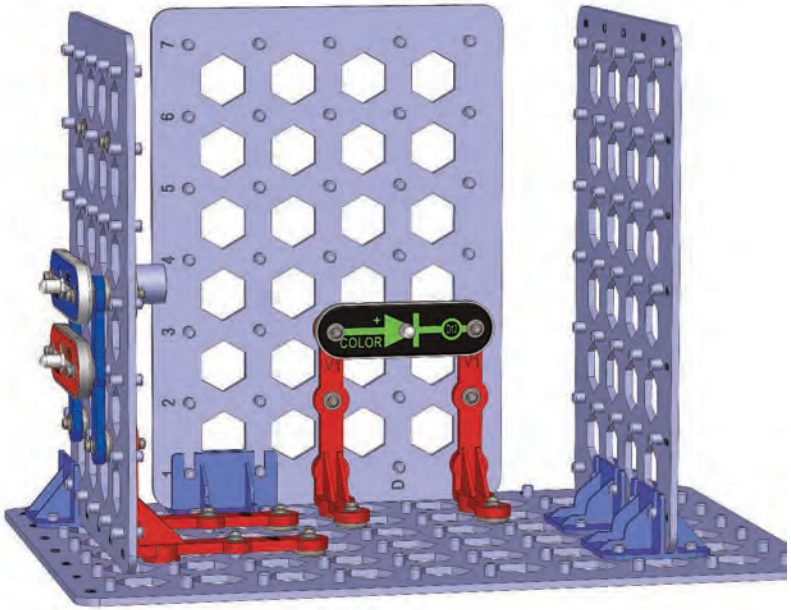


Assembly:

1. Place base grid supports on base grid A.

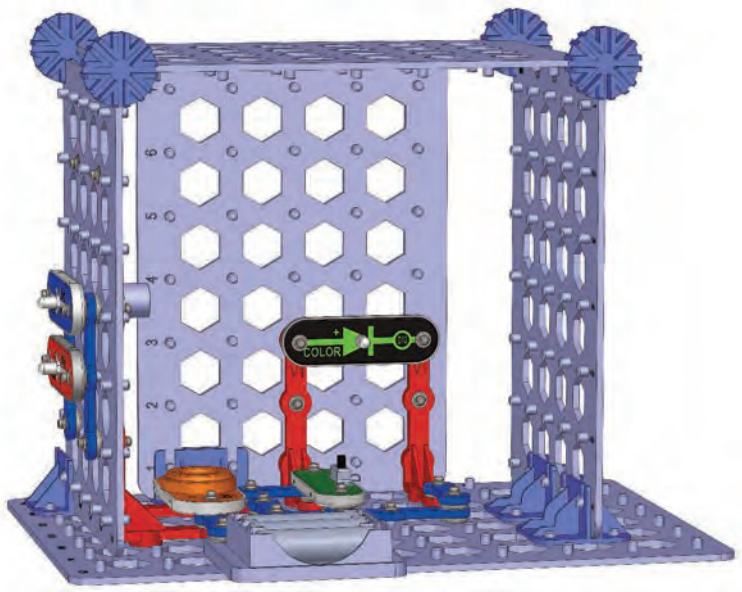


2. Place parts base grids B & C, then install grids B, C, & D into base grid supports on grid A. The pegs on grids C must be pointed inward. Grid B must be the two-sided grid.



3. Mount grid E on top of grids B & D using 4 stabilizers.

4. Place the remaining parts on grid A.



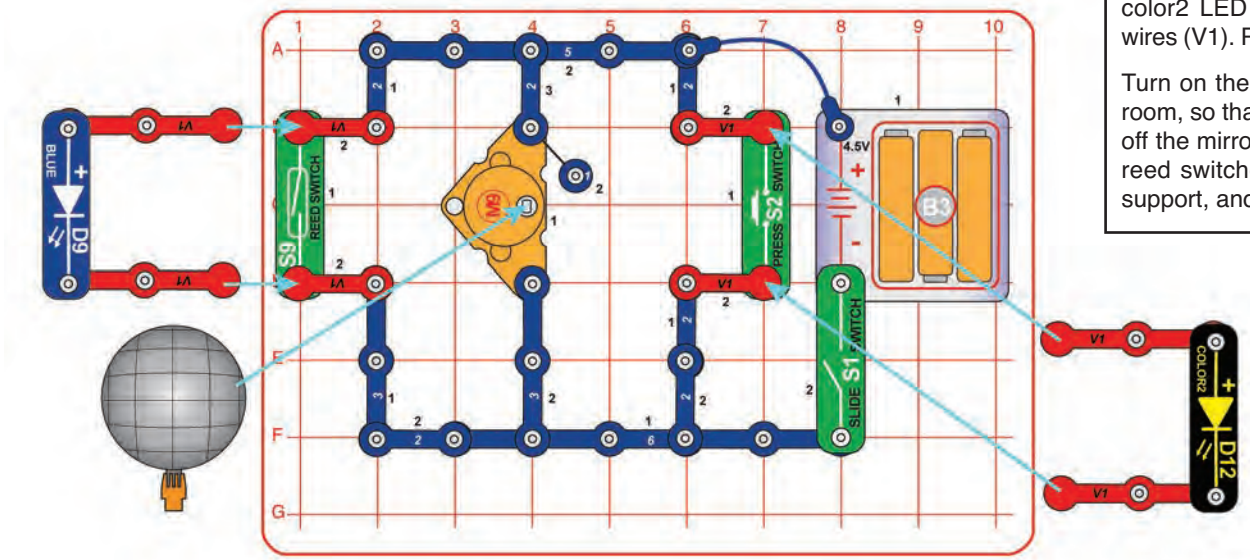
Turn on the slide switch (S1) to light the LEDs (D9, D11, & D12) and lamp (L4), and play a melody.

Project 57 Indoor & Outdoor

Use the preceding circuit, but remove the melody IC (U32), or replace it with the clear motor (M4) and wind fan. You can also re-arrange the lights, melody IC, or clear motor.

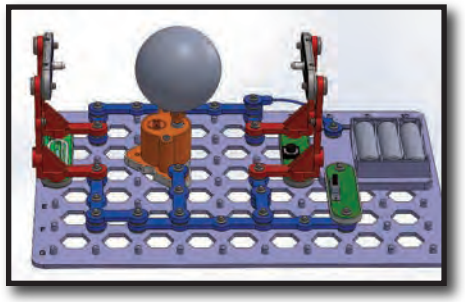
Project 58

Disco Lights



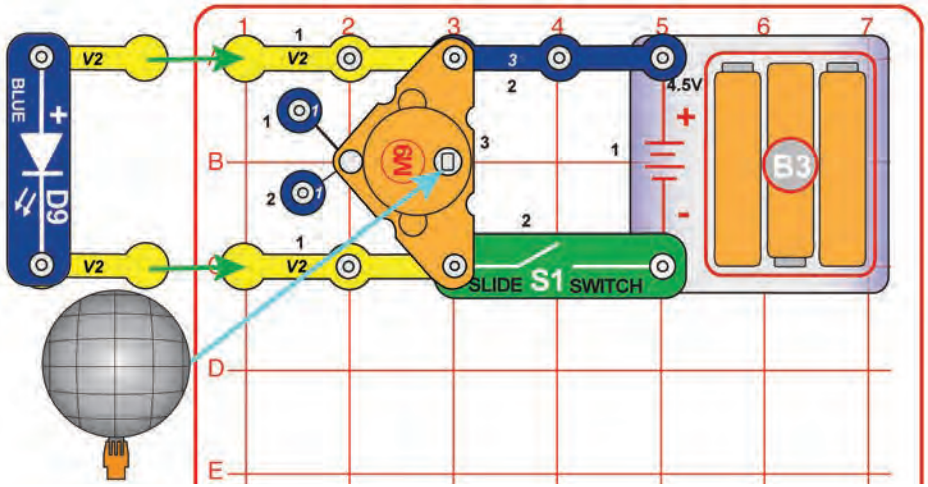
Build the circuit as shown; it has the blue LED (D9) and color2 LED (D12) each mounted on two vertical snap wires (V1). Place the mirror ball on the orange motor (M9).

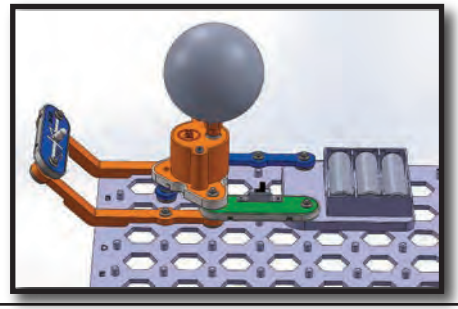
Turn on the slide switch (S1. Place the circuit in a dark room, so that light from the blue and color2 LEDs reflects off the mirror ball to the walls and ceiling. The press and reed switches (S2 & S9) are used only for mechanical support, and not electrically connected.



Project 59

Angled Disco Projector

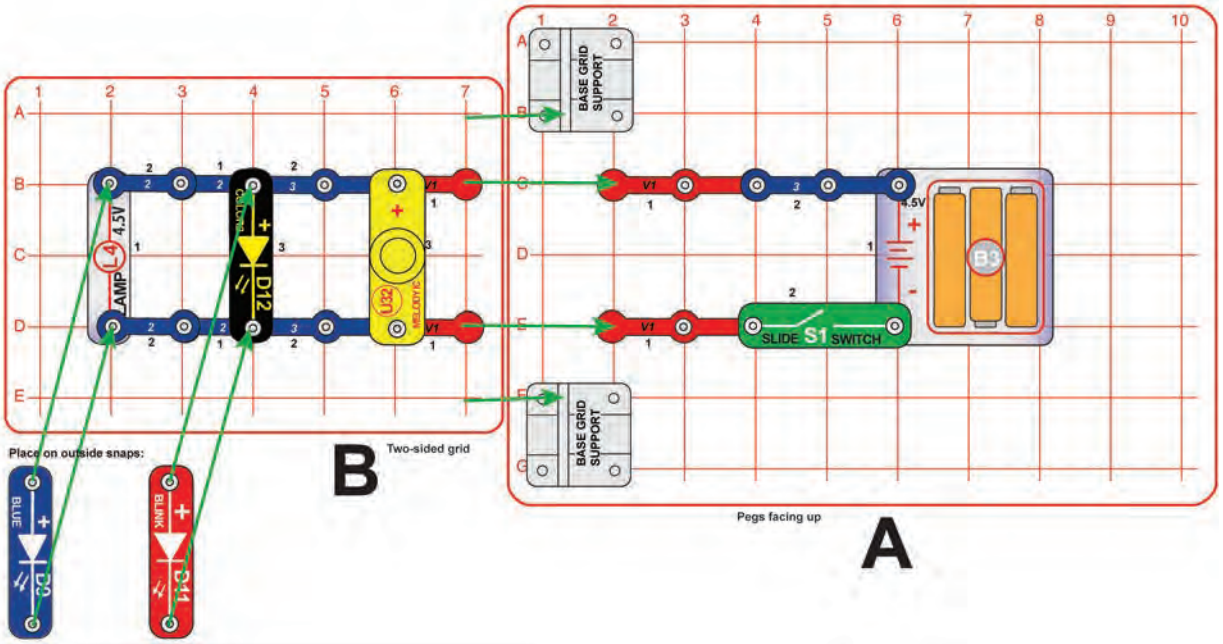




Build the circuit as shown; it has the blue LED (D9) mounted on two 45 degree vertical snap wires (V2). Place the mirror ball on the orange motor (M9).

Turn on the slide switch (S1) and place the circuit in a dark room, so that light from the blue LED reflects off the mirror ball to a nearby wall and ceiling.

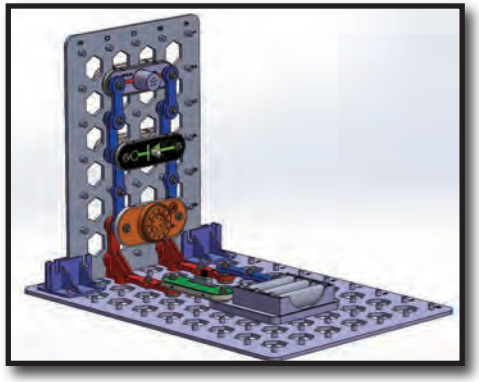
Project 60 Both Sides Lights



Assembly:

1. Place base grid supports on base grid A.
2. Place parts base grids B, then install grid B into base grid supports on grid Grid B must be the two-sided grid.
3. Place the remaining parts on grid A.

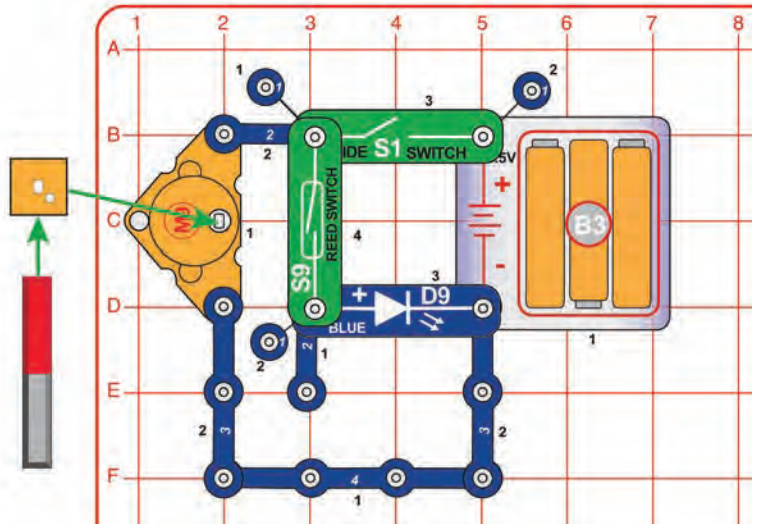
Turn on the slide switch (S1) to light the LEDs (D9, D11, & D12) and lamp (L4), and play a melody.



Project 61
Quiet Both Sides Lights

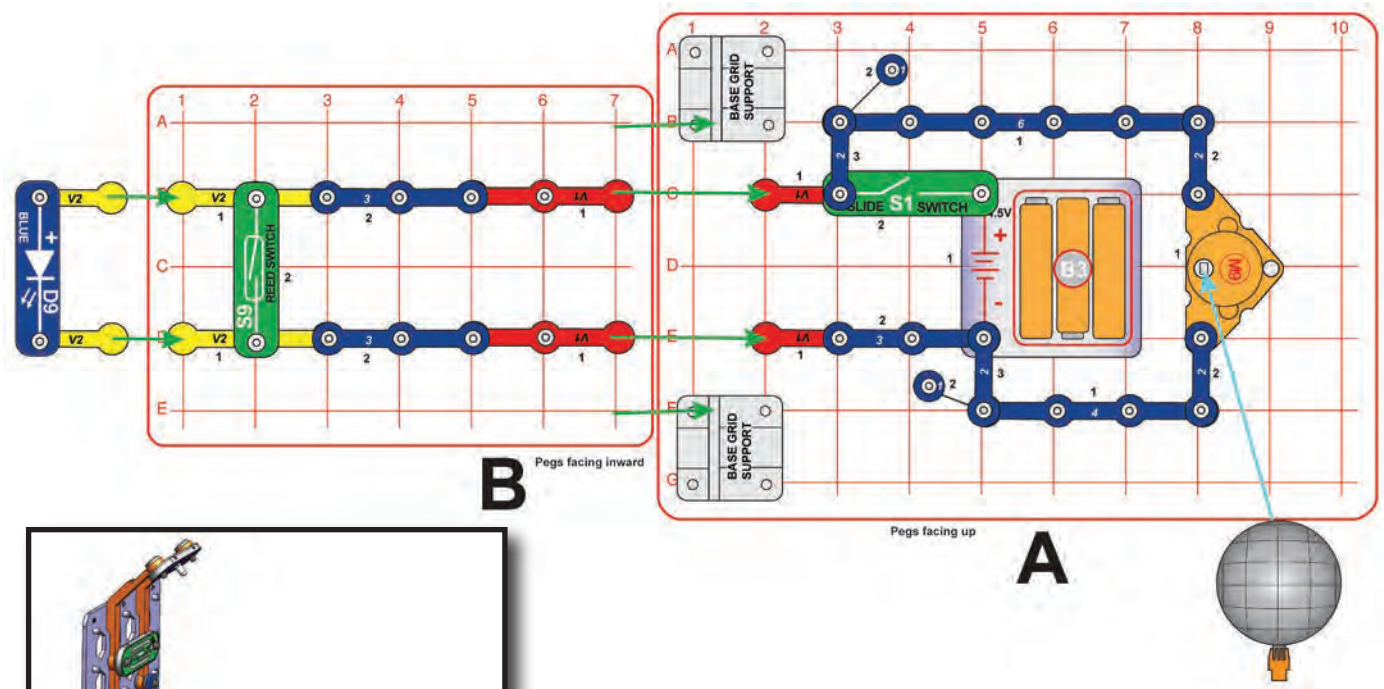
Use the preceding circuit, but remove the melody IC (U32). You can also re-arrange the lights.

Project 62 Spinning Magnet



Build the circuit, place the gear insert on the orange motor (M9), then lay the magnet so it is centered on the gear insert. Turn on the slide switch (S1). The orange motor slowly spins the magnet, activating the blue LED (D9) as the magnet passes over the reed switch (S9).

Project 63 Disco Spotlight

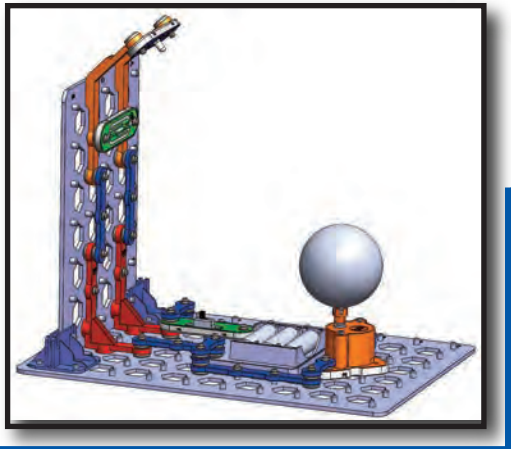


Assembly:

1. Place base grid supports on base grid A.
2. Place parts base grids B, then install grid B into base grid supports on grid A. Note that the blue LED (D9) is mounted on the 45 degree vertical snap wires (V2) so it can shine over grid A.
3. Place the remaining parts on grid A. Mount the mirror ball on the orange motor (M9).

Turn on the slide switch (S1). The orange motor spins the mirror ball, and the blue LED shines on it. Place the circuit in a dark room to see disco lights on the walls and ceiling.

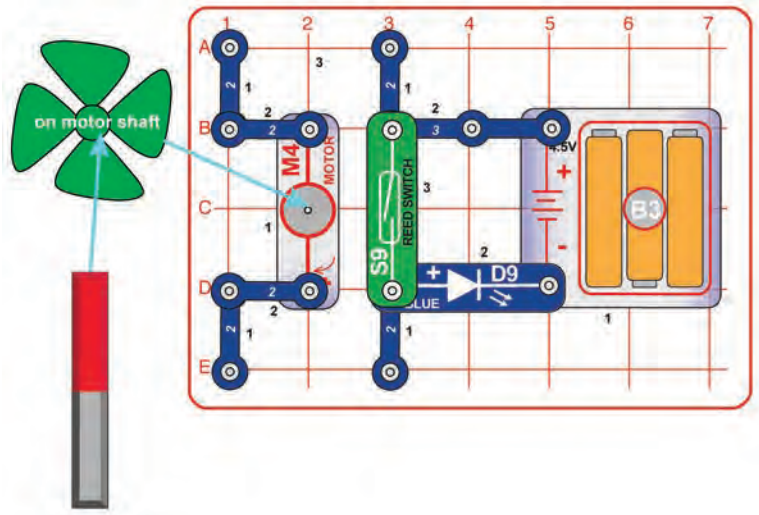
The reed switch is used here only for mechanical support, so do not activate it.



Project 64 Spotlight

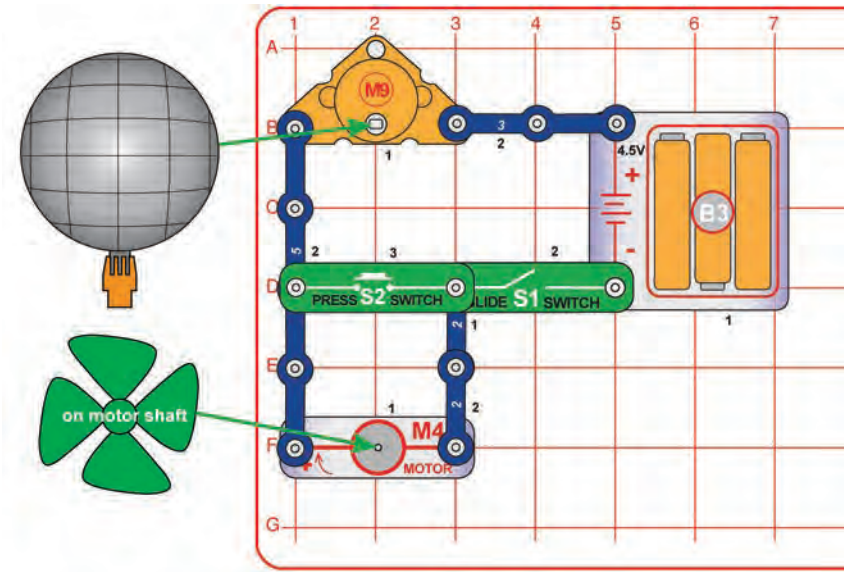
Use the preceding circuit, but replace the blue LED(D9) with the color2 LED (D12), blink red LED (D11), or the lamp (L4). You can also replace the orange motor (M9) and mirror ball with the clear motor (M4) and wind fan.

Project 65 Spin the Magnet



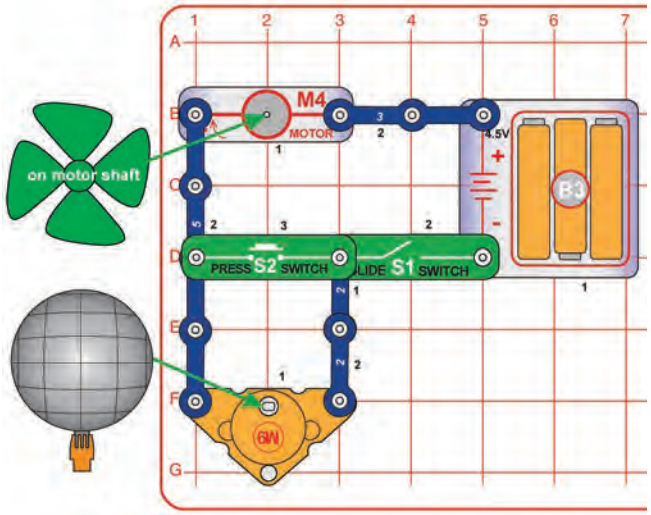
Build the circuit, with the wind fan mounted on the clear motor (M4). Lay the magnet on the fan and slowly spin the fan with your finger, keeping the magnet on the fan. The blue LED (D9) should turn on and off as the magnet moves over the reed switch (S9).

☐ Project 66 2-Speed Mirror Ball



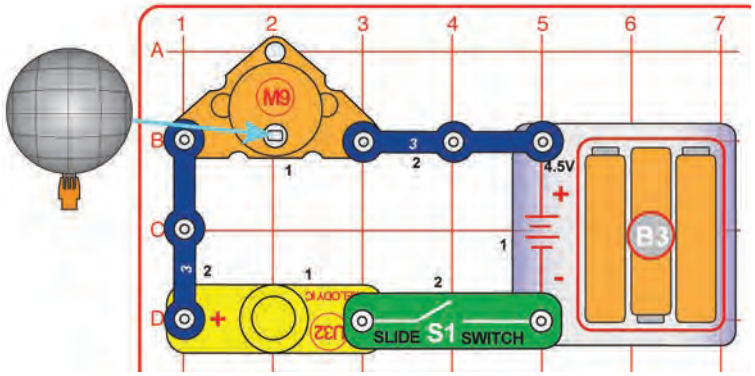
Build the circuit, placing the mirror ball on the orange motor (M9) and the wind fan on the clear motor (M4). Turn on the slide switch (S1); both the mirror ball and the fan spin. Push the press switch (S2) to speed up the mirror ball and shut off the fan.

☐ Project 67 2-Speed Fan



Use the preceding circuit but swap the locations of the orange and clear motors, to match the circuit shown here. Turn on the slide switch (S1); both the mirror ball and the fan spin. Push the press switch (S2) to speed up the fan and stop the mirror ball.

☐ Project 68 Musical Mirror Ball



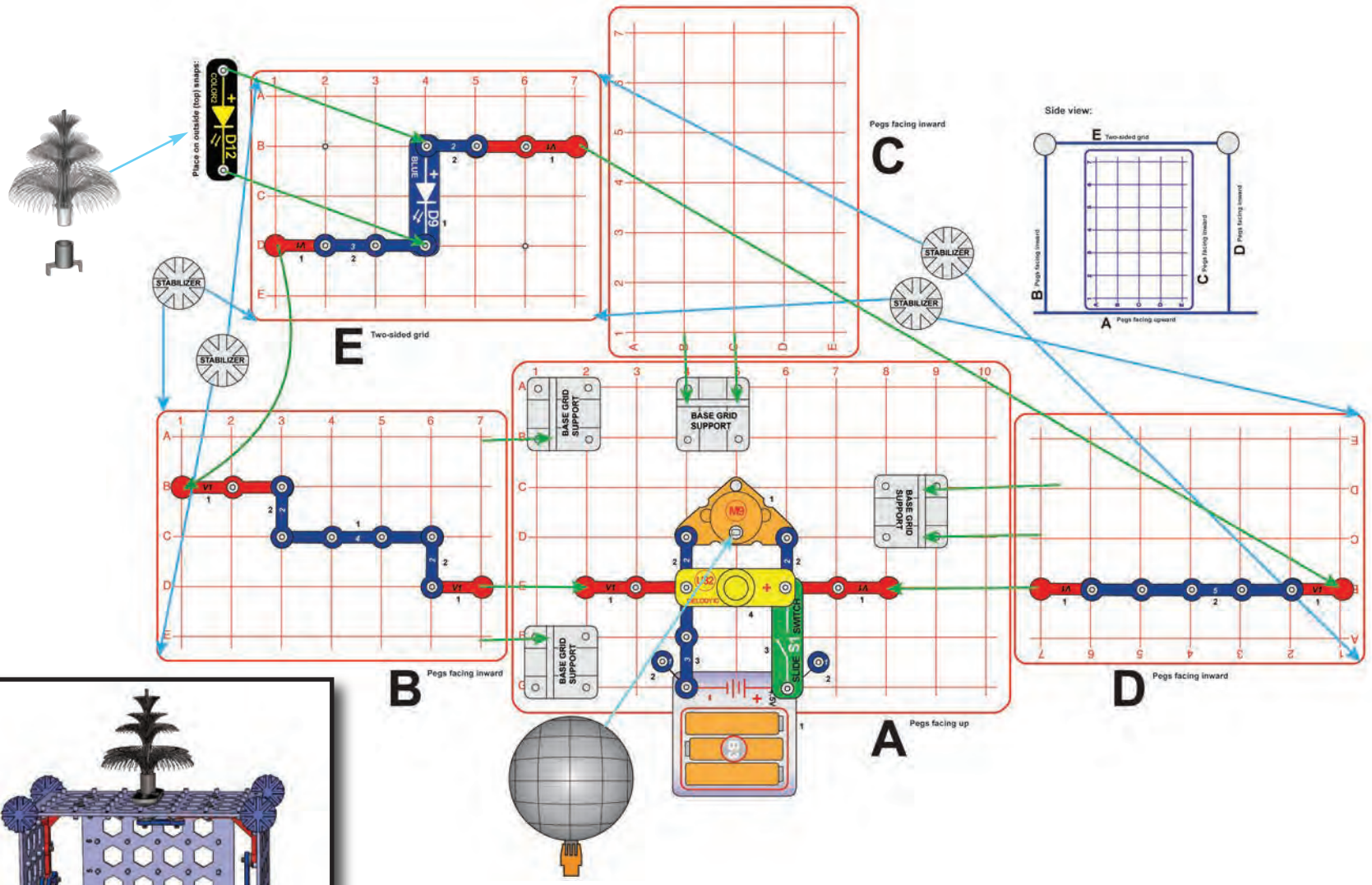
Build the circuit, placing the mirror ball on the orange motor (M9). Turn on the slide switch (S1). A melody plays and the mirror ball spins. The speed of the mirror ball varies as the melody changes. The sound may be abnormal, especially if your batteries are weak.

