SNAP CIRCUITS

GREEN ENERGY LAB

BUILD 44 PROJECTS

Discover *Green Energy*

Build *A Wind Turbine*

Produce *Solar Power*

SNAP CIRCUITS®

Table of Content

For Additional Projects:

Go to:
www.elenco.com/scgrneng-manuals/
to download projects 19 - 44

Download projects 19-44, more information about your parts and how circuits work, and our Think Green – Learn About Energy book.

Simply Snap together

Snap Circuits® *uses building blocks with snaps to assemble real electronic circuits. Each block has a function: switch, light, battery, different length wire blocks, and more! With easy-to-follow project manual,* ***simply snap together to create working circuits!***

What is electricity? *Everything in the world around us is made of particles called protons, neutrons and electrons. These three tiny particles are found in everything around us. When the electrons move, they create electricity.*

Important Safety Notes for Parents and Kids

- **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. 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.
- Save the packaging and instructions. They contain important information.
- ⚠**Warning: Choking Hazard**- Small parts. Not for children under 3 years of age.
- ⚠**Warning:** This product produces flashes that may trigger epilepsy in sensitized individuals.
- ⚠**Warning: Shock Hazard** - Never connect Snap Circuits® to the electrical outlets in your home in any way!
- ⚠**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.
- Never modify your parts, as doing so may disable important safety features in them, and could put your child at risk of injury
- Save the packaging and instructions. They contain important information.

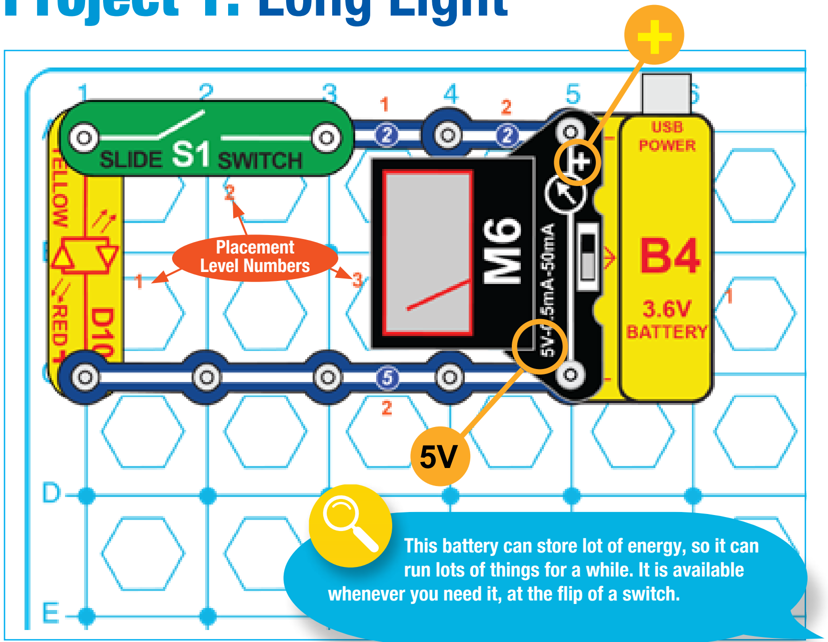
Helpful Symbols:
Look for these symbols throughout the manual.

GENERAL INFORMATION
·Definitions
·"How it works?"

SNAP CIRCUITS
Technical information using your parts.

ADULT ASSISTANCE REQUIRED
Get an adult to help with your build

Project 1: Long Light