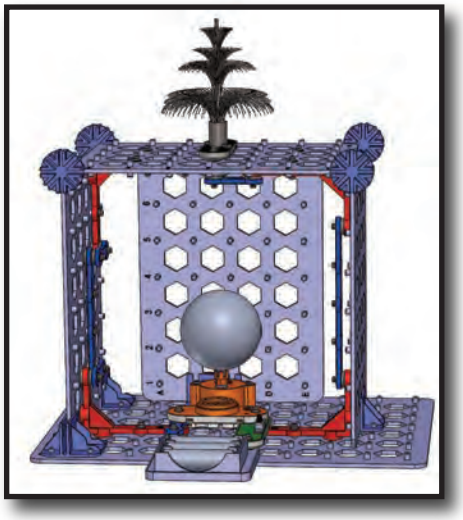
☐ Project 69 Musical Fan

Use the preceding circuit, but replace the orange motor (M9) and mirror ball with the clear motor (M4) and wind fan. The fan speed may vary a little as the melody changes, and the sound may be abnormal.

The clear motor briefly stops or reduces speed as the melody changes, but may be spinning too fast for the effects to be easily seen.

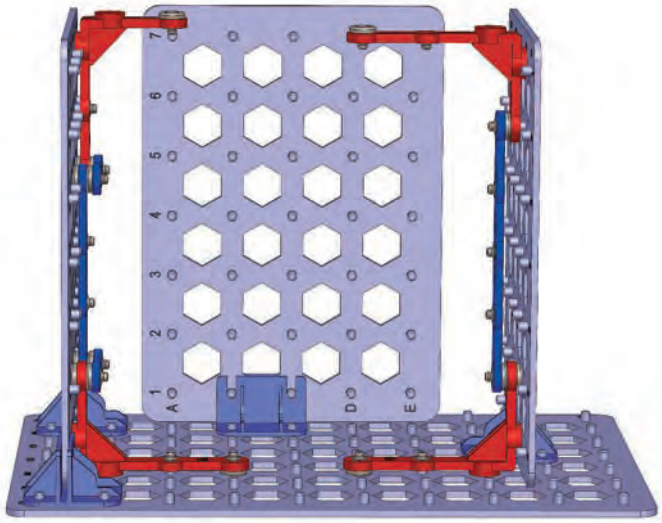
Project 70 Tree House



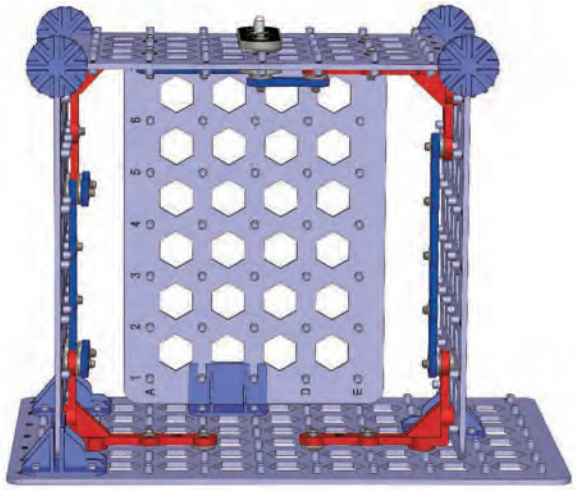


Assembly (adult supervision recommended):

1. Place base grid supports on base grid A.
2. Place parts base grids B & D, then install grids B, C, & D into base grid supports on grid A. The pegs must be pointed inward. Do not use the two-sided grid.

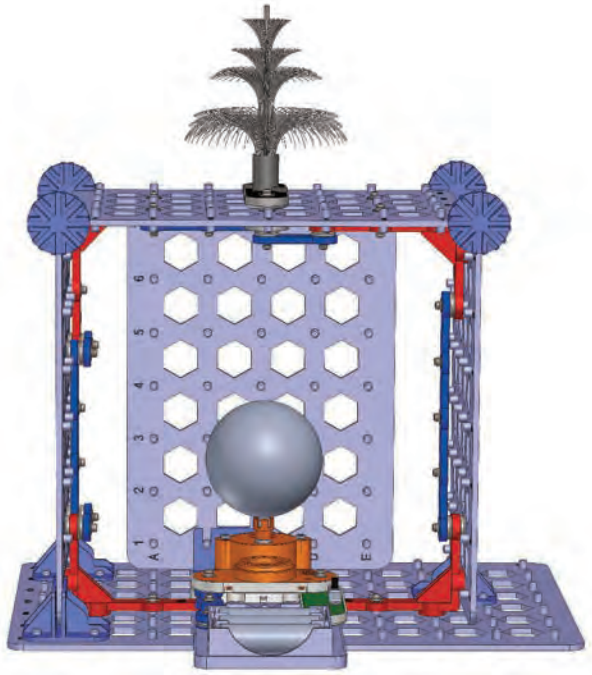


3. Place the blue & color2 LEDs (D9 & D12) on grid E, then mount grid E on top of grids B & D using 4 stabilizers, attaching the two 90 degree vertical snap wires (V1) as you do it. Grid E must be the two-sided grid. Place the remaining parts on grid E.



4. Place the remaining parts on grid A .Mount the mirror ball on the orange motor (M9), and mount the fiber optic festive tree on the color2 LED using the mounting base.

Turn on the slide switch (S1). The blue LED shines on the spinning mirror ball, the color2 LED lights up the festive tree, and the melody IC (U32) plays music. For best effects place the circuit in a dark room.



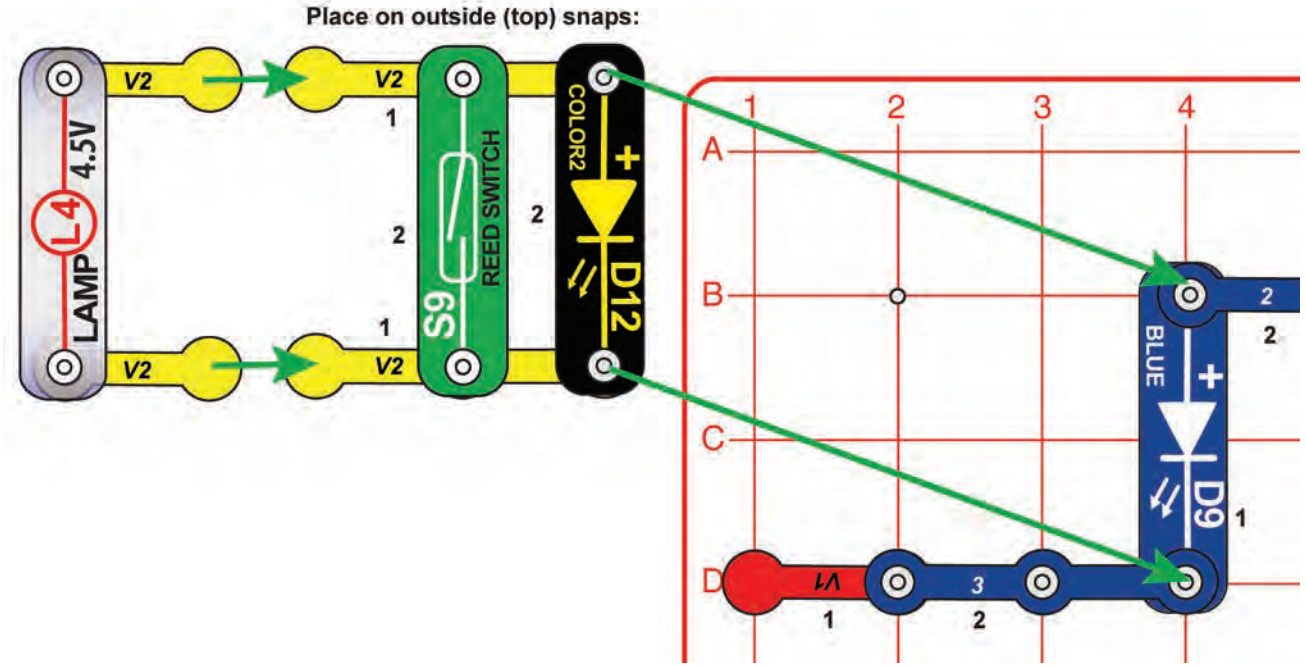
☐ Project 71 Brighter Tree House

Use the preceding circuit, but replace the blue LED (D9) with the lamp (L4).

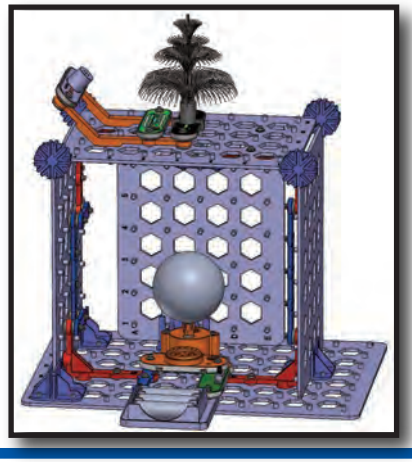
☐ Project 72 Blue Tree House

Use the project 70 circuit, but swap the locations of the blue LED (D9) and color2 LED (D12).

Project 73 Highlighted Tree House



Use the project 70 circuit, but add two 45 degree vertical snap wires (V2) beneath the color2 LED (D12). Then add the reed switch (S9) and lamp, so that the lamp will shine towards the festive tree. The reed switch is only used here for mechanical support, so do not use the magnet to activate it.



Project 74 Blinking Tree House

Use the preceding 4 circuits, but replace the lamp (L4), blue LED (D9), or color2 LED (D12) with the blink red LED (D11).

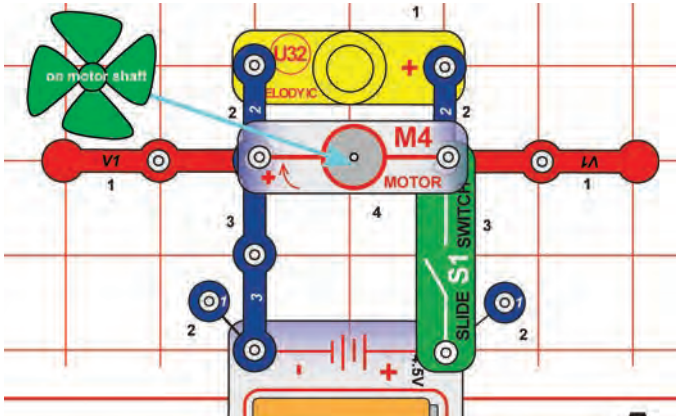
Project 75 Egg House

Use any of the preceding 5 circuits but replace the fiber optic festive tree with the egg.

Project 76 Silent Tree House

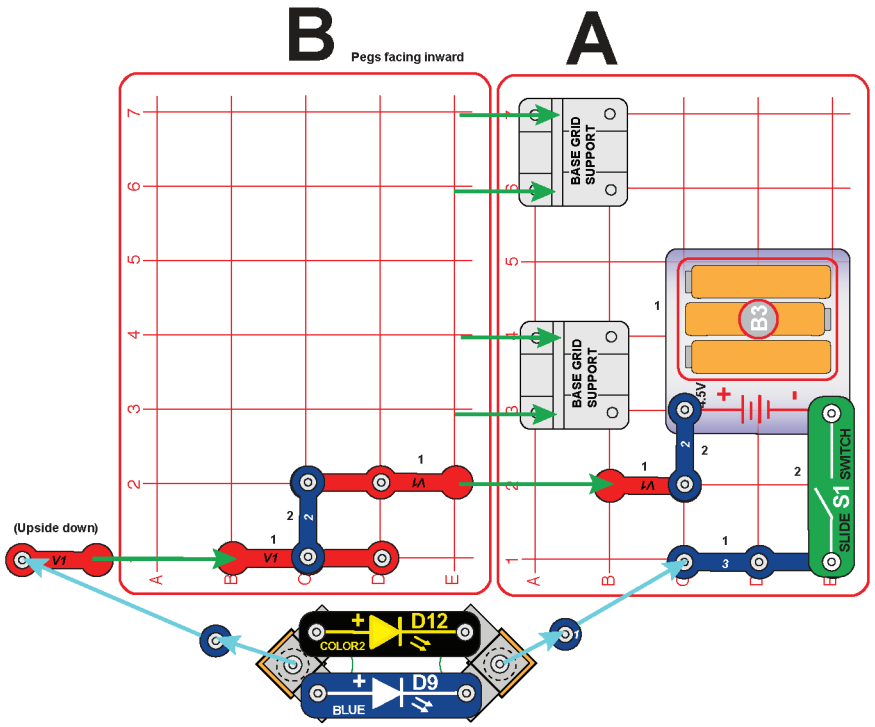
Use any of the preceding 6 circuits, but remove the melody IC (U32).

Project 77 Tree House with Fan



Use any of the preceding 7 circuits, but remove the orange motor (M9) and mirror ball, move the melody IC (U32) to where the orange motor was, then place the clear motor (M4) and wind fan where the melody IC was.

Project 78 Manual Rotation Vertical Lights



Assembly (adult supervision recommended):

1. Place base grid supports on base grid A.

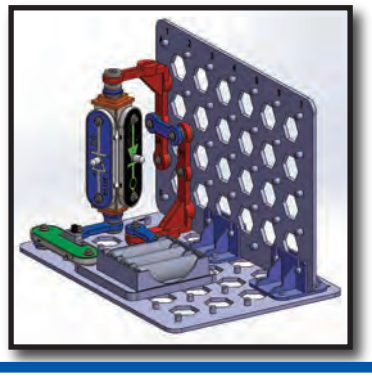
2. Place parts on grid B, and install into base grid support on grid A. The pegs should be facing inward.

3. Mount the blue & color2 and LEDs (D9 & D12) to the 3D snaps, and attach two 1-snap wires on opposite sides, as shown.

4. Place the remaining parts on grid A.

5. Mount the LED assembly from step 3 between the vertical snap wire that hangs upside down from grid B and the 3-snap wire on grid A, as shown. The "+" side of the LEDs should be up.

Turn on the slide switch (S1). The color2 and blue LEDs should light; rotate them to any desired position.

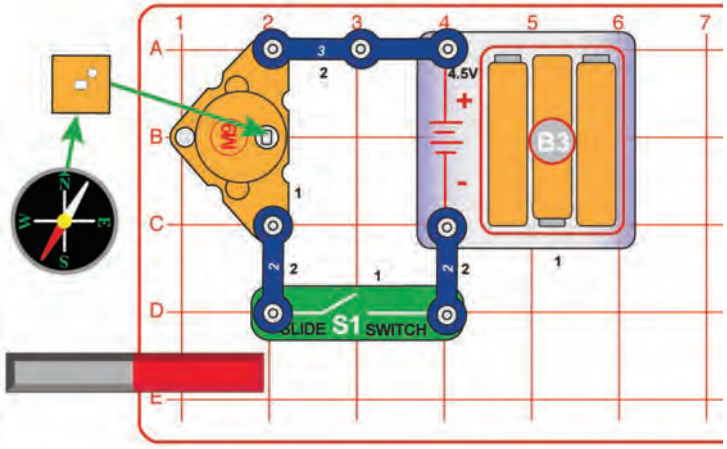


Project 79

Manual Rotation Vertical Lights Variants

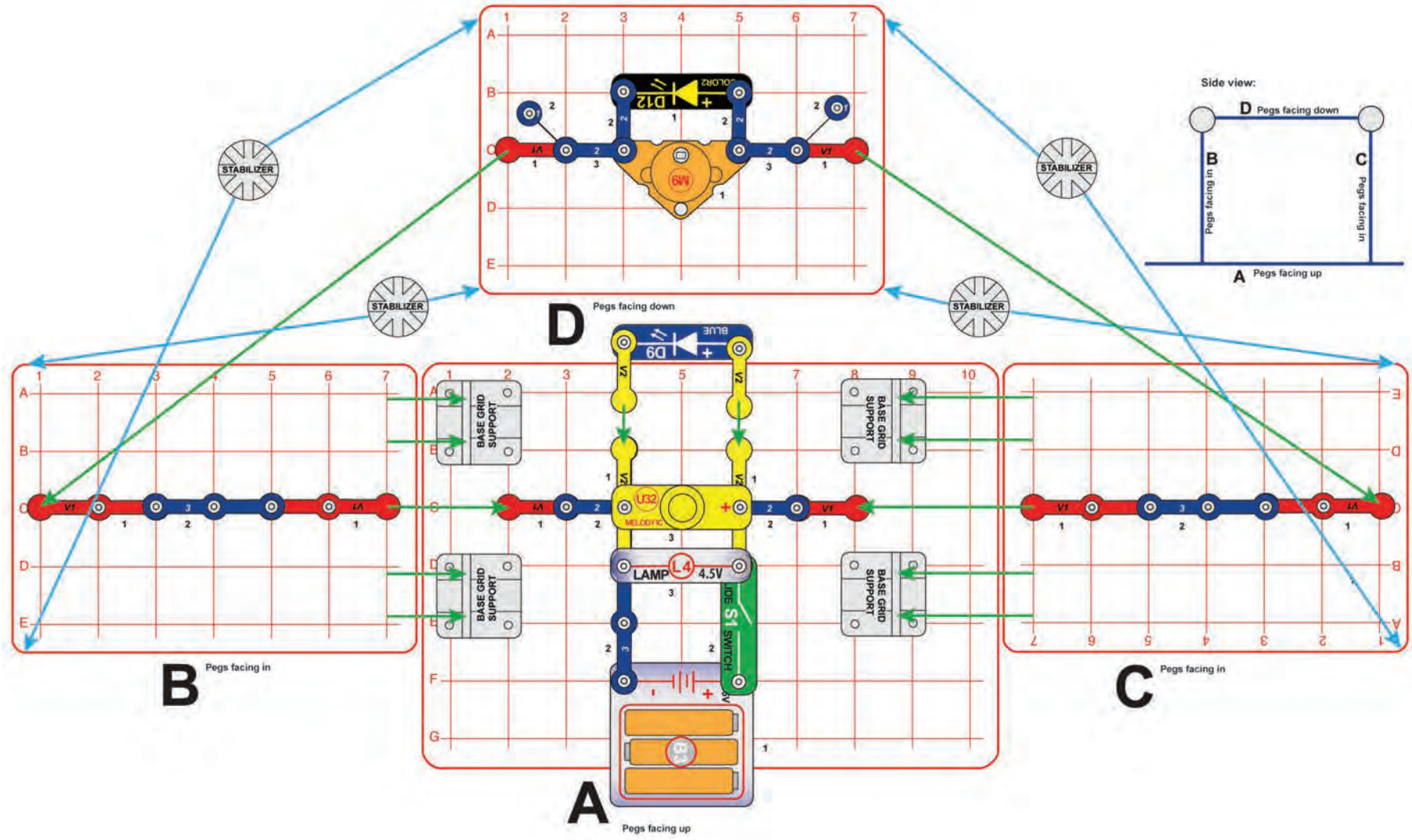
Use the preceding circuit, but replace any of the LEDs (D9 & D12) with the blink red LED (D11), the lamp (L4), or the melody IC (U32).

Project 80 Stay with the Magnet



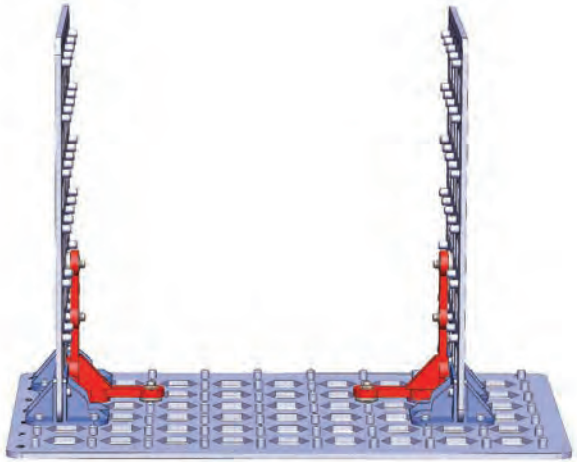
Build the circuit, mounting the gear insert on the orange motor (M9) and placing the compass so it is centered on the gear insert. Turn on the slide switch (S1) and hold the magnet near the side of the compass. The compass needle should always point towards the magnet, even as the motor rotates the compass. Move the magnet around until you find a position where this works well. Next, move the magnet far away. The compass needle should point north, and continue pointing north as the compass itself is rotated by the motor.

Project 81 Ceiling Disco Ball

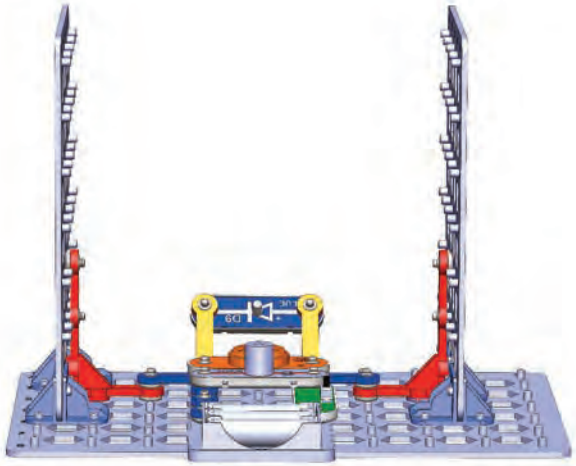


Assembly (adult supervision recommended):

1. Place base grid supports on base grid A.
2. Place parts on base grids B & C, and then install grids B & C into base grid supports on grid A. The pegs must be pointed inward. Do not use the two-sided grid.

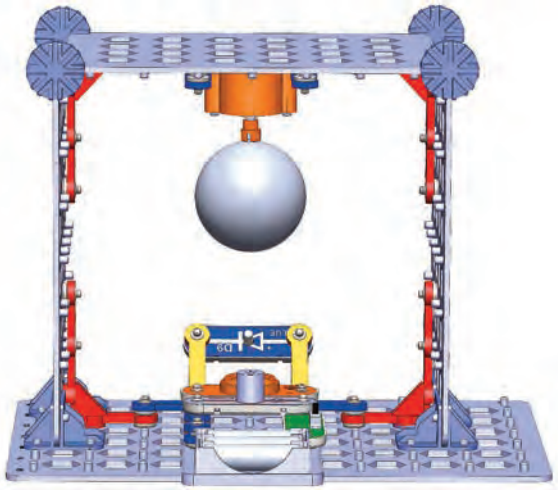


3. Place the parts on grid A.



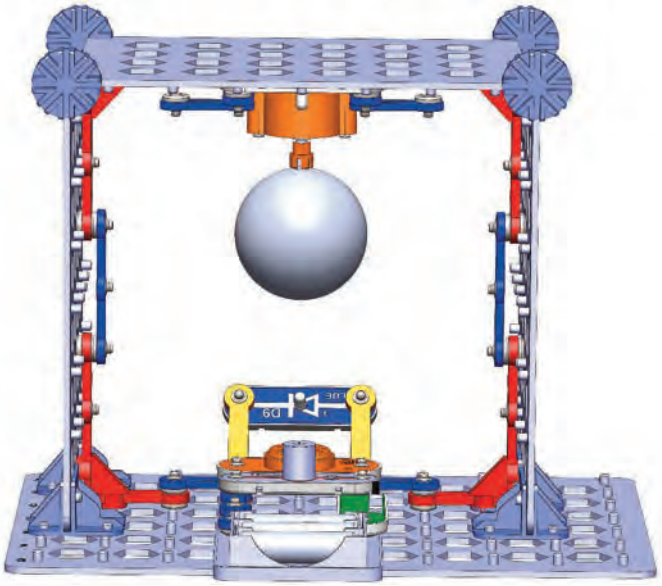
4. Mount the mirror ball (MB) on the orange motor (M9). Place the motor and color Led (D12) on the grid D, then connect the both parts use two 2-snaps.

5. Mount grid D on top of grids B & C using 4 stabilizers, attaching the two vertical snap wires (V1) as you do it.



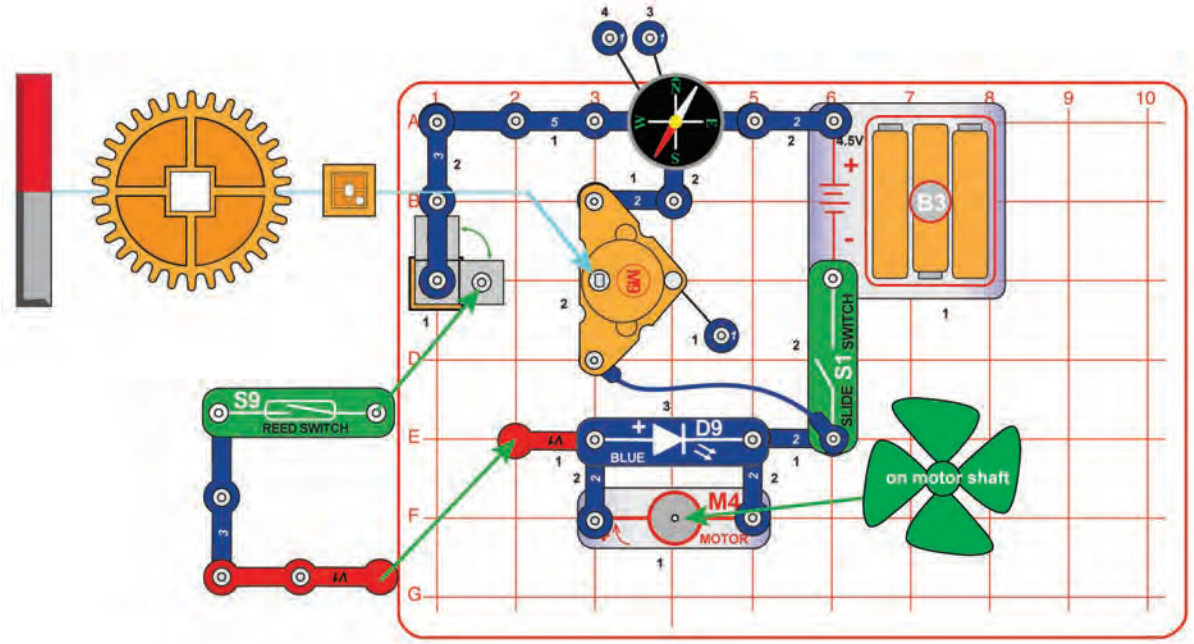
6. Place the remaining parts on grid D.

Turn on the slide switch (S1). The blue LED and lamp shines on the spinning mirror ball and the melody IC (U32) plays music. For best effects place the circuit in a dark room.



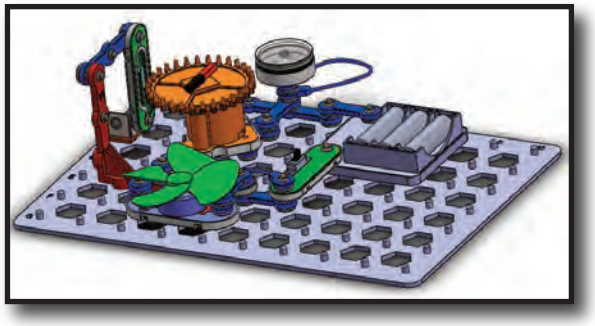
Project 82

Rotating Field



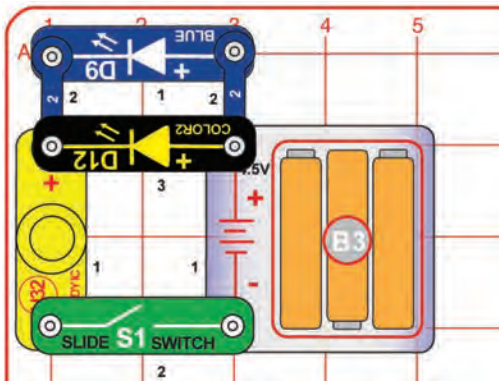
Build the circuit, mounting the gear insert and the large gear on the orange motor (M9). Place the magnet in the center of the gear.

Turn the slide switch (S1) on and the gear starts to rotate. When one end of the magnet faces the reed switch (S9), the fan spins and blue LED flashes. The compass needle will also rotate as it follows the rotating the magnetic field.



Project 83

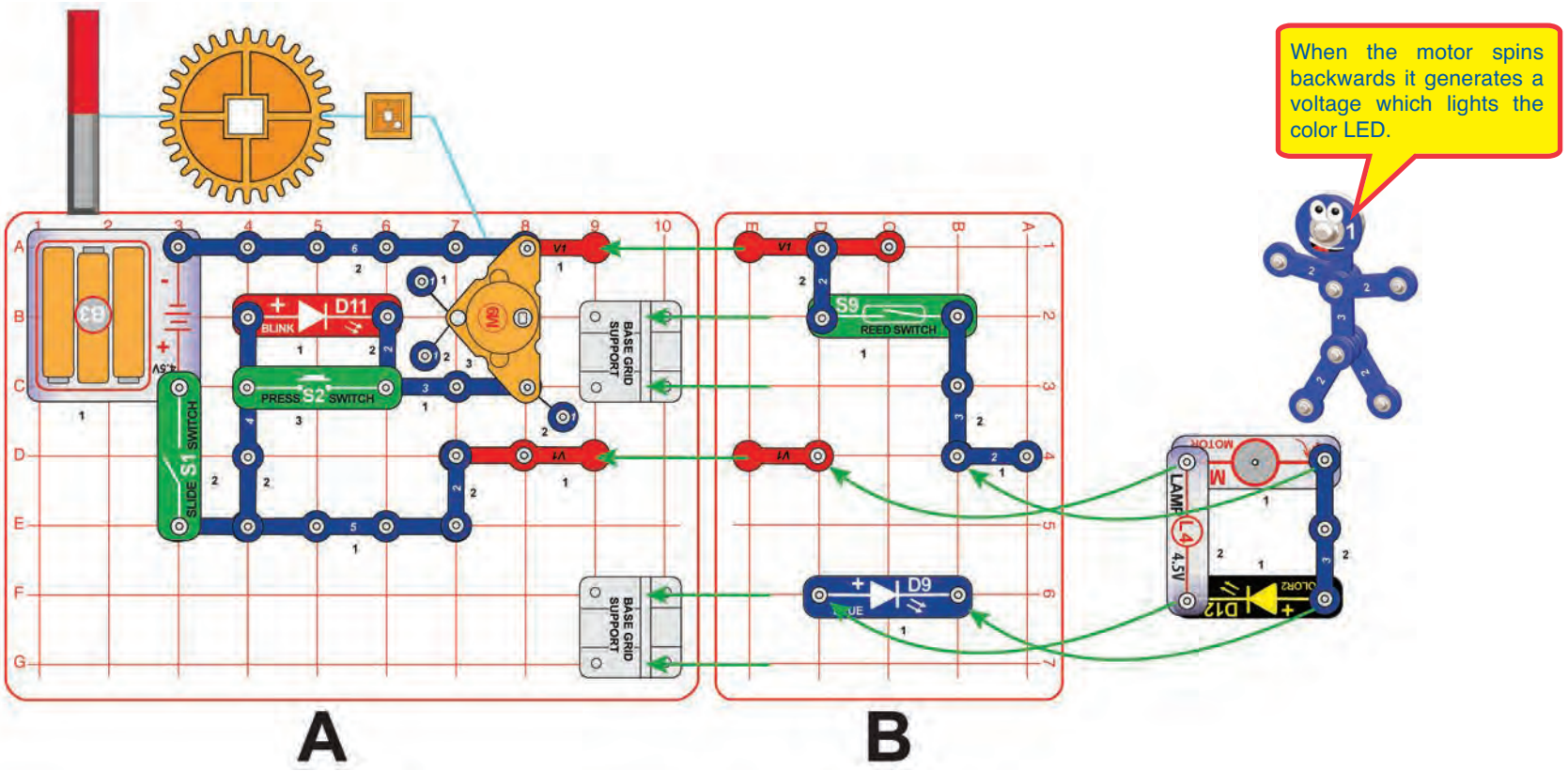
Flash and Sound



Turn on the slide switch (S1). The circuit makes strange sounds and lights. The sound is not very loud.

You can replace either LED (D9 or D12) with the blink red LED (D11).

Project 84 Lifter

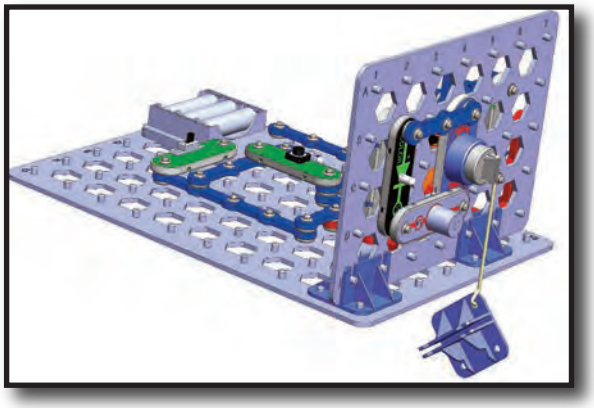


Assembly :

1. Place base grid supports on base grid A.
2. Place parts on both sides of the double sided grid B, then install grid B into base grid supports on grid A.
3. Place remaining parts on grid A. Mount the gear insert and the large gear on the orange motor (M9). Place the magnet in the center of the gear.
4. Mount the Illusion card holder onto the clear motor (M4) and insert string into the slots as shown.
5. Wind the string around the shaft several times to get it started.
6. Tie the other end of the string to a 45 degree vertical snap wire (V2) or base grid support.
7. Place circuit so the motor is over the edge of the table as shown.
8. Place the 45 degree vertical snap wire on the floor and wind the string around the shaft so it is straight.

Turn on the slide switch (S1). The gear starts turning as the red and blue LEDs (D11 & D9) light. When the magnet passes the reed switch (S9) the 45 degree vertical snap wire (or base grid support) rises then falls and the color2 LED (D12) flashes. Push the press switch (S2) if the orange motor does not start.

If the base grid support does not have enough weight to pull the string down, then tie the string to something heavier.



Project 85
Fast Lifter

Place a blue jumper wire across the red LED (D11). Turn on the slide switch (S1); the 45 degree vertical snap wire (V2) rises and falls more often since the gear spins faster.

You can also swap the blue & red LEDs (D9 & D11) to make the lights different.

Project 86
Magnet Fan

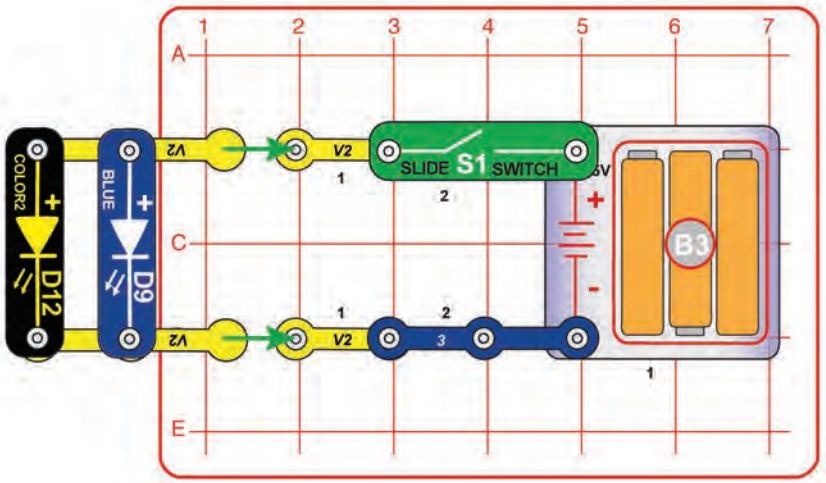
Use Project 84 circuit, but remove the string and 45 degree vertical snap wire (V2). Replace with the Illusion card holder with the fan. Turn on the slide switch (S1); when the magnet passes the reed switch (S9) the fan spins and then turns off. The color2 LED (D12) will not flash since the motor does not turn backwards.

Project 87
Fast Magnet Fan

Use the preceding circuit, but place the blue jumper wire across the red LED (D11). Turn on the slide switch (S1); the fan spins more often since the gear spins faster.

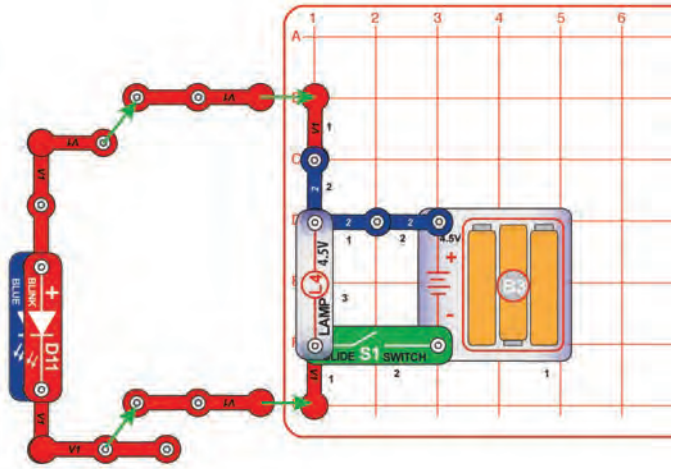
You can also swap the blue & red LEDs (D9 & D11) to make the lights different.

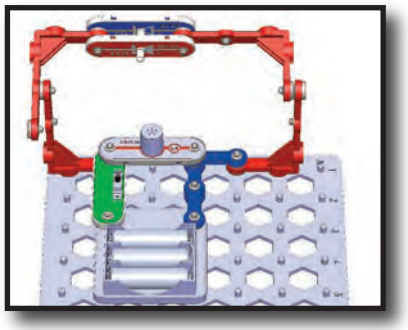
Project 88 45° LEDs



Place all the parts on the base grid, then install the blue LED (D9) and color LED (D12) on the 45 degree snap wires (V2). Turn on the slide switch (S1); both LEDs should light.

Project 89 Pivot LED Bar

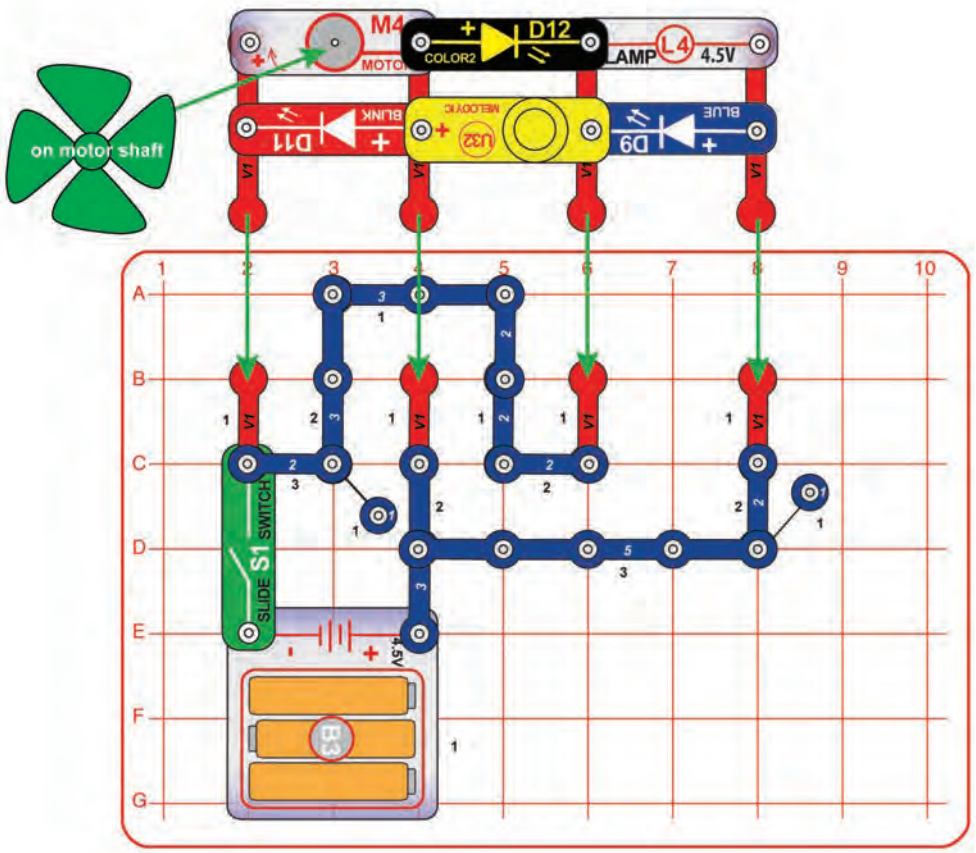


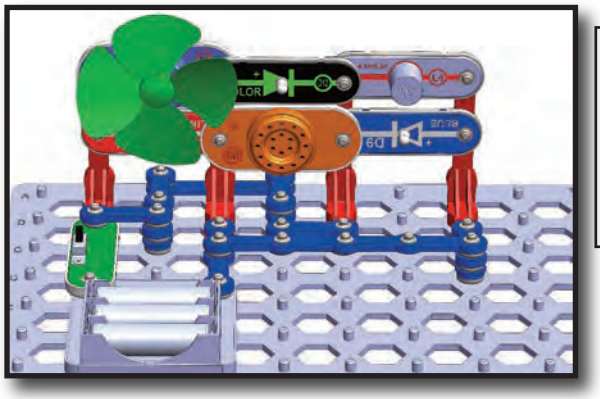


Place the parts on the base grid, then assemble the parts on the vertical snap wires (V1).

Push the press switch (S2) on; the LEDs and lamp turn on. The LEDs pivots around the top snap of vertical snap wires; move the LEDs to different positions,

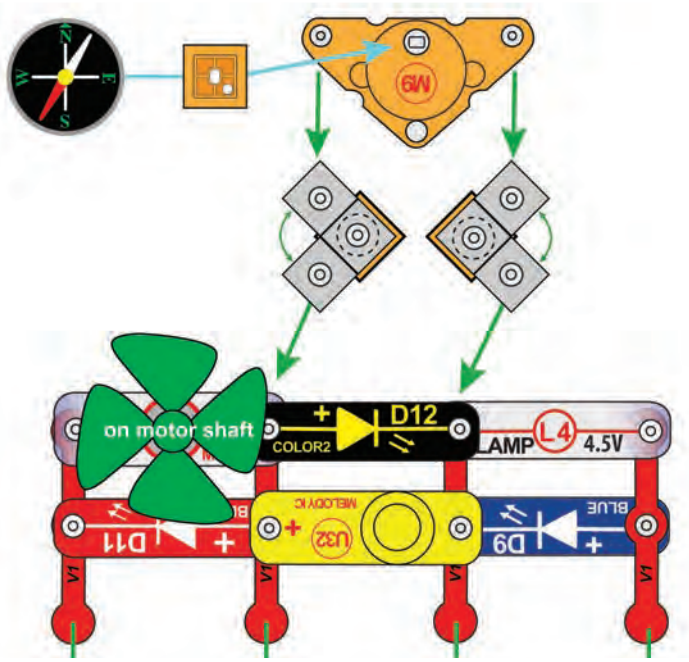
Project 90 Side Ways





Place all the parts on the base grid, then the parts on the four vertical snap wires. Turn on the slide switch (S1); the lights turn on, the fan spins, and the music plays.

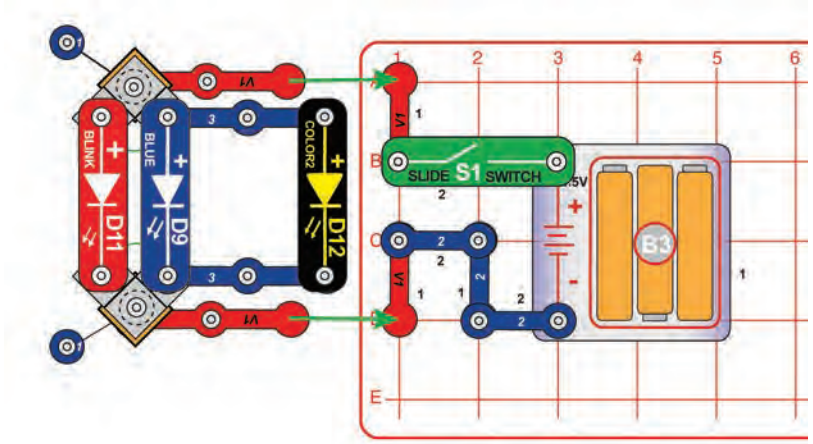
Project 91 Side Ways 2



Use the preceding circuit, but attach a 3D snap on the back of the two vertical snap wires (V1) connected to the clear motor (M4) and lamp (L4). Attach the orange motor (M9) across the two 3D snaps as shown. Mount the gear insert and large gear on the orange motor.

Turn on the slide switch (S1). The lights turn on, music plays, the fan spins, and the gear rotates.

Project 92 Swing LEDs

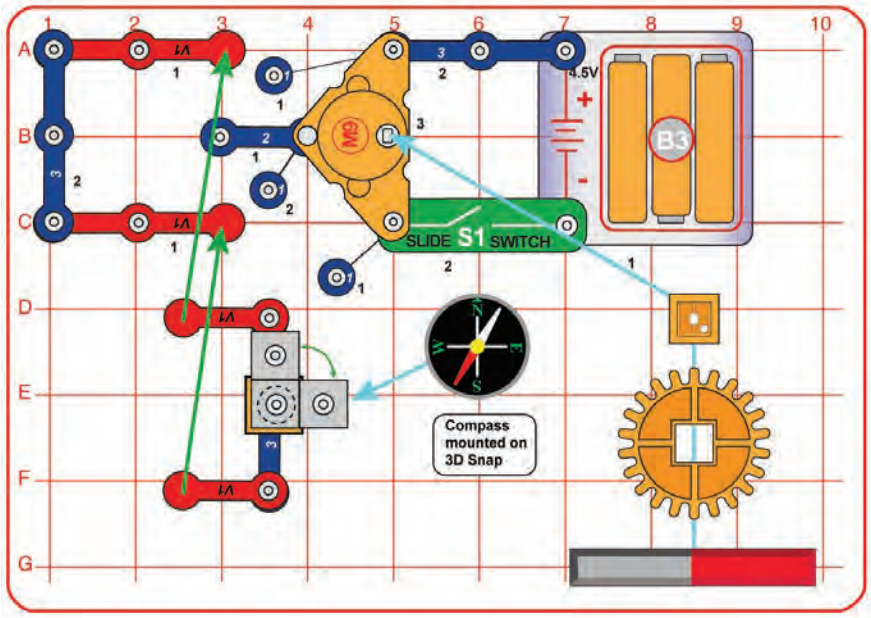


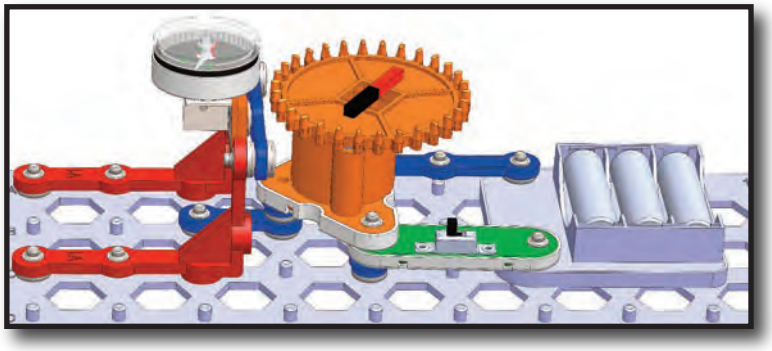
Place all the parts on the base grid, then assemble the LEDs on the vertical snap wires (V1). Turn on the slide switch (S1) and all the LEDs light. Adjust the LEDs to different angles.

Project 93 Swing LEDs ?

Place the circuit on a white page and rotate so the LEDs are facing down. Turn on the switch; a color pattern shines on the page. Change the image size by rotating the LEDs upwards.

Project 94 Follow the Field





Build the circuit as shown, mounting the gear insert and the small gear on the orange motor (M9). Place the magnet in the center of the gear.

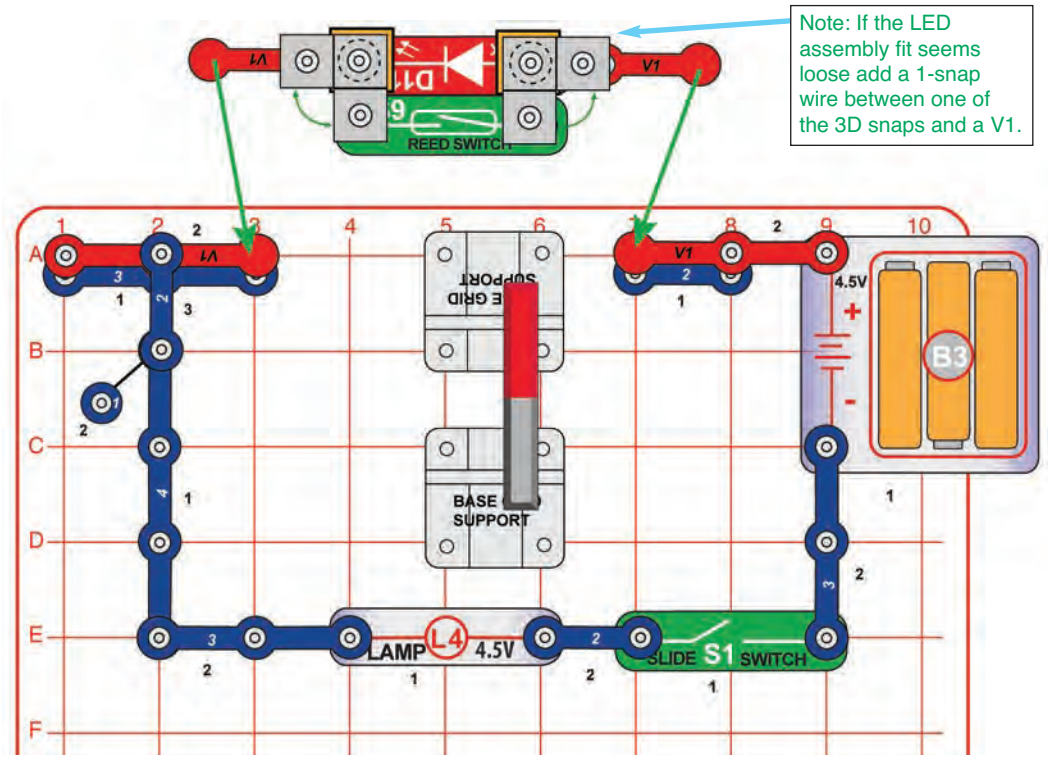
Mount the compass on the 3D snap, making sure it is level. Turn on the slide switch (S1). The gear and compass needle should be turning in opposite directions.

You can use a compass to trace out the magnetic field lines of a bar magnet. The needle of a compass is itself a permanent magnet and the north indicator of the compass is a magnetic north pole.

A magnetic north pole will attract the south pole of another magnet, and repel a north pole.

Project 95

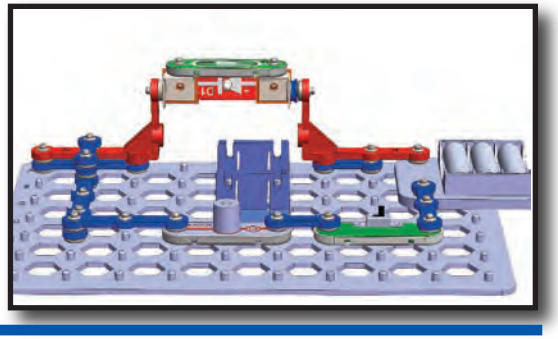
Rocking Switch



Build the circuit, then place the magnet across the base grid supports as shown. Turn on the slide switch (S1) and the red LED (D11) starts blinking. Slowly rotate the reed switch (S9) towards the magnet. When the reed switch is close enough to the magnet the switch closes, the lamp (L4) lights, and the LED turns off.

The magnetic field holding the switch closed decreases as the switch moves past the magnet. The switch opens again, lamp turns off, and the LED blinks.

Reed switches are used in security systems to indicate if a door or window is opened.



Project 96

Disco Ball Switch

Use the preceding circuit. Place the orange motor (M9) across base grid locations F4 & F6 on level 1. Connect the motor across the lamp using two blue jumper wires (J4). Mount the mirror ball on the motor and move the reed switch (S9) away from the magnet. Turn on the slide switch (S1); when the reed switch is on, the disco ball rotates and the lamp lights.

Project 97

Disco Ball Melody

Use the preceding circuit, but replace the lamp (L4) with the melody IC (U32, + on left). Turn on the slide switch (S1); when the reed switch (S9) is closed the disco ball rotates and the melody IC sounds.

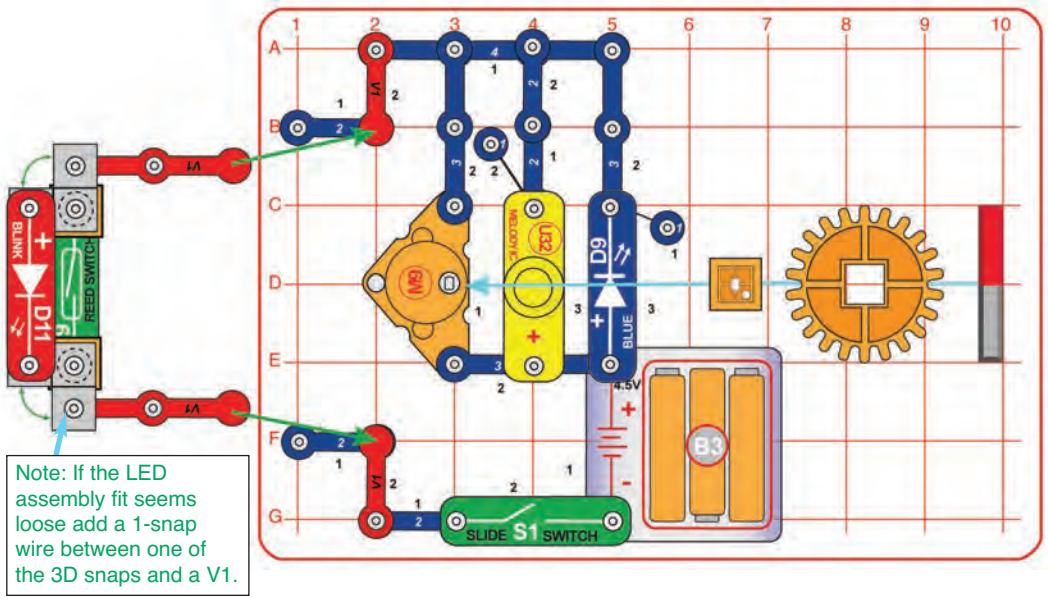
Project 98

Rocking Switch LEDs

Use project 95. Place the color2 LED (D12) and the blue LED (D9) across base grid locations F4 & F6 and G4 & G6 on level 1. Connect the LEDs using 2-snaps across F4 & G4 and F6 & G6 on level 2. Place two blue jumper wires (J4) across E4 & F4 and E6 & F6. Now, all lights turn on when the reed switch is closed.

Project 99

Speed Change

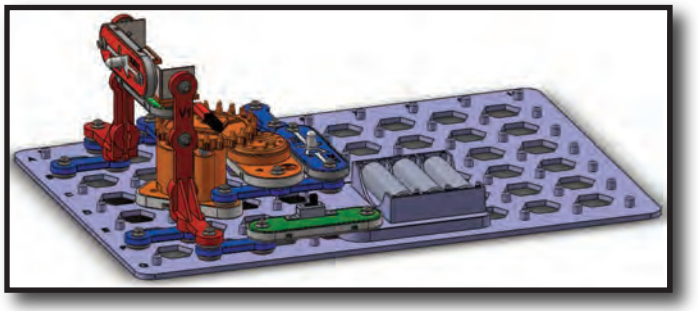


Note: If the LED assembly fit seems loose add a 1-snap wire between one of the 3D snaps and a V1.

Build the circuit as shown; mounting the gear insert and the small gear on the orange motor (M9). Place the magnet in the center of the gear.

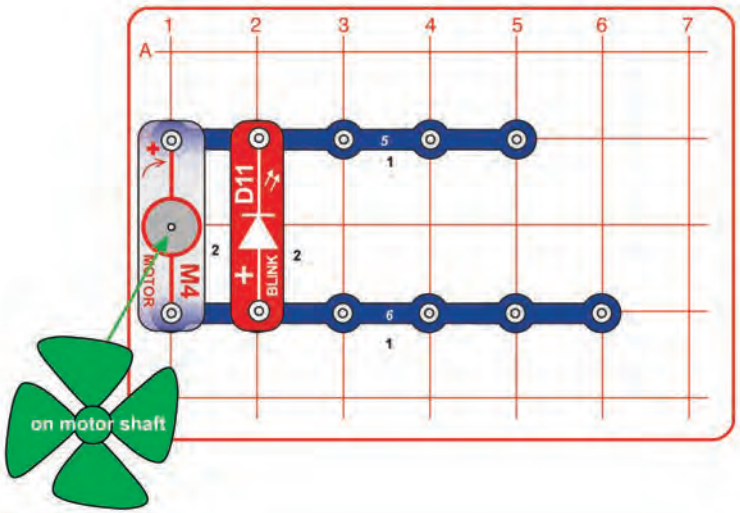
Turn the slide switch (S1) on; the gear rotates, and the blue LED (D9) lights as a melody plays. Rotate reed switch to different positions.

When the end of the magnet is towards the reed switch (S9), the reed switch turns on. The orange motor slows, the red LED (D11) starts blinking, and the blue LED and melody IC (U32) turn off until the magnet end passes.



Project 100

Fan Power



Build the circuit shown. Blow on the fan so the clear motor (M4) generates enough voltage to light the blink red LED (D11).

Now place the color2 LED (D12) across base grid locations B4-D4 (+ at D4). Blow on the fan again to light both LEDs.

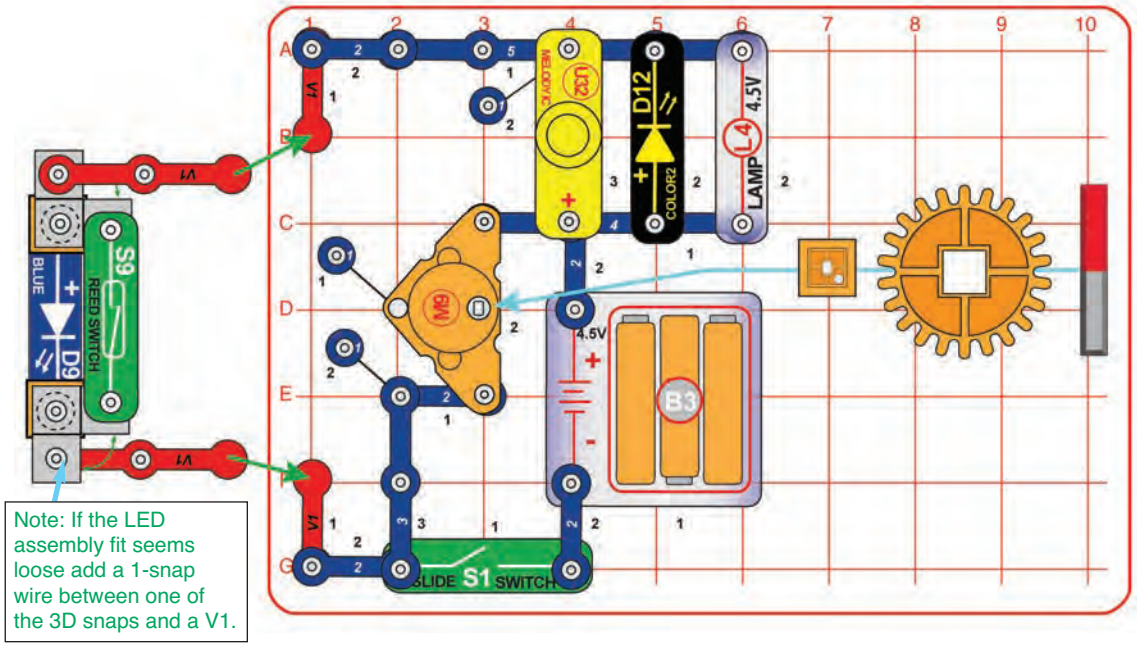
Project 101

Fan Power 2

Use the preceding circuit, but place the blue LED (D9) across base grid locations B4 & D4 and the melody IC (U32) across B5 & D5 (+ at bottom). The fan really needs to spin very fast for all the LEDs to light and the melody IC to make sound.

Project 102

Door Bell



Note: If the LED assembly fit seems loose add a 1-snap wire between one of the 3D snaps and a V1.

Build the circuit; mounting the gear insert and the small gear on the orange motor (M9) as shown. Place the magnet on the gear. Turn the slide switch (S1) on; the gear rotates and the blue LED (D9) lights. When the magnet moves near the reed switch (S9), the melody IC (U32), color2 LED (D12), and lamp (L4) turn on and off twice. The melody IC sounds like a door bell.

Project 103

Door Bell Lights

Use the preceding circuit, but place one of the LED attachments (fiber optic festive tree or egg) on the color2 LED (D12), and dim the room lights. The fiber optic festive tree must be used with its mounting base.

Project 104

Fan Speed

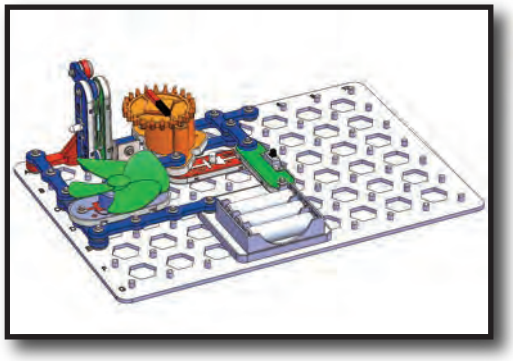
Use the project 102 circuit, but replace the lamp (L4) with the clear motor (M4) and fan. Turn the slide switch (S1) on; the blue lights and the fan spins slowly. When the reed switch closes U32, D12 and L4 turn on and the fan speeds up.

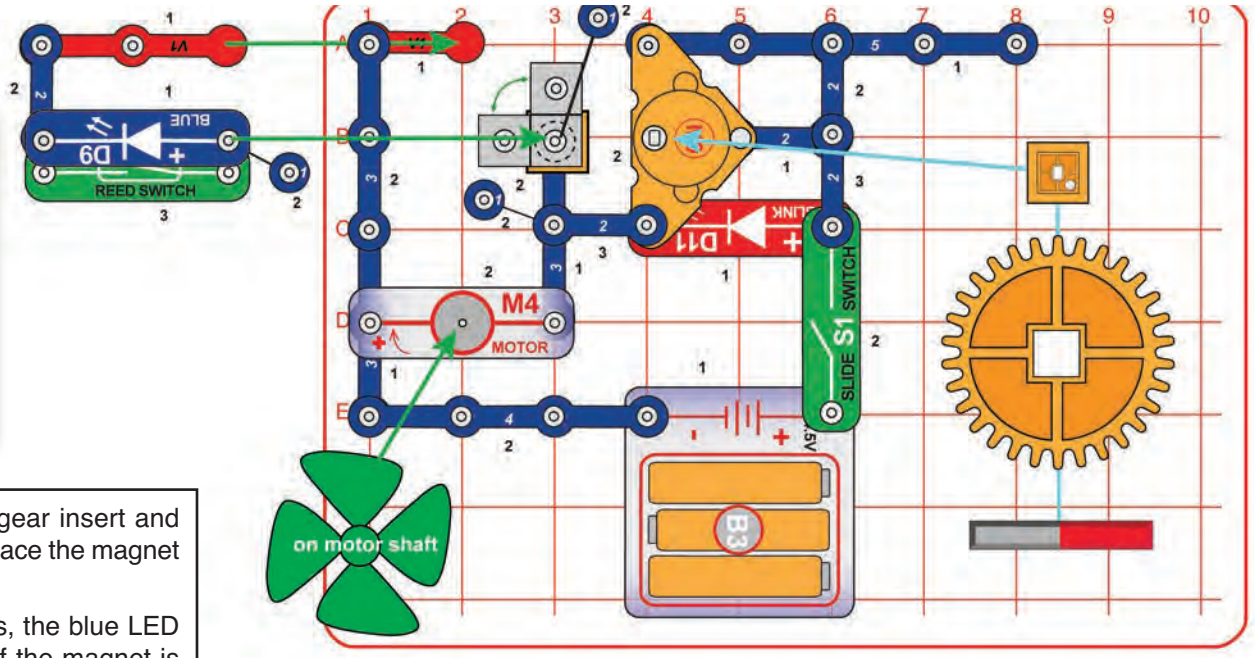
Project 105

Disco Ball Switch

Use the project 102 circuit, but replace the melody IC (U32) with the blink red LED (D11) and remove the lamp (L4). Place the egg on the blink red LED and the fiber optic festive tree on the color2 LED (D12) using the mounting base. Turn on the slide switch; now the egg and tree light together.

Project 106 Fan Speed





Build the circuit as shown, mounting the gear insert and the large gear on the orange motor (M9). Place the magnet in the center of the gear.

Turn the switch on, the gear slowly rotates, the blue LED lights and the fan spins. When the end of the magnet is towards the reed switch the orange motor (M8) speeds up, clear motor (M4) slows down and the blinking LED (D11) gets brighter.

Project 107 Manual Fan Speed

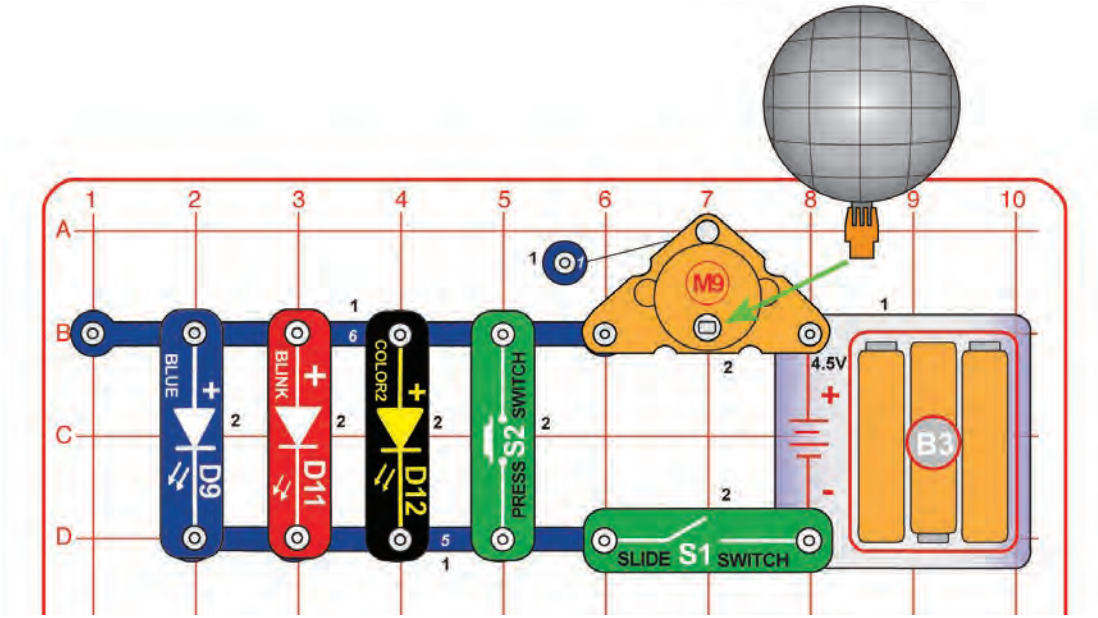
Use the preceding circuit, remove the magnet and hold it next to the reed switch. The fan and blue LED turn off, geared motor speeds up and LED D11 is blinking. See how close the magnet must be to the reed switch.

If you have any extra magnets compare their strenth using this project. See which one can be held farthest away from the reed switch.

Project 108 Fan Speed 2

Use the preceding circuit, remove the two snap on B6 & C6. Turn the switch on, only LED D11 blinking and the fan spins slowly. Stop the fan by placing the magnet next to the reed switch.

Project 109 Mirror Ball Speed Control



Build the circuit and turn on the slide switch (S1). The mirror ball spins and three LEDs light. Push the press switch (S2) to make the mirror ball spin faster.

All the electricity flowing through the orange motor (M9) splits up between the three LEDs. The press switch speeds up the orange motor by bypassing the LEDs.

Project 110

Mirror Ball Speed Control (II)

Use the preceding circuit, but remove any one or two of the LEDs (D9, D11, and D12).

Next, add the lamp (L4) in place of one of the removed LEDs. Compare the mirror ball speed.

The lamp has low resistance, so adding it will be similar to pushing the press switch (S2).

Project 111

Mirror Ball Speed Control (III)

Use the project 109 circuit, but replace one of the LEDs with the clear motor (M4) and fan. Compare the mirror ball speed.

Next, remove another of the LEDs and compare the mirror ball speed.

Project 112

Fan Speed Control

Use the project 109 and 110 circuits but replace the orange motor (M9) and mirror ball with the clear motor (M4) and fan. Compare the fan speed as you push the press switch (S2) or remove one or two LEDs.

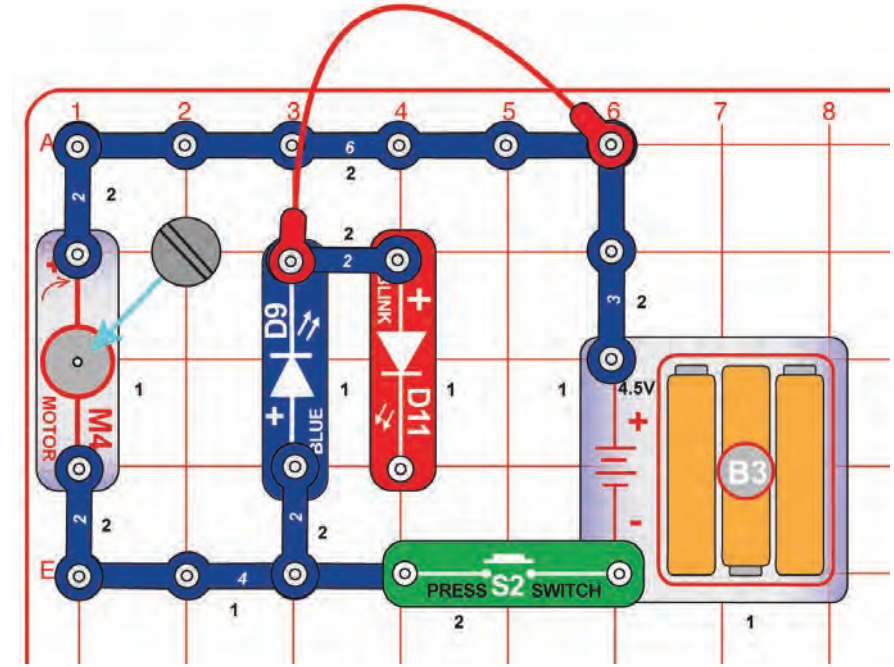
Project 113

Illusion Card Speed Control

Use the project 109 and 110 circuits but replace the orange motor (M9) and mirror ball with the clear motor (M4) and illusion card holder, with one of the illusion cards in it. Compare the image on the spinning illusion card as you vary the spin speed.

If the illusion card comes out at high speed then insert a small piece of paper into the cardholder with the illusion card to make it fit more snugly.

Project 114 Generator



Build the circuit as shown; then mount the illusion card holder on the motor shaft. Wind the string through the mirror holder and then around the motor shaft about 10 times. Holding the base with one hand pull the string; the blue LED (D9) lights briefly. Spinning the motor generates enough voltage to light the LED. Push the press switch (S2) to rewind the string and try lighting the LED again.

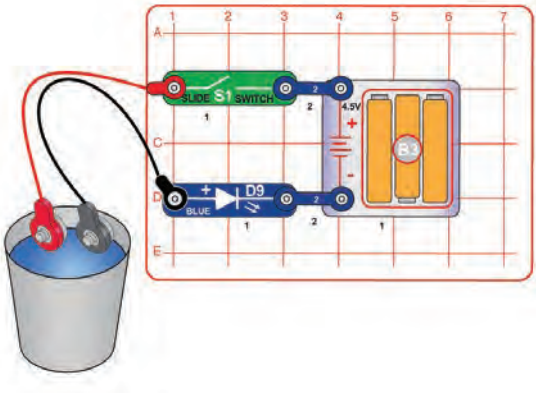
Now move the end of the red jumper wire from base grid location B3 to D4, to add the blink red LED (D11) to the circuit. When you pull the string now, LEDs D9 and D11 light briefly.

The clear motor (M4) can also be used to generate electricity, all that you have to do is turn the shaft. But you have to turn the shaft very fast to generate enough electricity to do much.

Project 115 Generator 2

Use the preceding circuit, but place the color2 LED (D12) across base grid locations B5 & D5 (+ side to D5), and add a 2-snap across base grid locations D4 & D5. Move the end of the red jumper wire from base grid location B3 to B5. Pull the string and all three LEDs should light.

Project 116 Water Completes the Circuit



Build the circuit as shown, leaving the ends of the red & black jumper wires unconnected for now. Turn on the slide switch (S1); the blue LED (D9) should be off.

Place the loose ends of the red & black jumper wires into a cup of water (but not distilled water), without them touching each other. The blue LED should be on now, because water conducts electricity, completing this circuit.

Try dissolving some salt in the water or using different liquids, and see how the LED brightness changes.

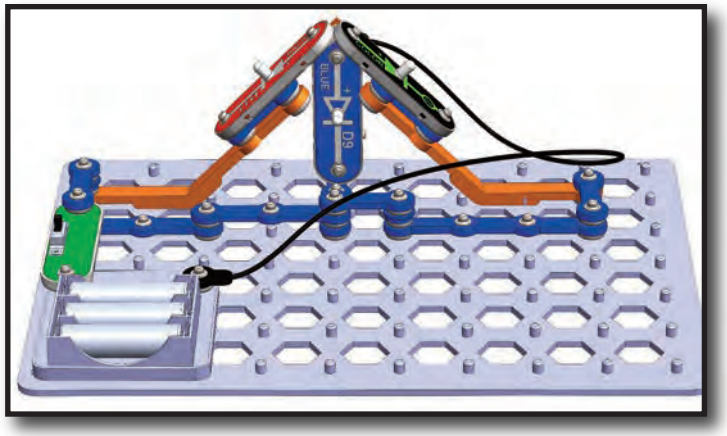
Don't drink any liquids used here.

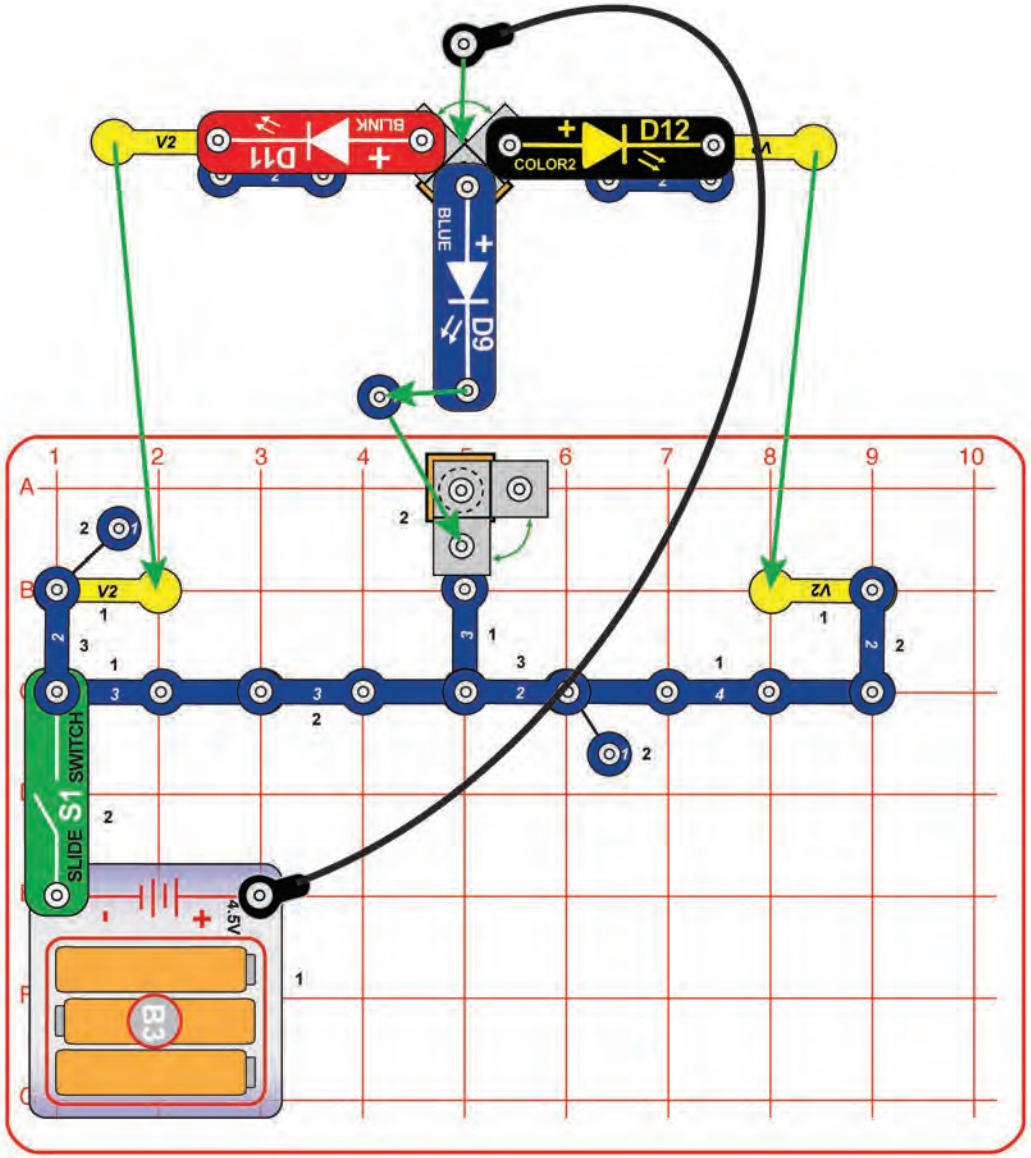
Project 117 You Complete the Circuit

Use the preceding circuit, but instead of placing the red & black jumper wires in water, touch the metal part of each with your fingers, using your body to complete the circuit. Wet your fingers to get better electrical contact. The blue LED (D9) should be on, but brightness may vary.

Project 118 Arrow LEDs

Place all the parts on the base grid then assemble the parts on and around the two 45 degree vertical snap wires (V2) Turn the slide switch (S1); the LEDs light and form a arrow shape. You can attach the egg to one of the LEDs.



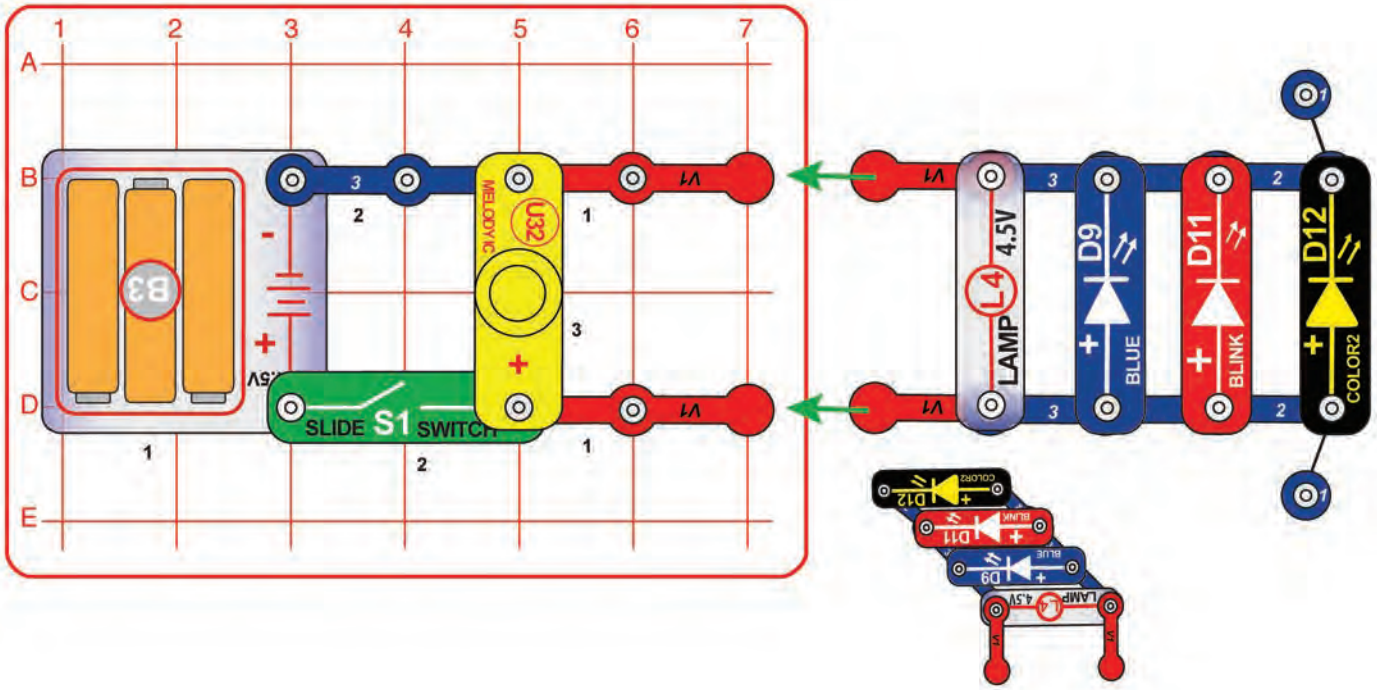


Project 119 Arrow Melody

Use the preceding circuit, add sound by placing the melody IC (U32) across base grid locations C3-E3 on level 3 (+ towards battery holder). Turn on the slide switch(S1), the LEDs light and as the melody plays.

Project 120

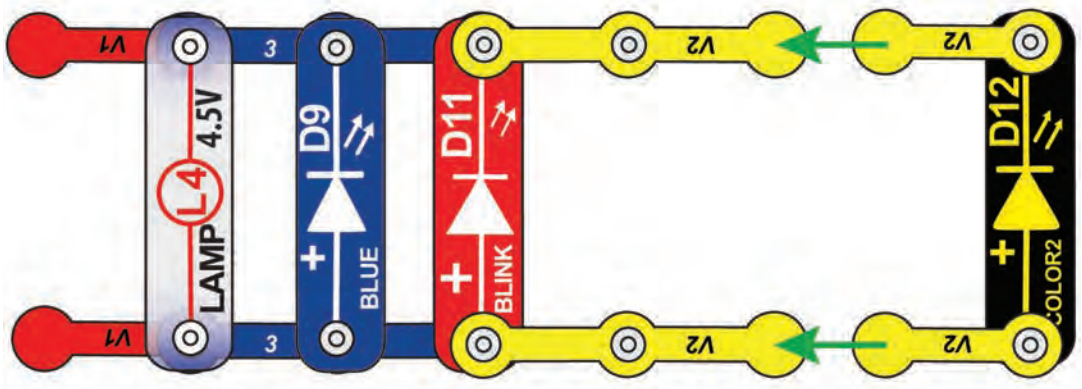
Light Stairs



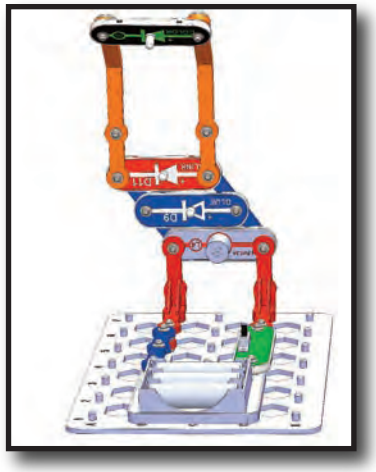
Place all the parts on the base grid, then assemble the parts on the two 90 degree vertical snap wires (V1). Position the LEDs to the right as shown. Turn on the slide switch (S1); all the lights turn on and a melody plays. Adjust the light assembly to different positions.

Project 121

Light Stairs 2

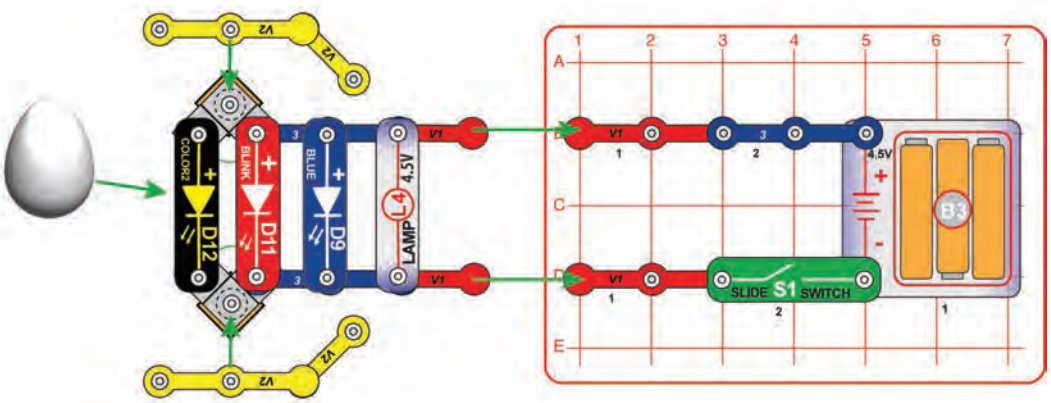


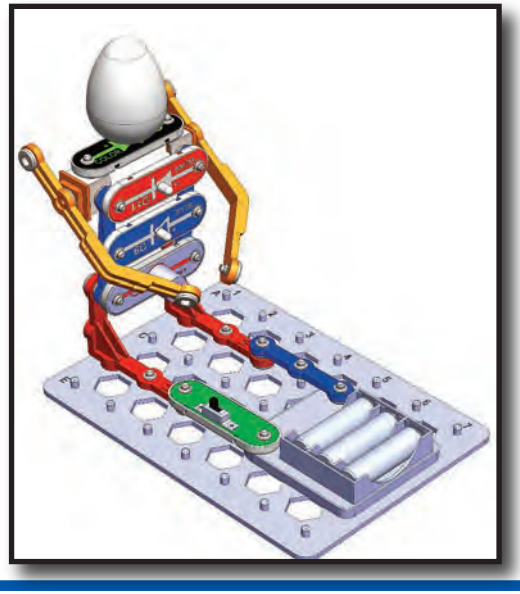
Use the preceding circuit, but replace the 2-snap wires and 1-snap wires under LEDs D11 and D12 with two 45 degree vertical snap wires. Turn on the slide switch (S1) and adjust the light assembly to different positions.



Project 122

Egg Head



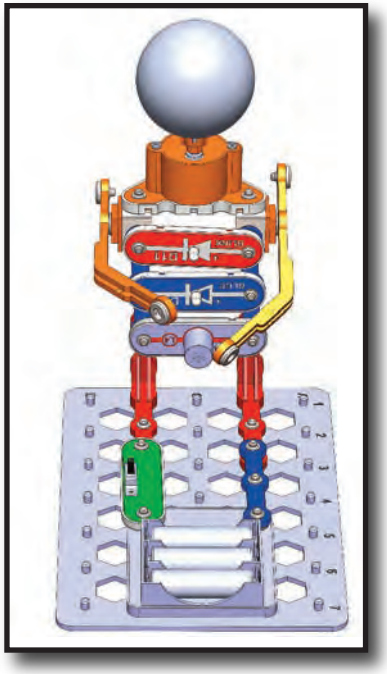


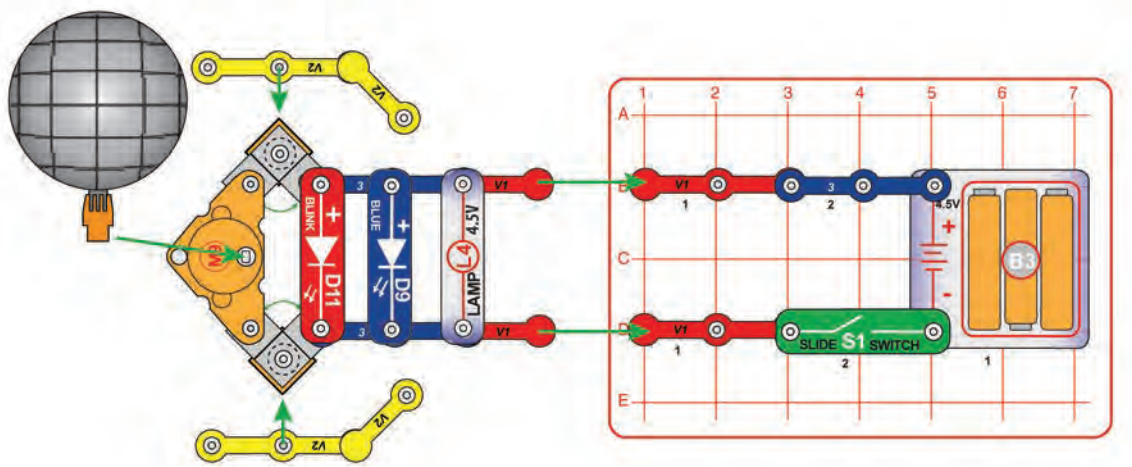
Place all the parts on the base grid then assemble the parts on the two 90 degree vertical snap wires (V1). Install the egg on the color2 LED (D12).

Turn on the slide switch (S1). The LEDs and lamp all light as the egg changes colors.

Project 123

Robot



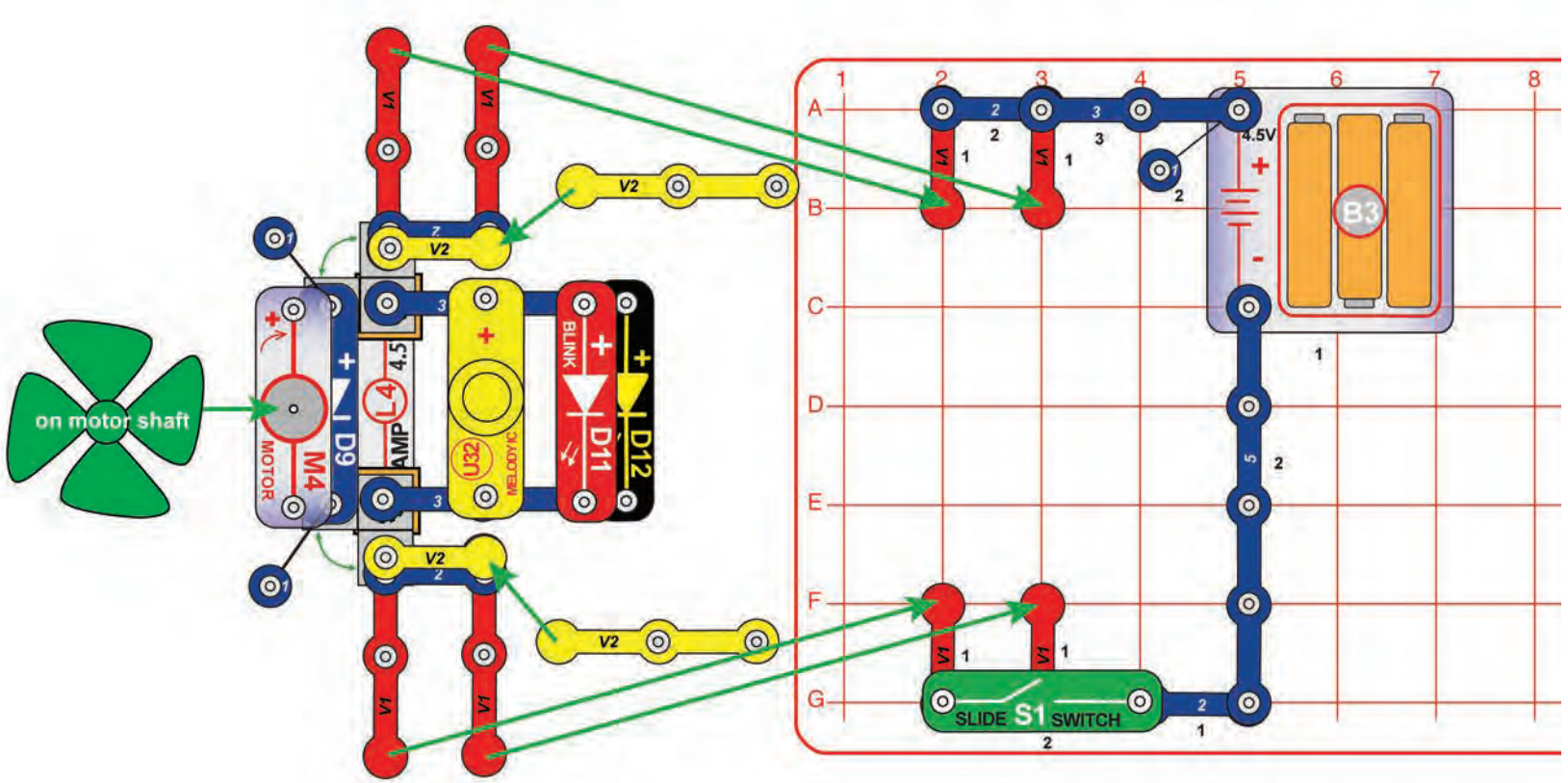


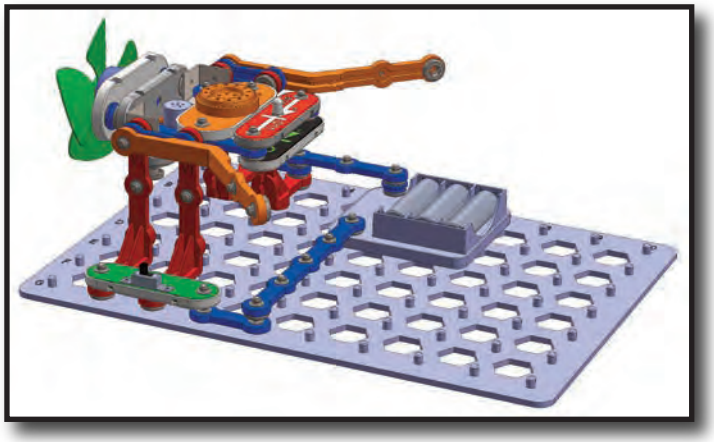
Place the parts on the base grid, then mount the 3-snap wires and lights on the 90 degree vertical snap wires (V1), then add the 3D snaps and orange motor (M9), then add the 45 degree vertical snap wires (V2), then place the mirror ball on the orange motor.

Turn the switch on, the robot's head spins and his body light up.

Project 124

Plane





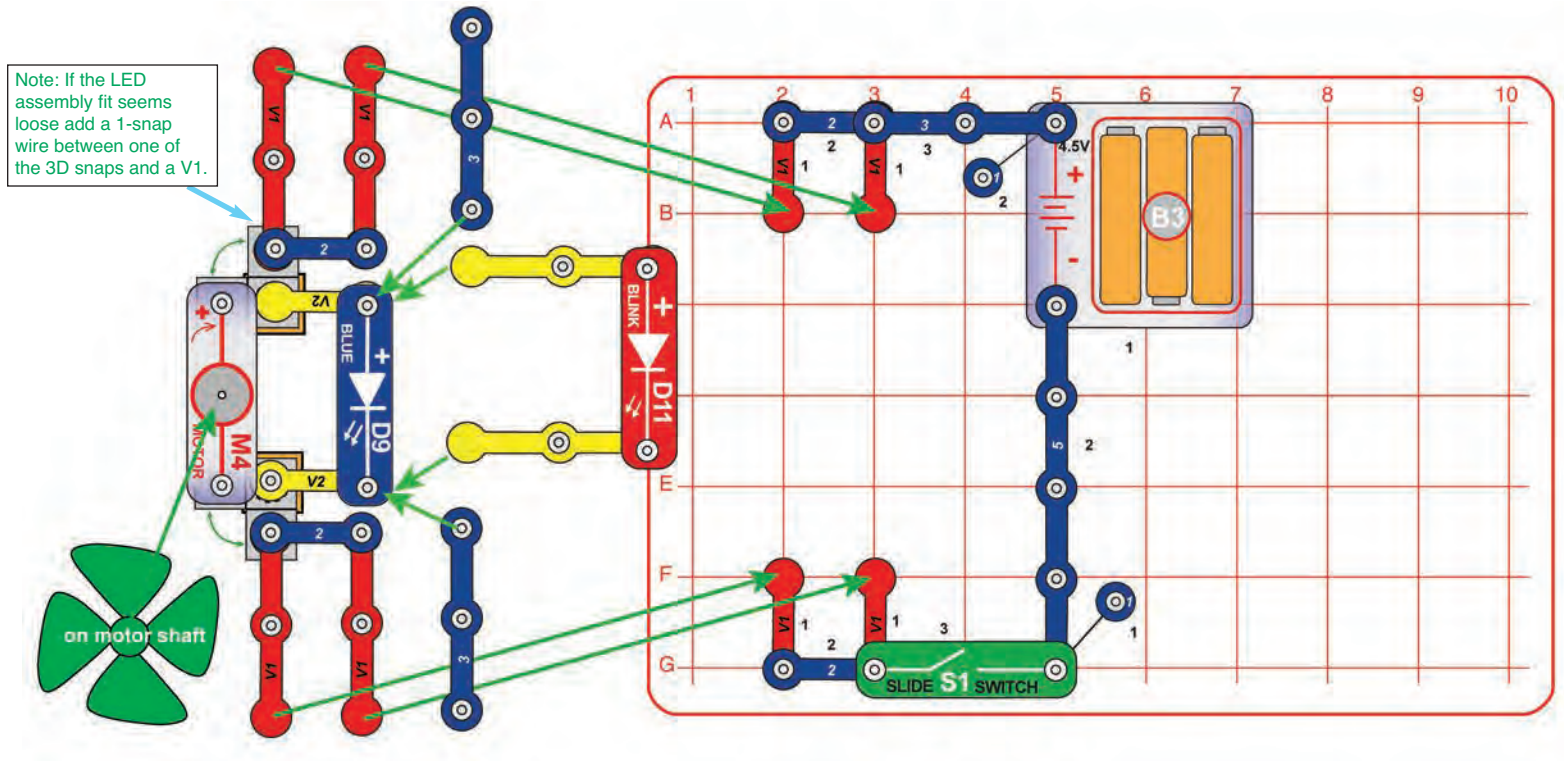
Place the parts on the base grid, then assemble the parts on the four 90 degree vertical snap wires (V1).

Be sure to hold the “plane” so that the green fan does not touch the base grid.

Turn the slide switch (S1) on; the plane’s prop spins with lights and sound. Rotate the body to simulate flying up or down.

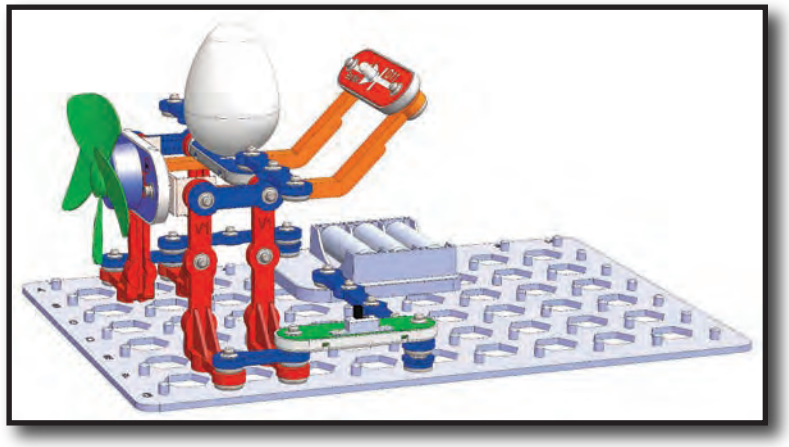
Project 125

Mini Plane



Place the parts on the base grid then assemble the parts on the four 90 degree vertical snap wires (V1).

Be sure to hold the “plane” so that the green fan does not touch the base grid.Turn the slide switch (S1) on; the mini plane is flying with a flashing tail light. Rotate the body to simulating flying up or down. if desired, place the egg LED attachment on the blue LED (D9).



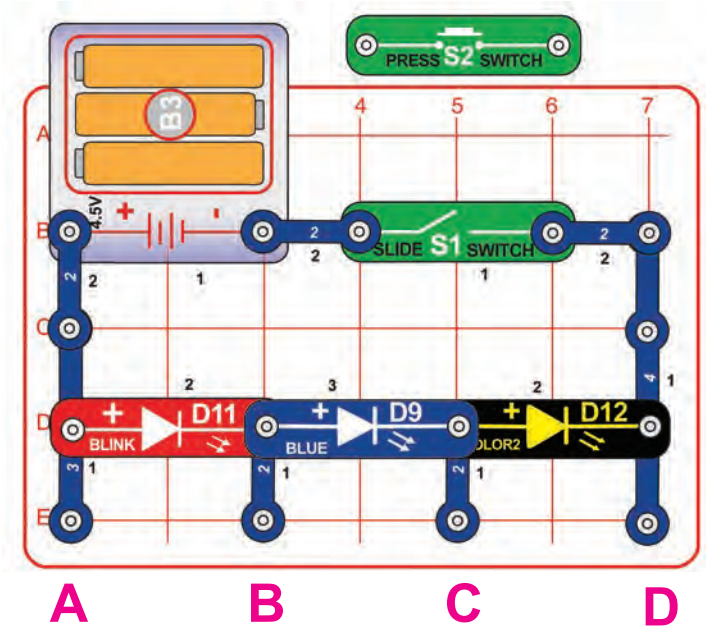
Project 126

Music Mini Plane

Use the preceding circuit, but replace the blue LED (D9) with the melody IC (U32) and replace the blink red LED (D11) with the lamp (L4). Turn the switch on; the mini plane now has sound and a white light.

Project 127

Triple Series



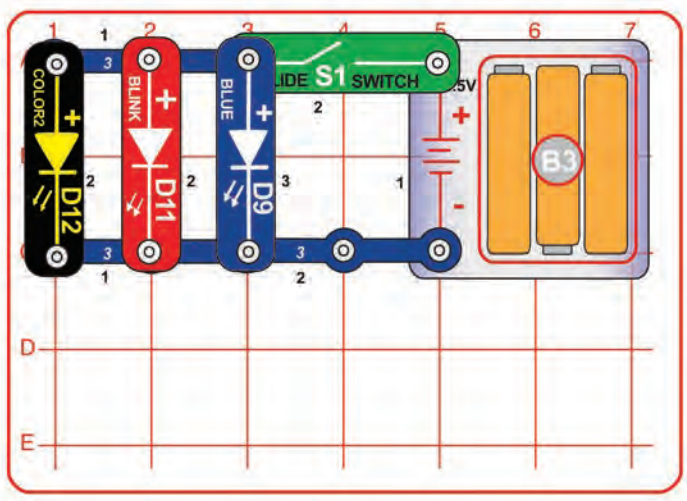
Build the circuit as shown, leaving the press switch (S2) out of the circuit for now. Turn on the slide switch (S1); most likely nothing will happen.

Now add the press switch between the points labeled A&B, B&C, or C&D, and push it. Try it at all 3 locations.

Most likely the battery voltage (4.5V) will not be strong enough to turn on any of the LEDs when all are connected together in series. Adding the press switch (S2) bypasses one of them, and should allow the remaining ones to operate, though probably not at their best.

Project 128

Triple Parallel



Build the circuit and turn on the slide switch (S1). All the LEDs are bright.

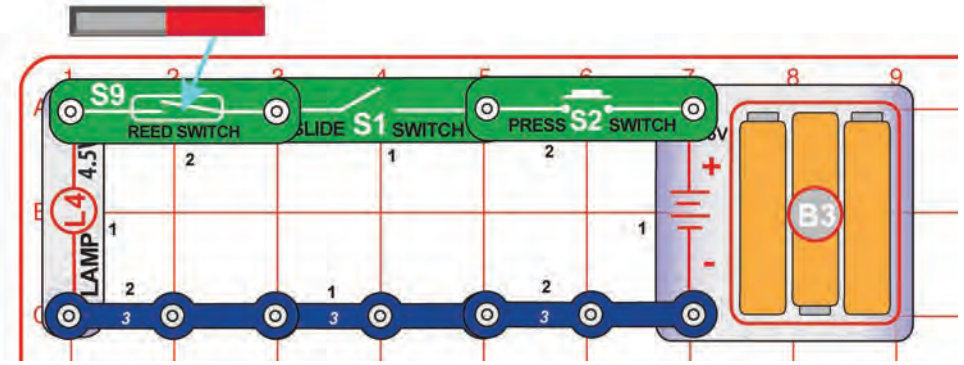
All the LEDs are all connected in parallel, and have enough voltage to perform at their best.

Project 129

AND Circuit

Place the magnet next to the reed switch (S9) to turn it on, push the press switch (S2), and turn on the slide switch (S1) in different combinations while seeing if the lamp (L4) lights. Fill out this table with the results:

S9	S1	S2	L4
OFF	OFF	OFF	
OFF	OFF	ON	
OFF	ON	OFF	
OFF	ON	ON	
ON	OFF	OFF	
ON	OFF	ON	
ON	ON	OFF	
ON	ON	ON	

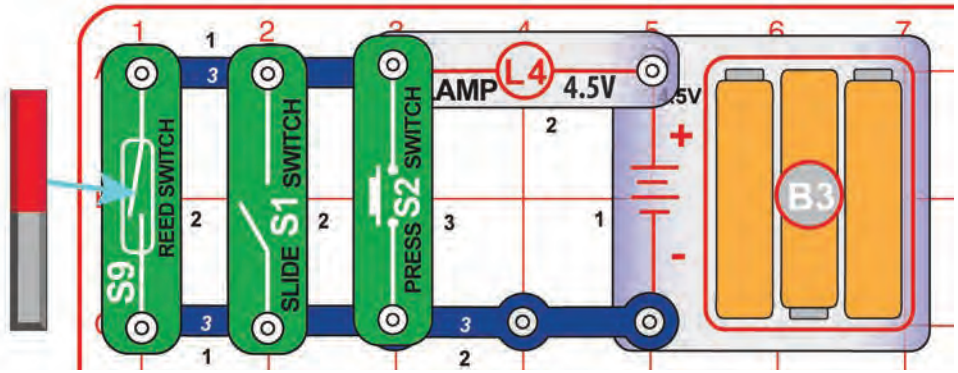


If switch S9, switch S1, AND switch S2 are on then the lamp will be on. Engineers refer to this switching combination as an AND sub-circuit (short for "this AND that").

Having to turn on several switches just to turn on a lamp seems simple but is very important. The press switch could represent an on/off switch on an electric saw, one of the slide switches could be a safety switch on the saw, and the reed switch could be a fuse box in your basement. Safety is very important in electrical wiring.

Project 130

OR Circuit

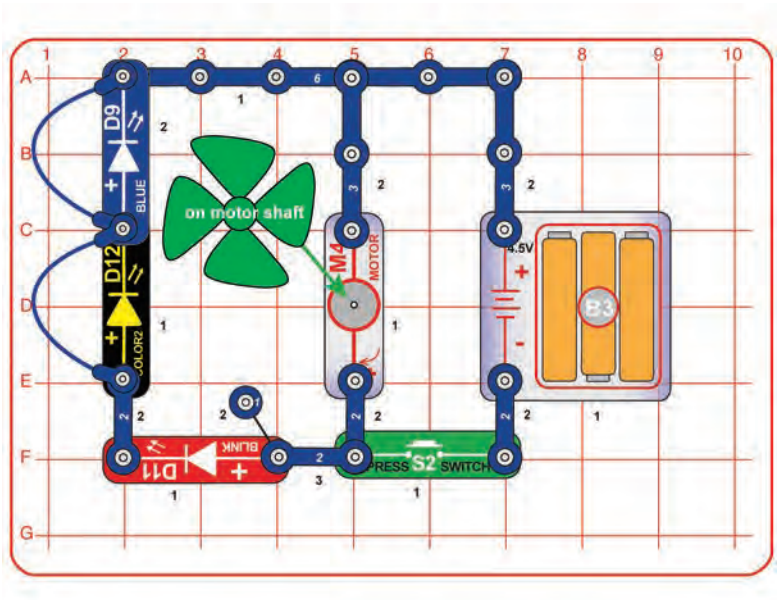


if switch S9, switch S1 **OR** switch S2 is on then the lamp will be on. Engineers refer to this switching combination as an OR sub-circuit (short for "this OR that"). The same type of circuit is used throughout your home, such as having several sensors controlling a security light.

Place the magnet next to the reed switch (S9) to turn it on, push the press switch (S2), and turn on the slide switch (S1) in different combinations while seeing if the lamp (L4) lights. Fill out this table with the results:

S9	S1	S2	L4
OFF	OFF	OFF	
OFF	OFF	ON	
OFF	ON	OFF	
OFF	ON	ON	
ON	OFF	OFF	
ON	OFF	ON	
ON	ON	OFF	
ON	ON	ON	

Project 131 Back EMF



Build the circuit as shown. Push the press switch (S2) for a few seconds; the fan spins but the red LED (D11) doesn't light. When you release the switch, the red LED flashes. Wait until the fan stops before pushing S2 again. The red LED is not bright so dim the room lights to see it better.

When the switch is pressed, electricity flows from the battery (+), through the clear motor (M4) and press switch, then back to the negative side (-) of the battery, but does not flow through the LED since it is backwards.

Electric current produces a magnetic field in the motor and when the press switch is released, the magnetic field collapses and generates an EMF in the electromagnet coil windings. The voltage produced by a motor when it is spinning is called its Back Electro-Motive-Force (Back EMF).

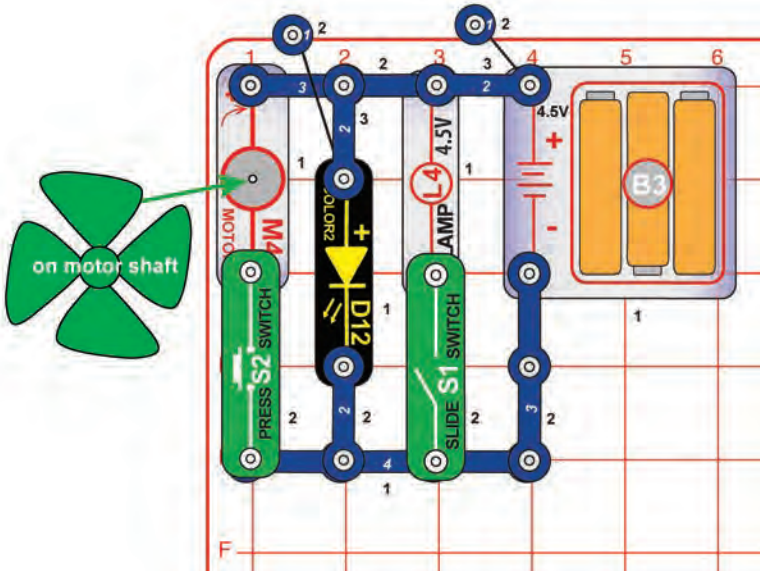
The voltage can only power the LED for a second.

Project 132 EMF 2

Use the preceding circuit, but remove the blue jumper wire across base grid locations C2 & E2. Press the switch the fan spins. Release the press switch and now both LEDs light. The LEDs are not bright so dim the room lights.

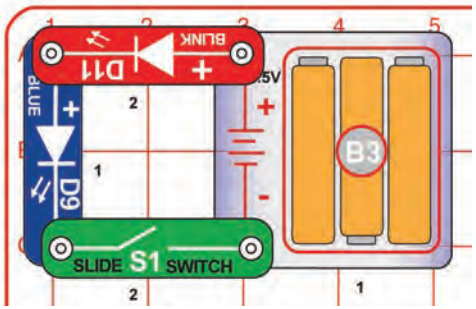
See if the circuit has enough power to light all the LEDS by removing the blue jumper wire across base grid locations A2 & C2.

Project 133 Lamp & Fan Independent



Build the circuit as shown. Depending on which of the switches (S1 & S2) are on, you can turn on either the lamp (L4), the clear motor (M4), or both together. The color2 LED (D12) is connected across the battery, so it's always on.

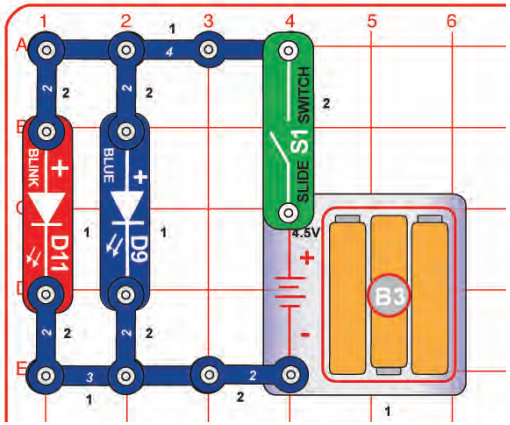
Project 134 LEDs in Series



Build the circuit and close (turn on) the slide switch (S1). The LEDs (D9 & D11) light.

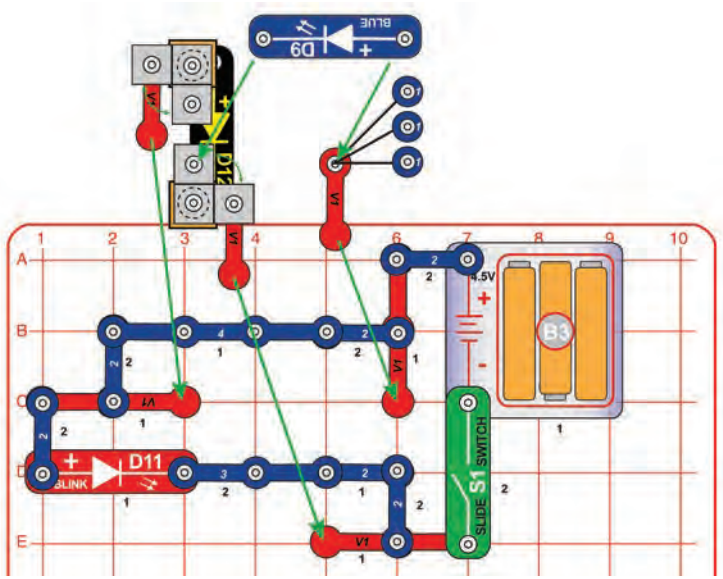
Current flows from the batteries through the LEDs and back to the battery through the switch. The closed (on) switch completes the circuit. In electronics this is called a closed circuit. When the switch is open (off), the current can no longer flow back to the battery, so the LEDs turn off. In electronics this is called an open circuit. Engineers refer to switches being open or closed because the switch symbol resembles an architect's symbol for a door.

Project 135 LEDs in Parallel



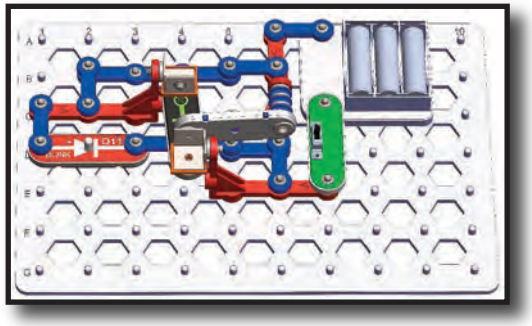
When you close (turn on) the slide switch (S1), both LEDs (D9 & D11) turn on. Current flows from the batteries through the switch back to the battery through the LEDs. Remove the red LED (D11) and notice that the blue LED (D9) does not change in brightness. In a parallel circuit each part has its own path to the battery so removing one LED does not affect the other one. The voltage is the same across the LEDs, but not the current.

Project 136 Cross Over



Place the parts on the base grid, then assemble the parts on the three 90 degree vertical snap wires (V1). The LEDs are in parallel so when you turn the switch on, all should light.

Change the circuit by switching the LEDs around or add sound by replacing the color2 LED (D12) with the melody IC (U32).

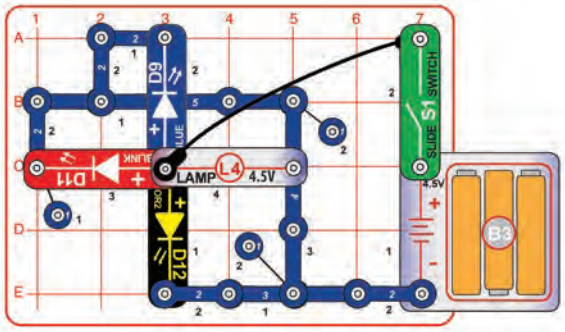


Project 137 Cross Over Tree

Use the preceding circuit, but place the fiber optic festive tree on the color2 LED (D12) using the mounting base.

Project 138

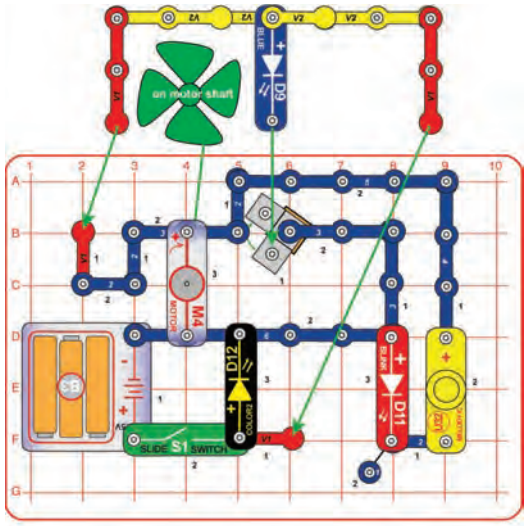
Lighted Cross

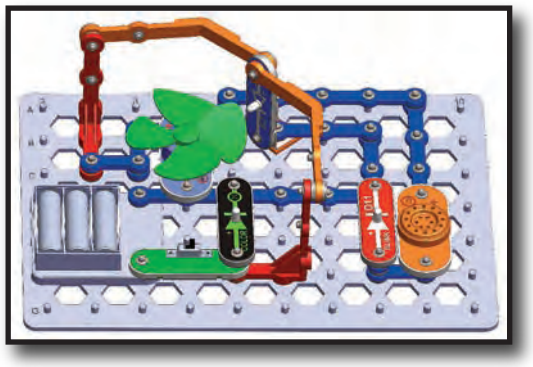


Build this circuit and turn on the slide switch (S1) The lights turn on, forming a cross.

Project 139

Green Dot





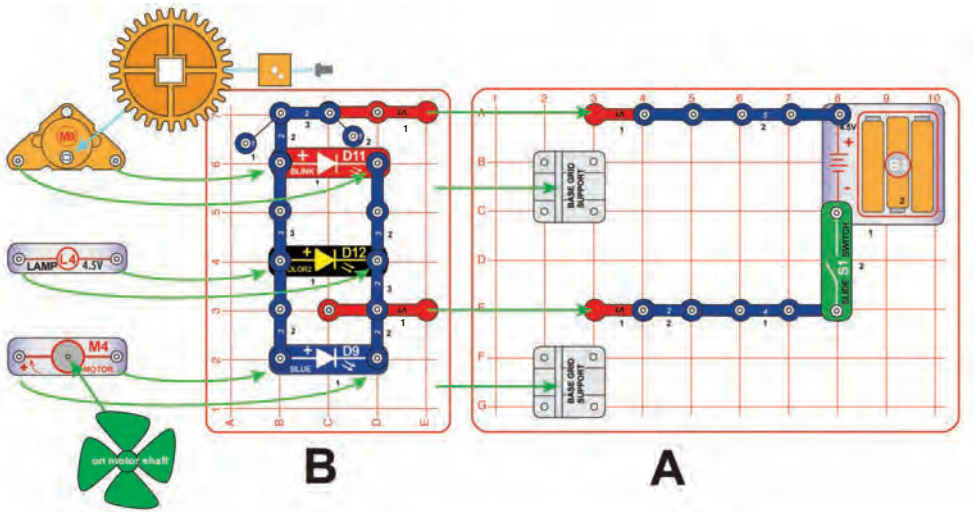
Place the parts on the base grid, then assemble the parts on the two 45 degree vertical snap wires (V2).

Turn on the slide switch (S1); the LEDs light as the melody IC (U32) makes a strange sound; the sound may not be very loud. The blue LED (D9) next to the motor (M4) creates a green line across the spinning fan.

Remove the clear motor (M4). Now the sound is much louder.

Project 140

2-Sided Grid



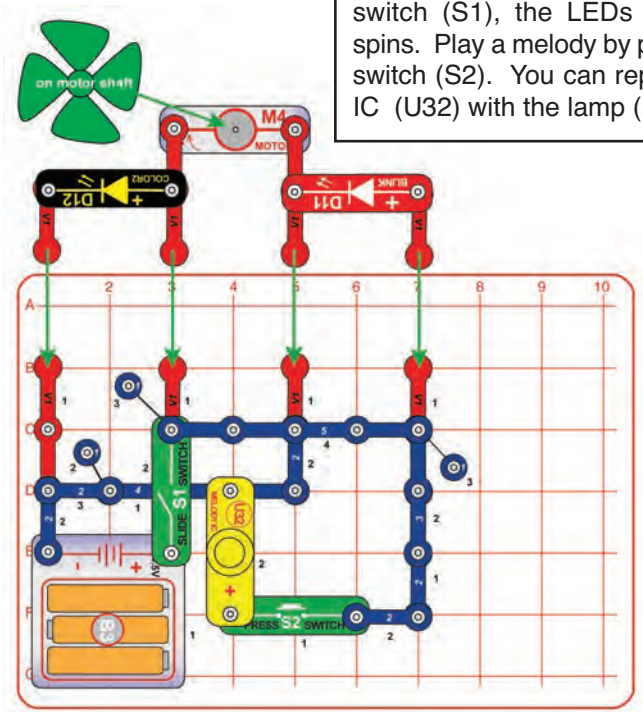
Assembly:

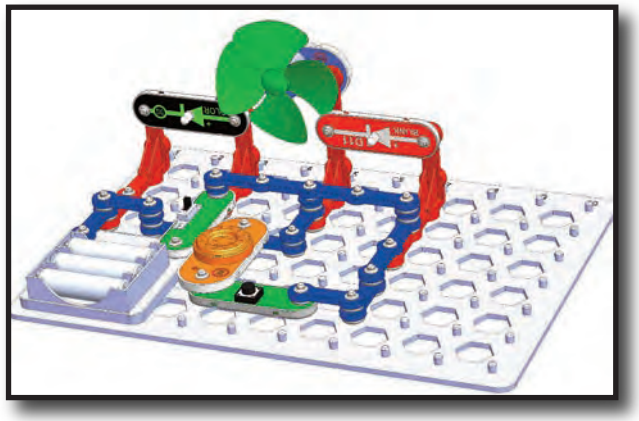
1. Place base grid supports on base grid A.
2. Place the parts (except for attachments on the motors) on grid B, and install into base grid supports on grid A.
3. Mount the gear insert and the large gear on the orange motor (M9), teeth facing out.
4. Attach the fan to the clear motor (M4).
5. Place the remaining parts on grid A.

This circuit demonstrates using the 2-sided base grid. Turn on the slide switch (S1); the lights and motors all turn on.

Project 141 Wall Fan

Place the parts on the base grid, then assemble the parts on the 90 degree vertical snap wires (V1). Turn on the slide switch (S1), the LEDs light as the fan spins. Play a melody by pushing the press switch (S2). You can replace the melody IC (U32) with the lamp (L4).





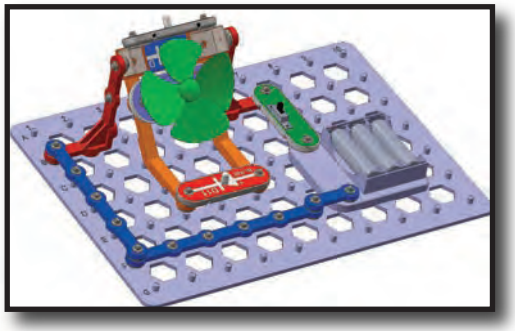
Project 142 Wall Fan 2

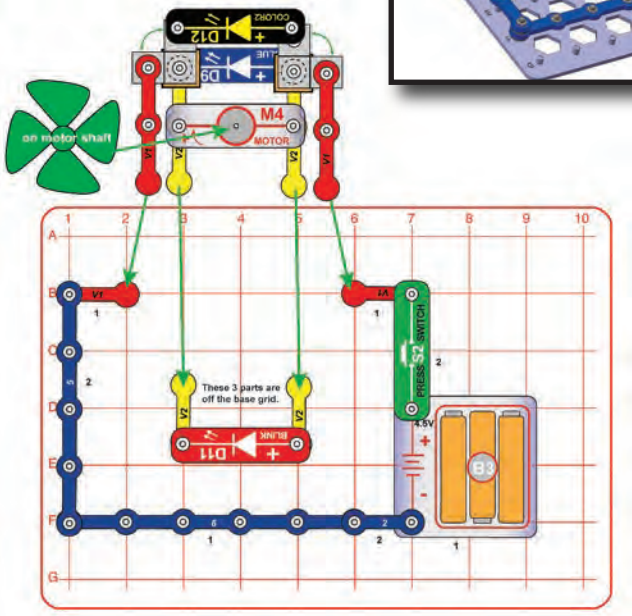
Use the preceding circuit, but replace the clear motor (M4) with the lamp (L4), and replace the melody IC (U32) with the clear motor. Turn on the slide switch (S1); the lights light. Now push the press switch (S2) and the fan spins.

Project 143 Green Light Ball

Place the parts on the base grid, then assemble the parts on the 90 and 45 degree vertical snap wires (V1 & V2).

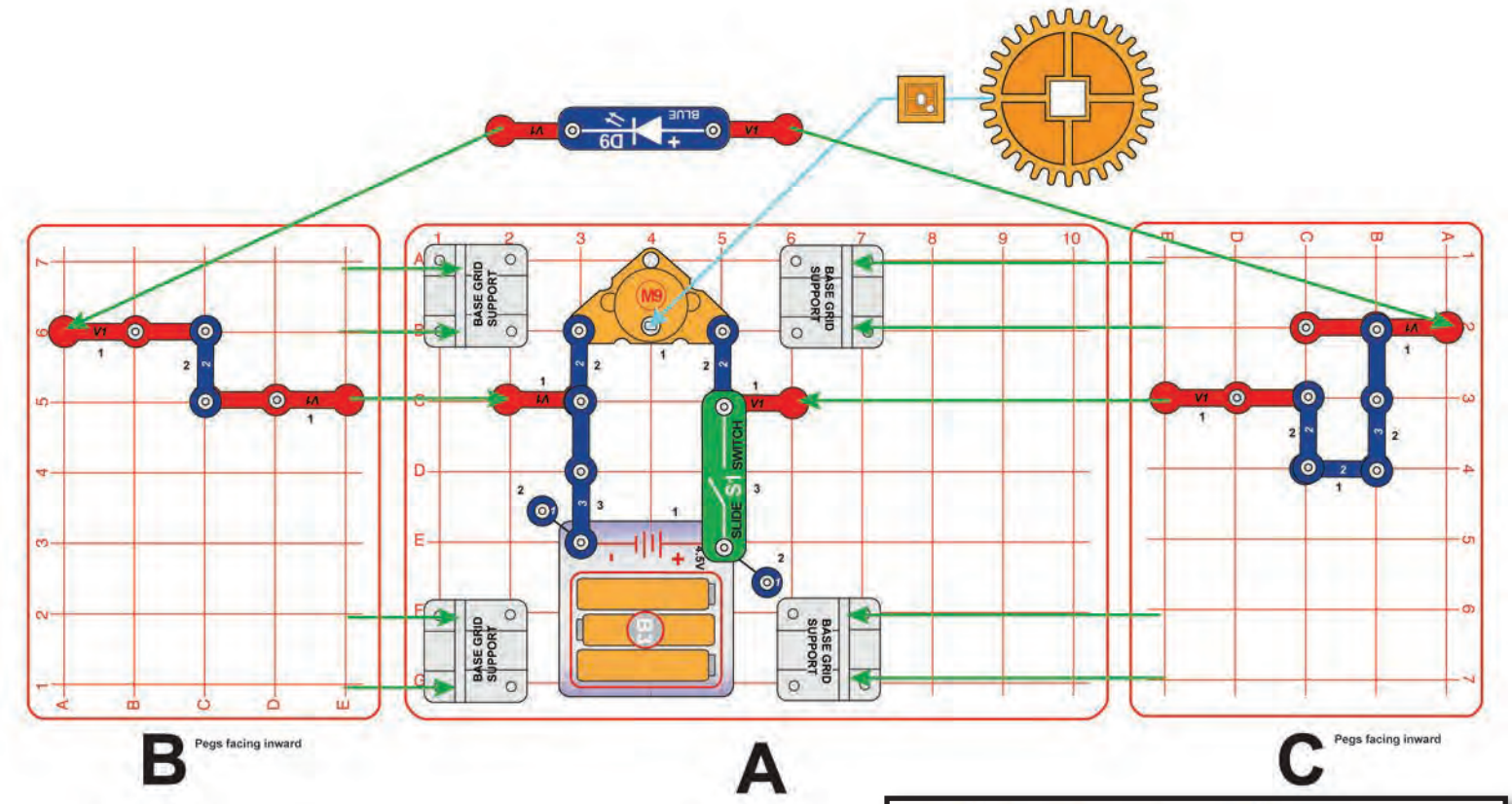
Press the switch, The LEDs light as Looking from the side, you should see a green ball of light on the fan. The blue LED (D9) shining on the back of the fan, creates a green ball of light.





Project 144

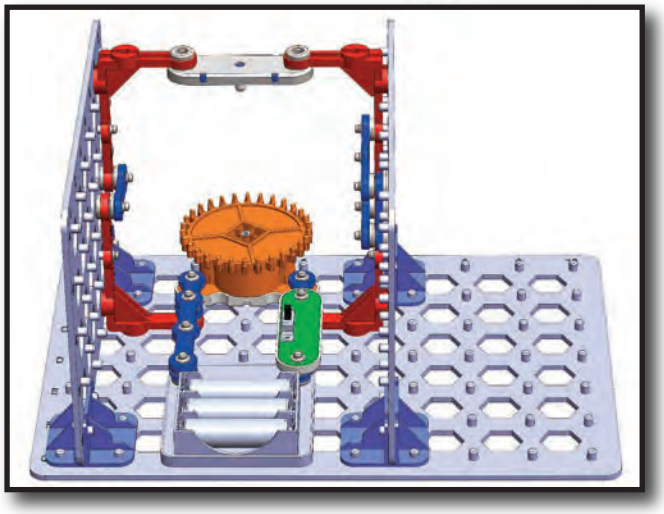
Showcase



Assembly:

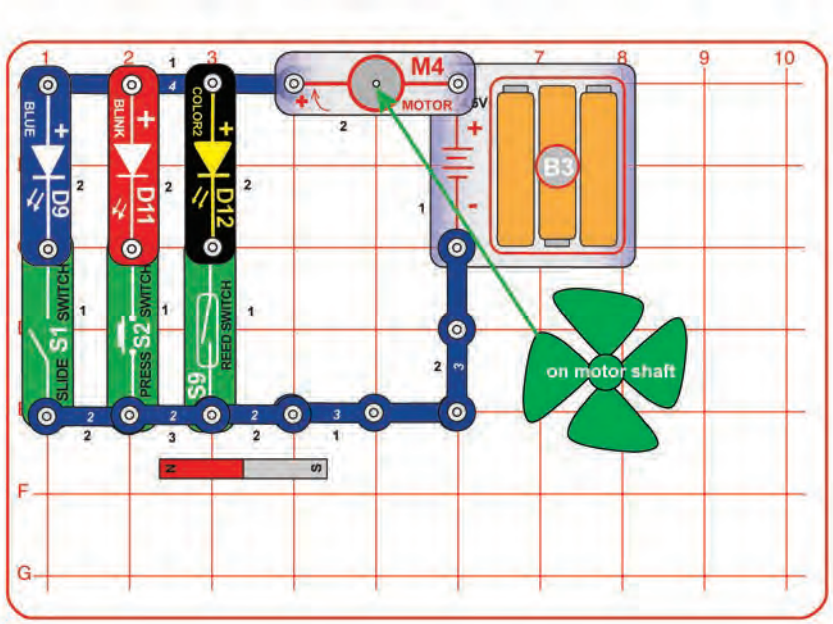
1. Place base grid supports on base grid A.
2. Place parts on grids B & C, then install into base grid supports on grid A. The pegs must be pointed inward.
3. Install remaining parts on grid A. Place the gear insert on the orange motor (M9), flat side up.
4. Install the blue LED (D9) on the two vertical snap wires (V1) that hang over the orange motor.

Place any object you want to showcase the on the orange motor. Turn on the slide switch (S1); the orange gear slowly spins the “showcase object”, and the LED shines on it. Dim the room lights for best effects. You can replace the blue LED with the color2 LED (D12).



Project 145

Current Law



In this circuit, the clear motor (M4) is in series with a parallel circuit. The parallel circuit has three current paths, S1 & D9, S2 & D11 and S9-D12. The amount of current flow through the paths are not equal, indicated by how fast the fan spins.

Turn on the slide switch (S1); the blue LED (D9) lights as the fan spins. Turn the switch off.

Push the press switch (S2); the blink red LED (D11) starts blinking as the fan spins.

Finally, place the magnet next to the reed switch (S9); the color2 LED (D12) lights and but the fan spins very slow or not at all. Try giving the fan a push to get started.

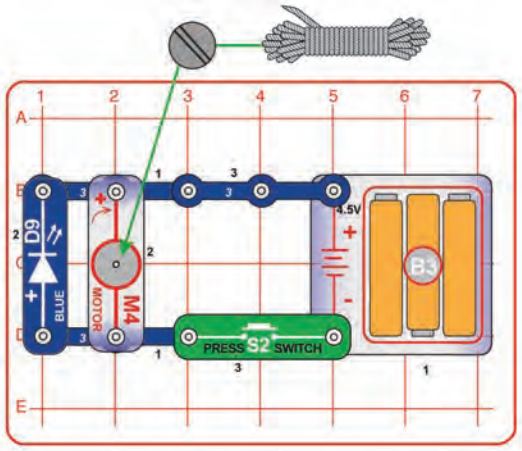
Turn on all the switches and see how fast the fans spins.

Kirchoff's First Law:
The sum of currents flowing into a junction is equal to the sum of currents flowing out of that junction.

In this circuit the current from the batteries all flows through the motor, then divides among the LEDs whose switches are on, then recombines and flows through the 3-snap wires and back to the batteries.

Project 146

Two Pull Power



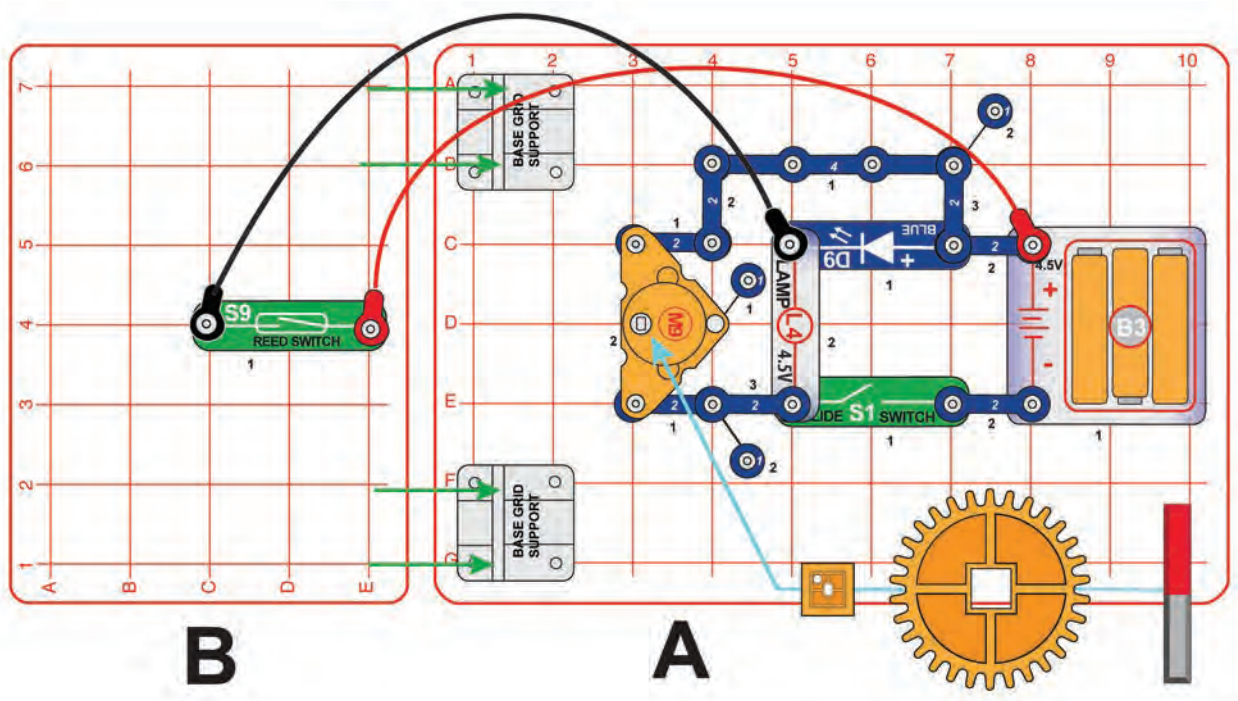
Assembly :

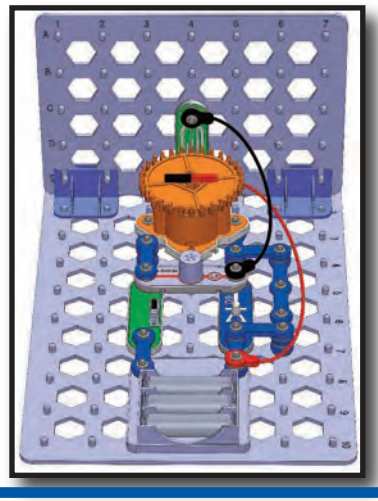
1. Place the parts on the base grid.
2. Mount the illusion card holder on the clear motor (M4).
3. Place the end of the string in the illusion card holder and wind the string around the motor shaft a few times.

Holding the string, press the switch (S2) and wind the remaining string around the motor shaft, then release the switch. Now pull the string quickly; the motor generates a voltage which lights the blue LED (D9) if you pulled the string fast enough. Press the switch again to rewind the string and try again.

☐ Project 147

On Off





Assembly :

1. Place base grid supports on base grid A.
2. Place parts on grids A but do not connect the two jumpers wires.
3. Place the reed switch on grid B, then install grid B on base grid supports on grid A. The pegs must be pointed inward.
4. Connect the red & black jumper wires.
5. Install the gear insert and large gear (flat side up) on the orange motor, then place the magnet on the gear as shown.

Turn on the slide switch (S1); the blue LED (D9) lights and the gear rotates. When the end of the magnet faces the reed switch (S9) the switch closes, bypassing the blue LED (D9). The blue LED and lamp are turned on and off temporarily.

☐ Project 148

On Off 2

Use the preceding circuit, but replace the lamp (L4) with the melody IC (U32). Turn the slide switch (S1) on, the melody IC (U32) sounds once when the reed switch (S9) is closed and opened.

☐ Project 149

Twice On Off

Use the project 147 circuit, but re-position the reed switch (S9) so it is across base grid B locations D3-D5. Turn the slide switch on; the lamp and LED turn on and off twice as the magnet passes the reed switch.

☐ Project 150

Twice On Off 2

Use the preceding circuit, but replace the lamp (L4) with the melody IC (U32, + on top). Turn the slide switch on; the melody IC and LED turn on and off twice as the magnet passes the reed switch.

☐ Project 151

Twice On Off 3

Use the project 158 circuit, but place the clear motor (M4) across the blue LED (D9) on level 4. Turn the slide switch on; the lamp, LED, and motor turn on and off twice as the magnet passes the reed switch.

Project 152

Compass

1

3

2

Refrigerator Door

1. Hold your compass away from everything, notice that the red arrow always points north. Spin it around, the red arrow will adjust and resume pointing north.
   The earth's core is made of iron, which has a magnetic field. The compass points north because it is attracted to this magnetic field. This allows compasses to be used for navigation.
2. Now place the compass next to a large iron object, such as a refrigerator or car. If the object is heavy enough, the red arrow will point toward it.
   Large iron objects also exert a small magnetic field, which may attract a nearby compass. The magnetic field is much weaker than the earth's, but much closer to the compass.
3. Now place your magnet near the compass. The red arrow will immediately point toward the dark "S" side of the magnet, ignoring a nearby refrigerator.
   Magnets have been induced to have a concentrated magnetic field at either end. This magnetic field is much stronger than ordinary iron objects that may be nearby.
4. Pull out various parts in your kit and from around your home. Decide which of these you think the magnet will pick up, then try it and see if you were right.
   The physical properties of iron make it easy to induce a magnetic attraction in. This doesn't work for other metals or other materials.

All materials have tiny particles with electric charges, but these are so well balanced that you do not notice them unless an outside voltage disturbs them. The same tiny particles also have magnetic charges, which are usually so well balanced that you do not notice them unless a magnetic field disturbs them.

Magnets are materials that concentrate their magnetic charges at opposite ends. One side attracts while the other repels, but the overall material is neutral. Most magnets are made of iron. The name "magnet" comes from magnetite, an iron ore that magnetism was first seen in.

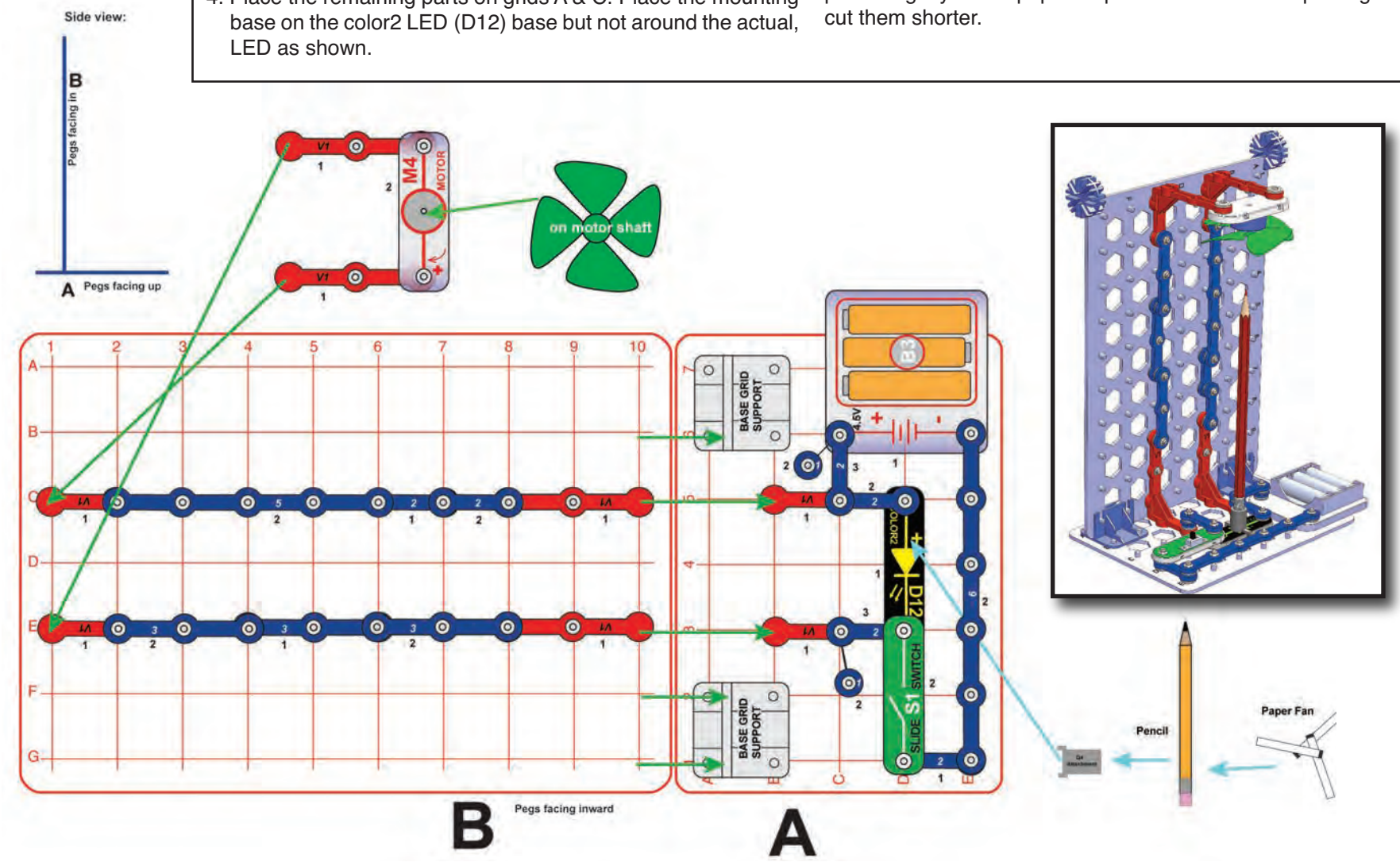
The earth we live on is a giant magnet, due to its iron core. A compass needle always points north because it is attracted to the earth's magnetic field. The opposite ends of a magnet are often labeled north and south, representing the north and south poles of the earth. A compass actually points to the earth's magnetic north pole (which is in the Arctic Ocean just north of Canada), not the geographic north pole.

Project 153 Downdraft

Assembly :

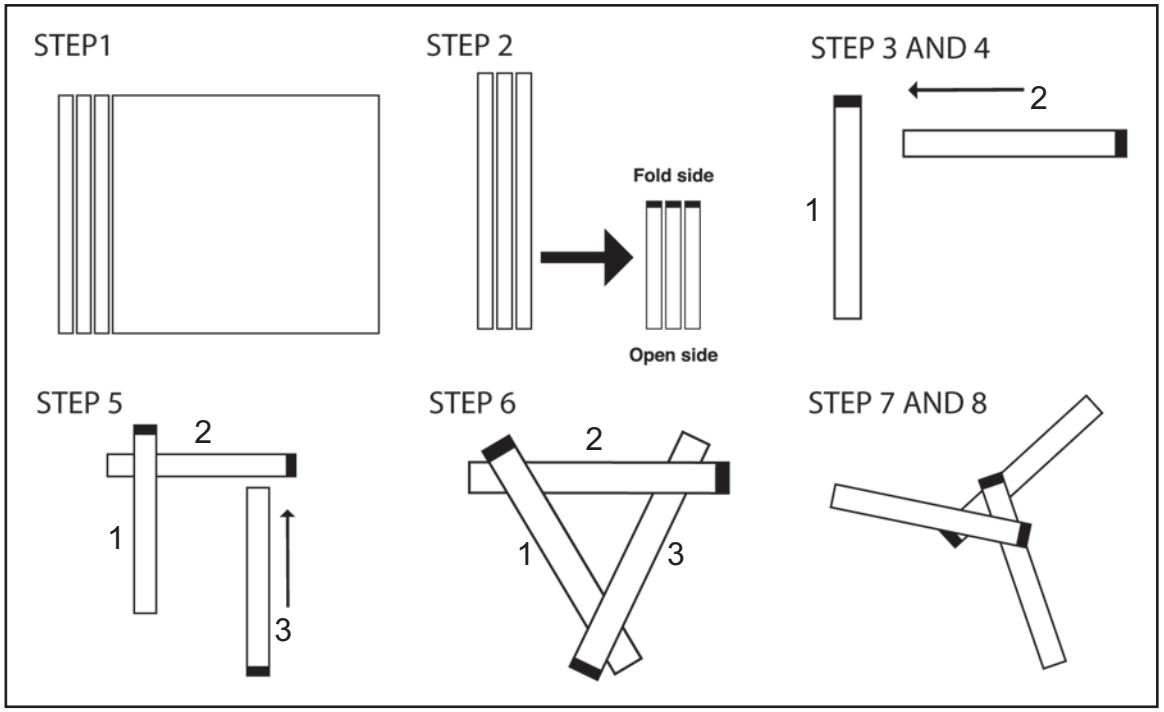
1. Place base grid supports on base grid A.
2. Place parts on grids B, then install grid B on base grid supports on grid A. The pegs must be pointed inward.
3. Install grid C onto grid B using 2 stabilizers, connecting the 2 vertical snap wires (V1) as you do it.
4. Place the remaining parts on grids A & C. Place the mounting base on the color2 LED (D12) base but not around the actual, LED as shown.
4. Assemble the pencil fan per the instructions on the following page.
5. Install a pencil into the mounting base, then place type A fan on the pencil tip.

Turn on the slide switch (S1); as the green fan blows, the paper fan should start to spin clockwise. You may need to adjust the pencil slightly. If the paper strips hit the wall when spinning then cut them shorter.

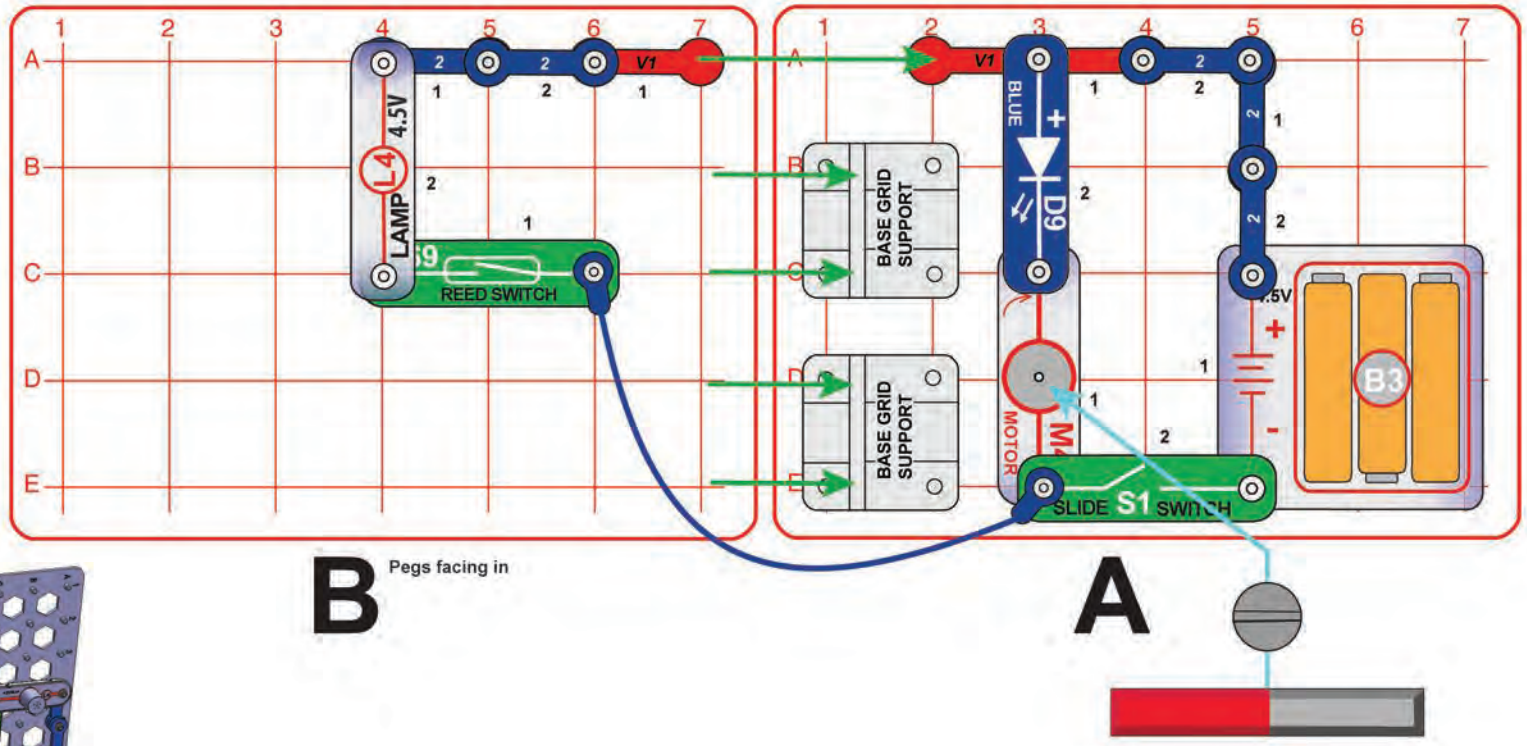


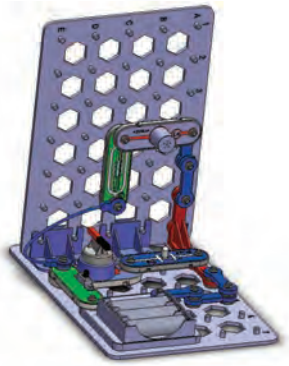
Pencil fan assembly instructions:

1. Take a sheet paper and cut half inch strips widthwise.
2. Folder paper strips in half as shown.
3. Take a folded paper strip and hold it vertically fold side up.
4. Insert both ends of a second paper strip between the folds of the first strip horizontally, fold side on the right.
5. Take the third paper strip, placing it vertically between the horizontal strip to pass through the folds.
6. Grab the loose ends from the first strip and pass it through the third strip.
7. Pull on the loose strips until the folded sides meet in the middle.
8. Adjust the middle so that all the folds are perpendicular to each other.
9. In order to change the fan direction, loosen the center by pulling on the folds. Once they are loose, push the center in and re-tighten the fan. Now the fan should turn in the opposite direction.



Project 154 Strobe

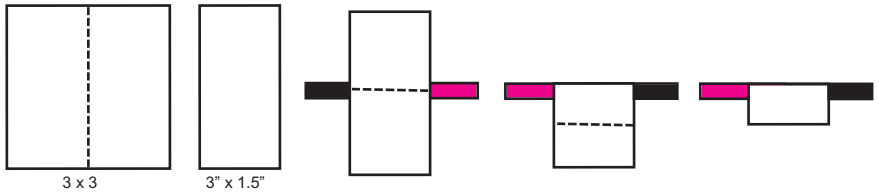




Assembly :

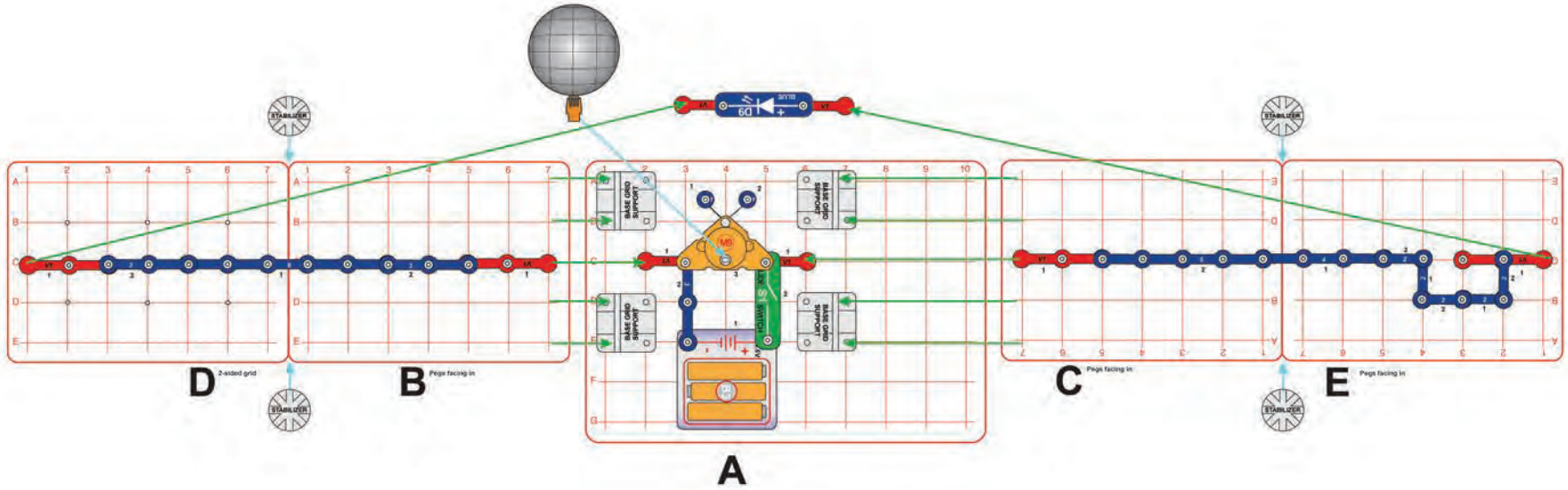
1. Place the base grid supports on base grid A.
2. Place parts on grid B, then install grid B on base grid supports on grid A. The pegs must be pointed inward.
3. Place remaining parts on grid A, and connect the blue jumper wire.
4. Assemble the paper magnet holder as shown.

Turn on the slide switch (S1). The lamp (L4) flashes as the magnet passes the reed switch (S9).



1. Cut a 3" x 3" piece of paper and fold in half
2. Place magnet in center and fold in half.
3. Fold in bottom section up as shown.
4. Insert ensemble into the Illusion card holder.

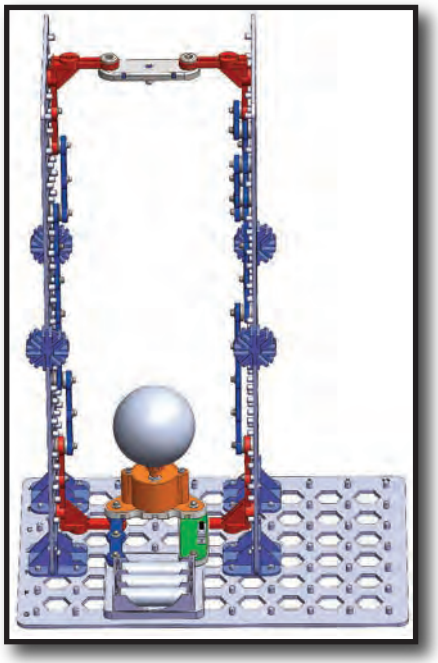
Project 155 Super Spotlight



Assembly:

1. Place the base grid supports on base grid A.
2. Place parts on grids B &C and install into base grid supports on grid A.
3. Install remaining parts on grid A except the blue jumper wire.
4. Place parts on grids D & E and install onto grids B & C using 2 stabilizers.
5. Place remaining parts.

Turn on the slide switch (S1); the mirror ball spins and the blue LED (D9) shines on it. For best effects place the circuit in a dark room.



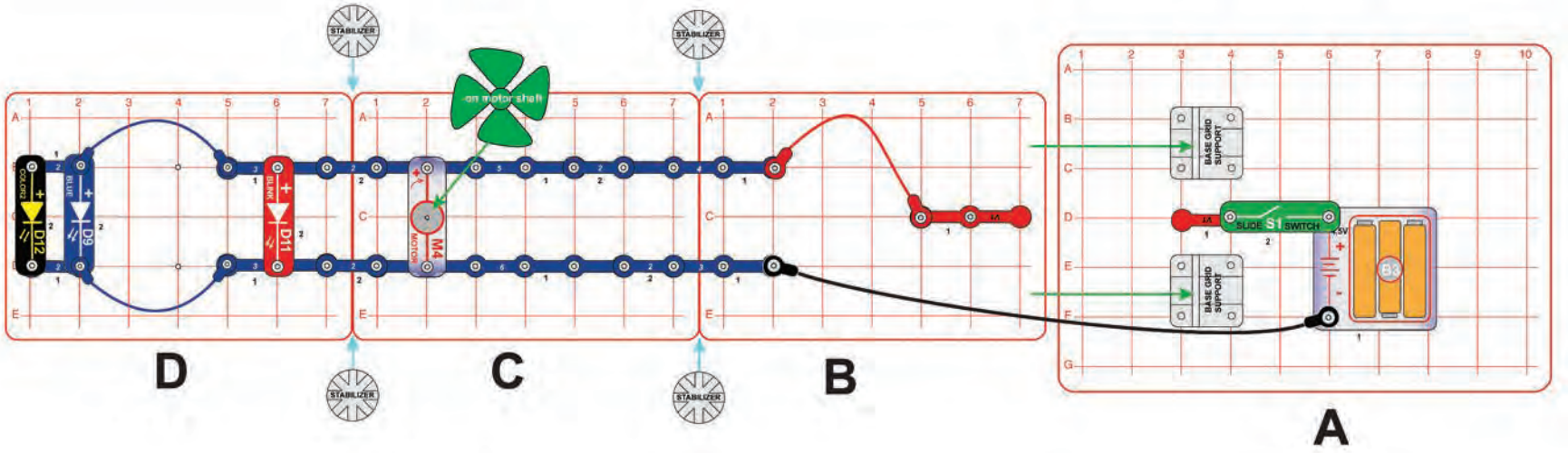
Project 156

Super Spotlight (II)

Use the preceding circuit, but replace the orange motor (M9) and mirror ball with the clear motor (M4) and fan, or replace the blue LED (D9) with the color2 LED (D12), blink red LED (D11), or lamp (L4).

☐ Project 157

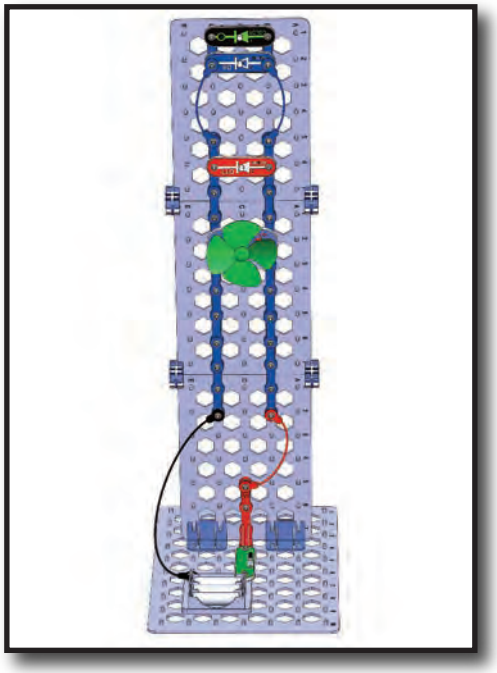
Tower



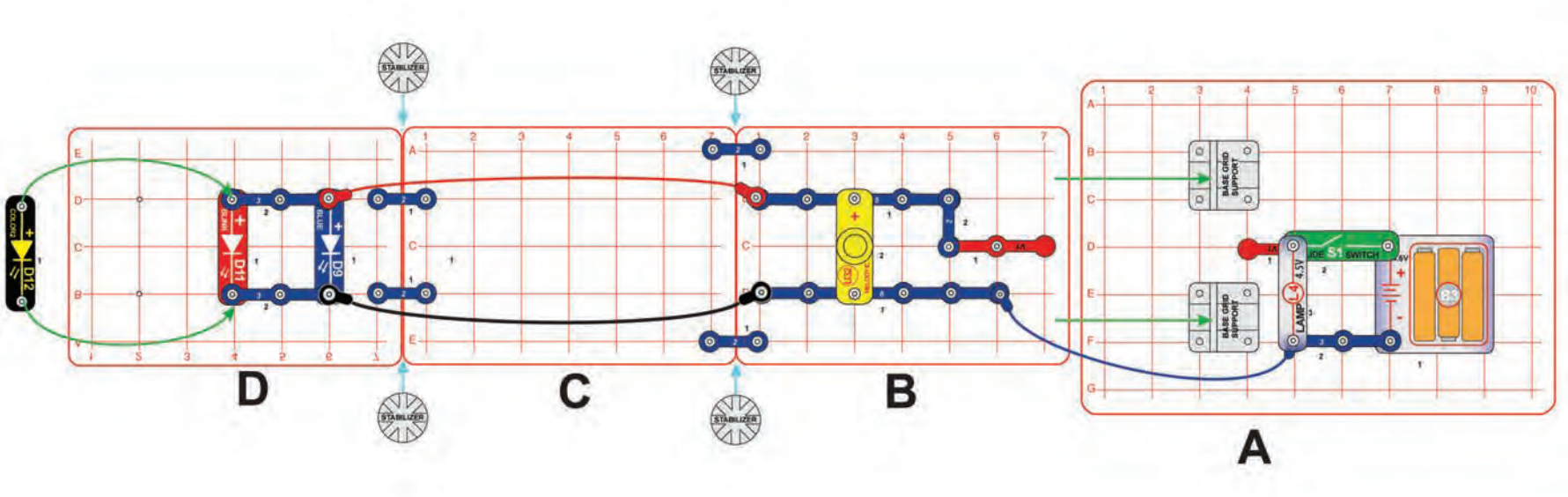
Assembly (adult supervision recommended):

1. Place the base grid supports on base grid A.
2. Place parts on grid B (except the jumper wires) and install into base grid supports on grid A. Note that two snap wires hang off the top of grid B.
3. Install remaining parts on grid A and connect the red & black jumper wires.
4. Install grid C onto grid B using 2 stabilizers and connecting the snap wires between them.
5. Place the remaining parts on grid C. Note that two snap wires hang off the top.
6. Install grid D onto grid C using 2 stabilizers and connecting the snap wires between them.
7. Place the remaining parts on grid D. Check everything to make sure the structure is stable.

Turn on the slide switch (S1). The LEDs light and a fan spins.



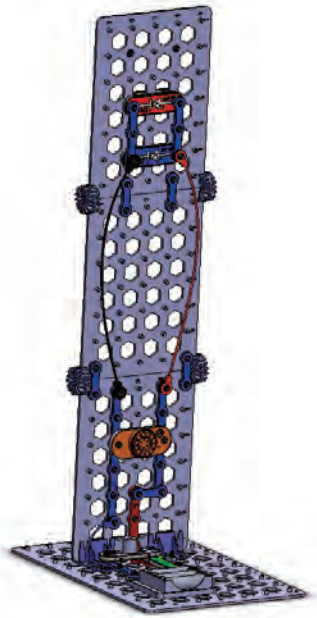
☐ Project 158 Mega Tower



Assembly (adult supervision recommended):

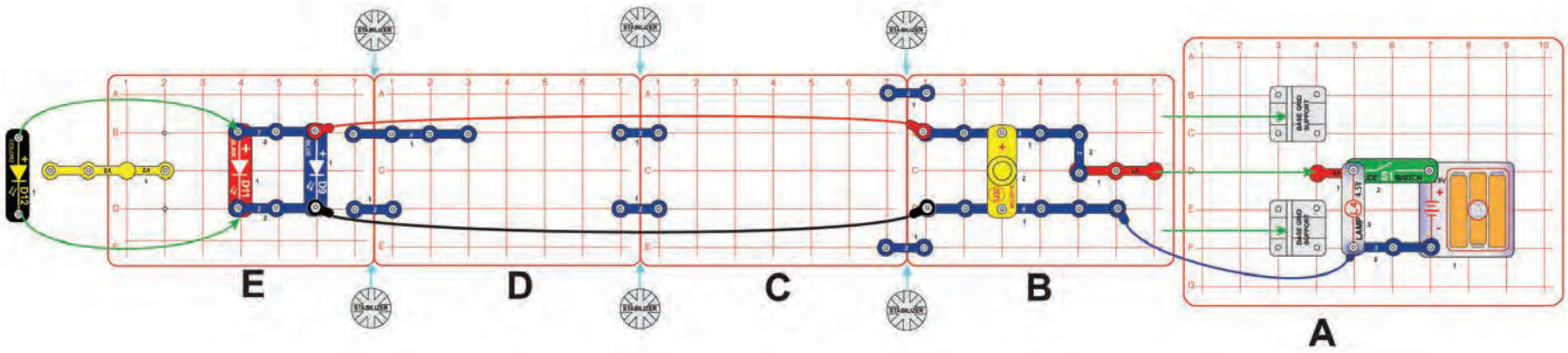
1. Place the base grid supports on base grid A.
2. Place parts on grid B (except the jumper wires) and install into base grid supports on grid A. Note that two snap wires hang off the top of grid B.
3. Install remaining parts on grid A and connect the blue jumper wire.
4. Install grid C onto grid B using 2 stabilizers and connecting the snap wires between them.
5. Place parts on grid D. Install grid D onto grid C using 2 stabilizers and connecting the snap wires between them.
7. Connect the red & black jumper wires. Check everything to make sure the structure is stable.

Turn on the slide switch (S1). The lights light and a melody plays.



Project 159

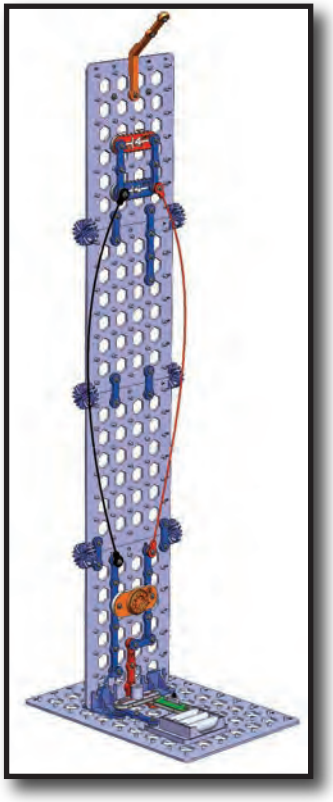
Super Tower



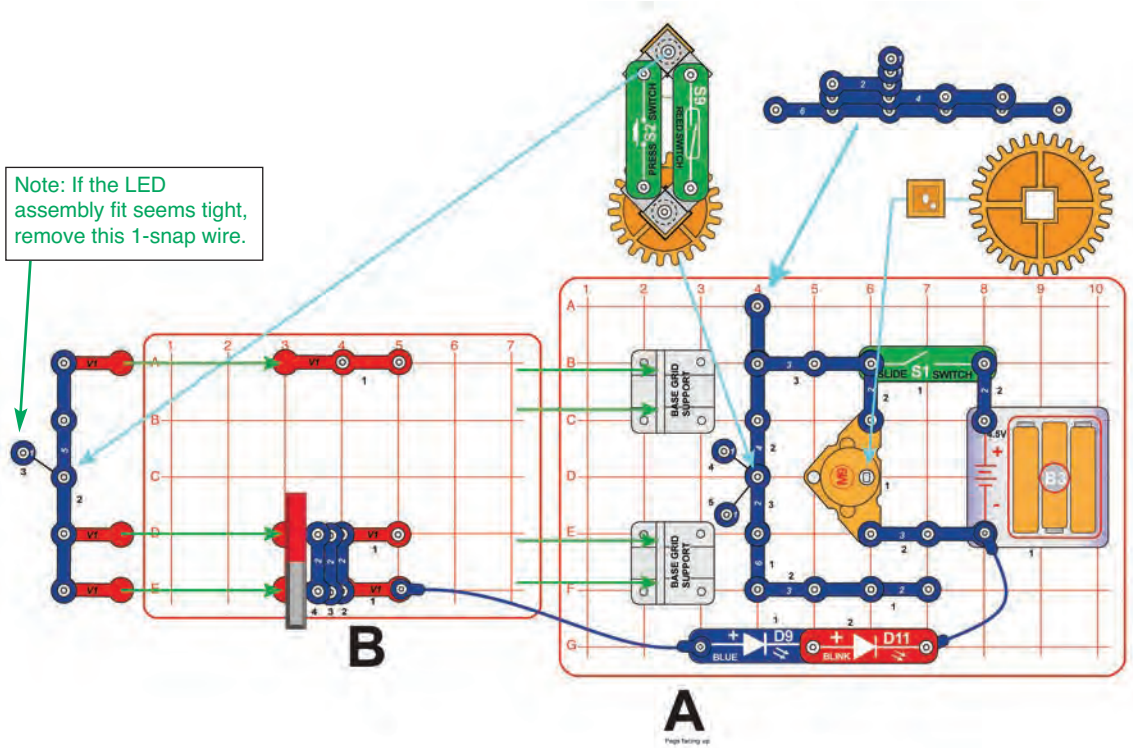
Assembly (adult supervision highly recommended):

1. Place the base grid supports on base grid A.
2. Place parts on grid B (except the jumper wires) and install into base grid supports on grid A.
3. Install remaining parts on grid A except the blue jumper wire.
4. Install grid C onto grid B by placing the 2 stabilizers and 2-snap wires that connect them.
5. Install grid D onto grid C by placing the 2 stabilizers and 2-snap wires that connect them.
6. Carefully install parts on grid E (which is the double-sided grid), and install onto D. Check everything to make sure the structure is stable.
7. Connect the jumper wires.

Turn on the slide switch (S1); the LEDs and lamp light, and the melody IC makes sound.



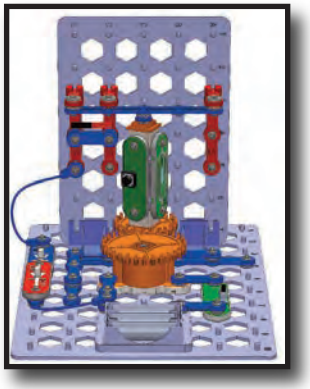
Project 160 Spinning Reed Switch



Assembly :

1. Place the base grid supports and the parts on base grid A.
2. Install the gear insert and large gear on the orange motor.
3. Place parts on grids B, then install grid B onto base grid supports on grid A.
4. Mount the reed switch (S9) to the 3D snaps, and attach the push switch (S2) opposite side as shown. Add the small gear.
5. Mount the switch assembly from step 4 between the 1-snap wires on grids A & B, as shown.
6. Lay the magnet on the 2-snap wires as shown.

Turn on the slide switch (S1); the gears rotate the switch assembly. When the reed switch moves past the magnet the switch closes and both LEDs light. If the LEDs don't light try adjusting the magnet position, and shift one of the blue jumper wires to the other side of the LED it connects to. If you have other magnets you can try using them.



Project 161

Spinning Reed Switch 2

Use the preceding circuit, but replace the blink red LED (D11) with the clear motor (M4). Attach the fan to the clear motor.

When the reed switch (S9) passes the magnet the switch closes, the blue LED (D9) flashes, and the fan spins.

Project 162

Spinning Reed Switch 3

Use the project 160 circuit, but replace the blink red LED (D11) with the lamp (L4), move the blue jumper wire from base grid A location G3 to G5, and connect the black jumper wire across base grid A locations G3 and E8.

Turn on the slide switch (S1). The blue LED (D9) lights. When the reed switch passes the magnet, the LED and the lamp turn on and off.

Project 163

Spinning Reed Switch 4

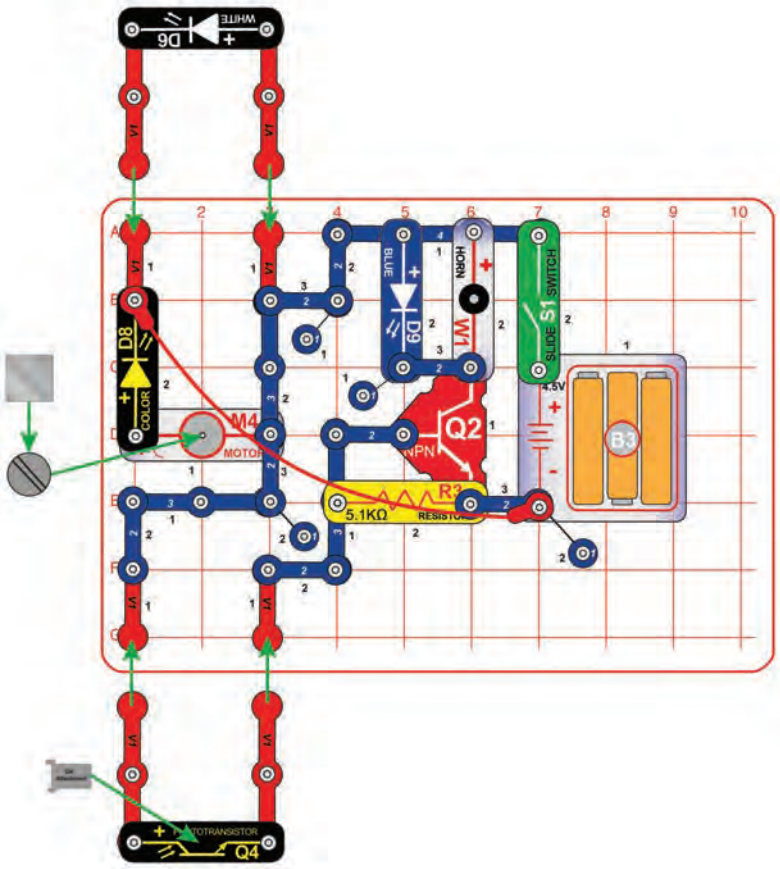
Use the preceding circuit, but replace the lamp (L4) with the clear motor (M4) and attach the fan.

Turn on the slide switch (S1). The fan spins and the blue LED (D9) lights. When the reed switch passes the magnet, the LED turns off and the fan speed up briefly.

Bonus Projects

These projects require additional Snap Circuits® parts that are not included in this set, but most can be built if you also have Snap Circuits® 3D & Illumination (model SC-3Di), or may be part of other Snap Circuits® sets you already have. They are provided here as examples of what can be made by combining this set with others. If you experiment further on your own then be sure to follow the guidelines in the DOs and DON'Ts pages of your manuals (page 8 of this manual). You may purchase additional Snap Circuits® parts at www.snapcircuits.net.

☐ Project B1 Bonus Spinning Mirror Beeper

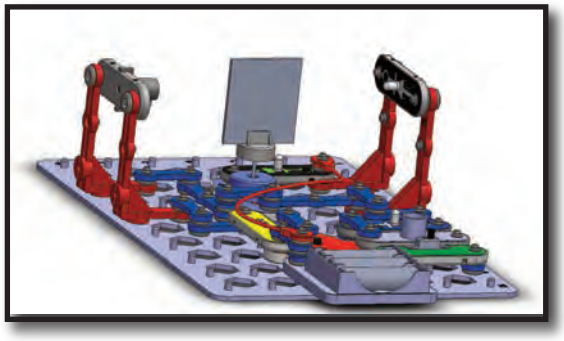


THIS PROJECT REQUIRES PARTS FROM MODEL SC-3Di.

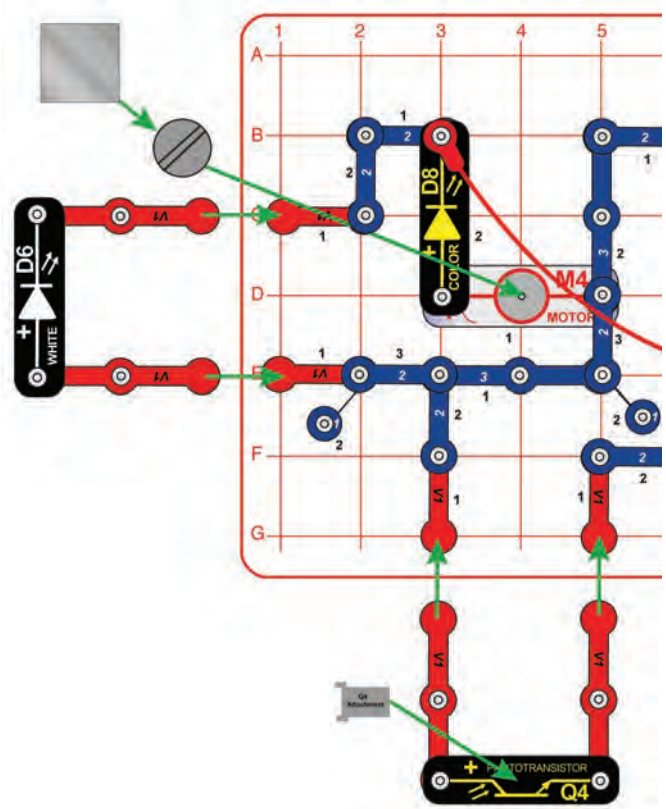
Build the circuit as shown, with the white LED (D6) mounted on two vertical snap wires (V1), shining towards the phototransistor (Q4), which is also mounted on 2 vertical snap wires. Place the mounting base on the phototransistor. Place the mirror (an illusion card will also work) in the illusion card holder and mount it on the clear motor (M4). This project works best with new alkaline batteries.

Turn on the slide switch (S1). The mirror should be spinning; if it is not, then give it a push to get started. As the mirror spins the horn (W1) beeps and the blue LED (D9) lights. The clear motor speeds up and slows down, controlled by the color LED (D8). If the sound is always on, point the phototransistor away from room light.

The horn is activated whenever the mirror position allows light from the white LED to shine onto the phototransistor.



Project B2

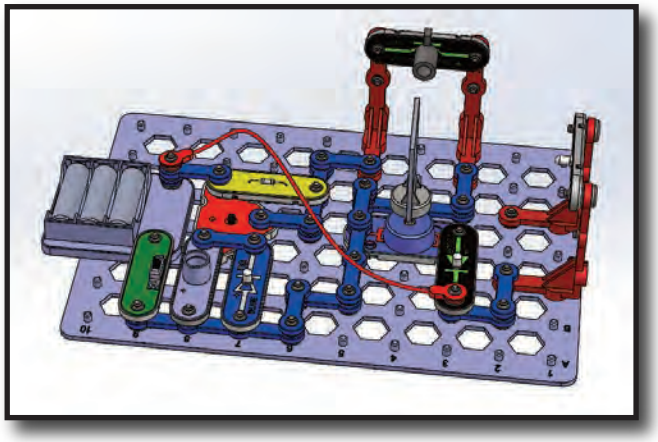


Bonus Spinning Mirror Beeper 90°

Requires parts from model SC-3Di.

Modify the preceding circuit to be this one, which has the white LED (D6) and phototransistor (Q4) at a 90 degree angle to each other. Place a mirror in the illusion card holder and mount it on the clear motor (M4).

Turn on the slide switch (S1). The mirror should be spinning; if it is not, then give it a push to get started. As the mirror spins the horn (W1) beeps and the blue LED (D9) lights. The clear motor speeds up and slows down, controlled by the color LED (D8). If the sound is always on, point the phototransistor away from room light.



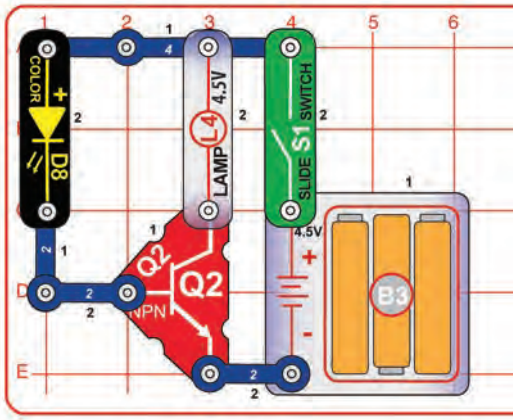
Project B3

Requires an NPN transistor (Q2), which is included in model SC-3Di and others.

Turn on the slide switch (S1). The color LED (D8) and lamp (L4) are blinking. If you remove the LED then the lamp will turn off.

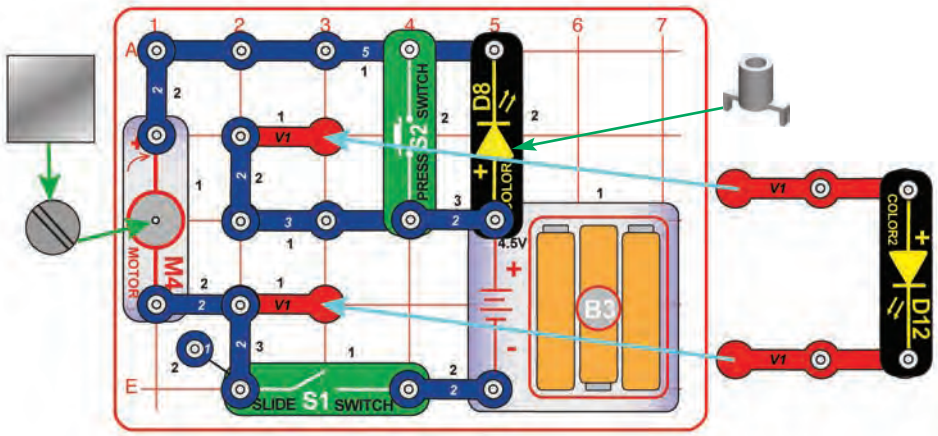
The blink red LED cannot control the lamp directly, but it can using the transistor.

Bonus Blinking Lamp



Project B4

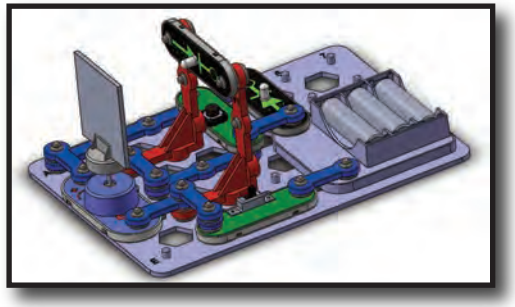
Bonus Reflection Light



Requires parts from model SC-3Di.

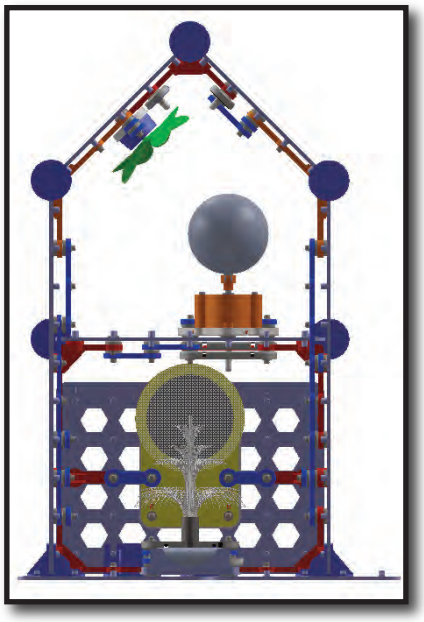
Turn on the slide switch (S1). If the clear motor (M4) is not spinning then push the press switch (S2) to get it started. Completely cover the color LED (D8) to block all its light. Place the circuit in a dark room and watch as light from the color2 LED (D12) is reflected onto the walls.

You can swap the locations of the color and color2 LEDs to change the effects, or replace either the LEDs with different ones.



Project B5

Bonus House with Loft



THIS PROJECT REQUIRES PARTS FROM MODEL SC-3Di.

Assembly (adult supervision highly recommended):

1. Place base grid supports on base grids A & B. Note that grid F will be the 2-sided grid.

2. Place parts on base grids C, D & E, and install into base grid supports on grid A, connecting the two vertical snap wires (V1) between the grids as you do it. Grids C & E are full size grids. The pegs should be facing inward.

3. Place parts on both sides of grid F, and install on grids C & E using 2 stabilizers. The orange motor (M9) should be on the top side.

4. Place remaining parts on grid A.

5. Attach grids G & H to each other using 2 vertical snap wires and 2 stabilizers.

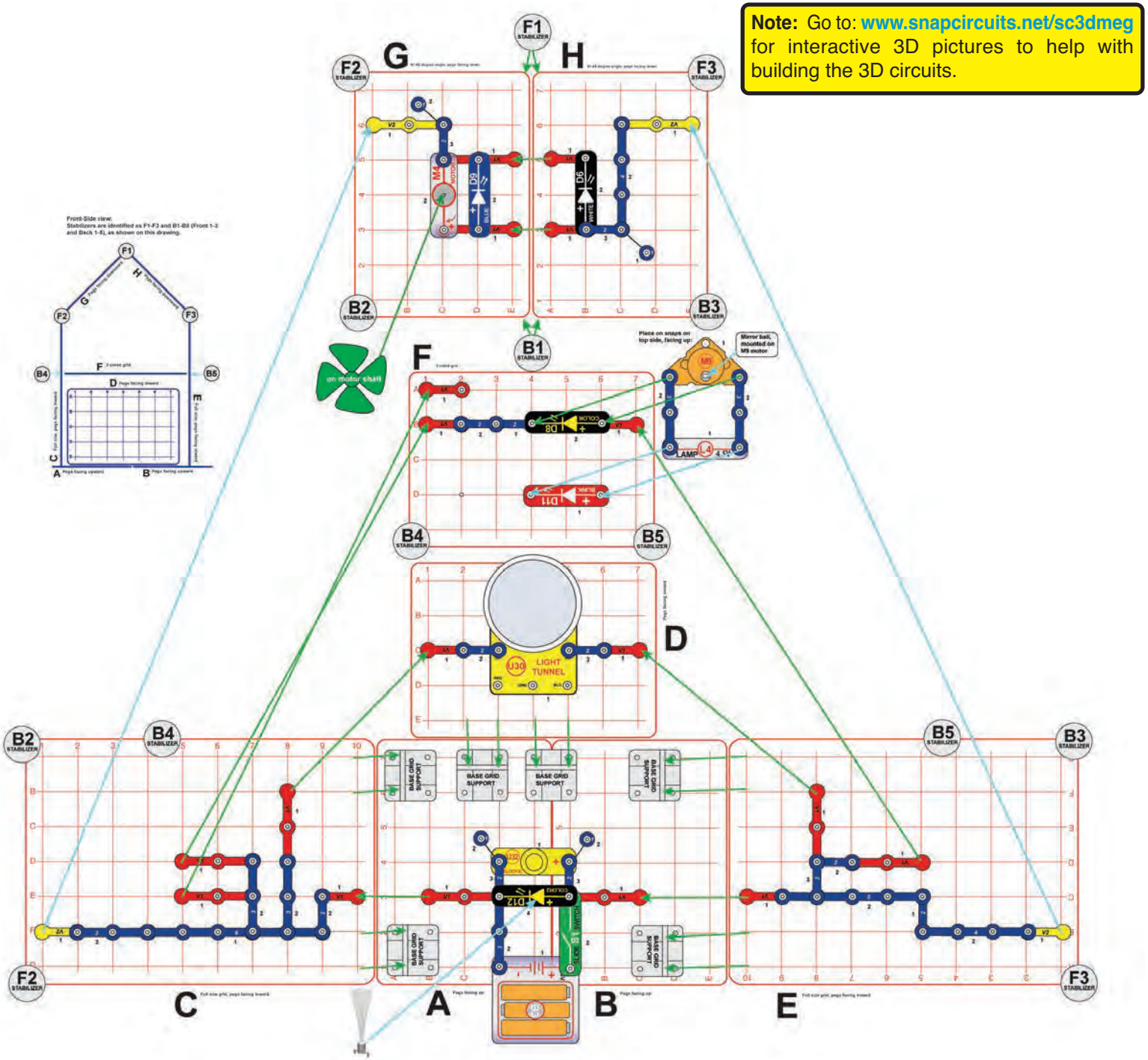
6. Mount grids G & H, at 45 degree angles and with pegs facing downward, on top of grids C & D using 4 stabilizers, attaching the two 45 degree vertical snap wires (V2) on grids C & D as you do it. Adjust the positions of the stabilizers as needed.

7. Carefully place the remaining parts on grids G & H.

8. Carefully place the wind fan on the clear motor (M4), the mirror ball on the orange motor, and the fiber optic festive tree (with its mounting base) on the color2 LED (D12) if you did not do so earlier.

Turn on the slide switch (S1) and enjoy the show! For best effects place the circuit in a dimly lit room.

Note: Go to: **www.snapcircuits.net/sc3dmeg** for interactive 3D pictures to help with building the 3D circuits.



Going Further

The structures shown below require additional Snap Circuits® parts that are not included in this set, but may be part of other Snap Circuits® sets you already have. They are provided here as examples of what can be made by combining this set with others. If you experiment further on your own then be sure to follow the guidelines in the DOs and DON'Ts pages of your manuals (page 8 of this manual). You may purchase additional Snap Circuits® parts at www.snapcircuits.net.

For assembly instructions and additional photos of these structures, go to www.snapcircuits.net/sc3di.

Big Structure

House of Lights

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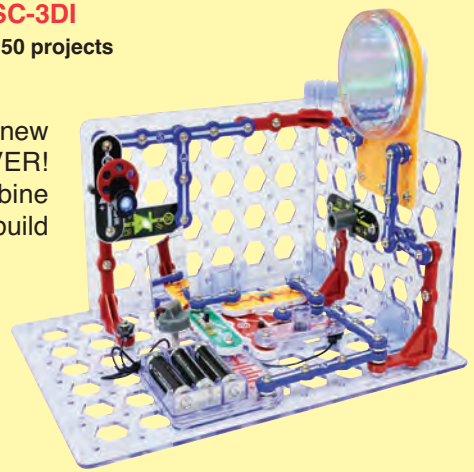

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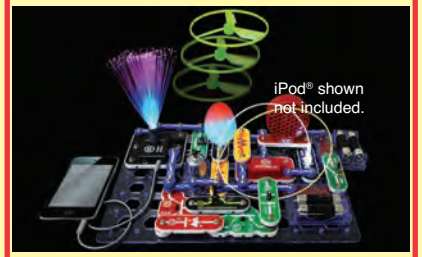
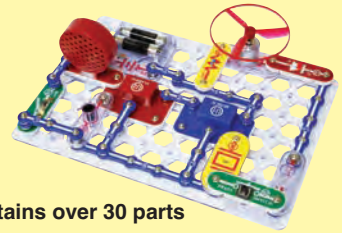


Snap Circuits® JR

Model SC-100 **with over 100 projects**



Contains over 30 parts

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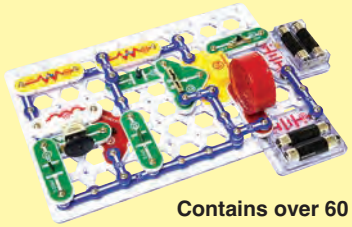

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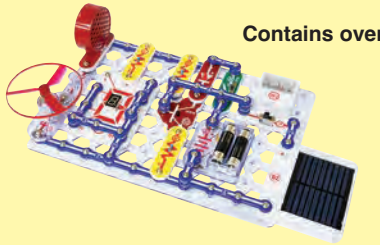

SC-3D M.E.G. Parts Layout

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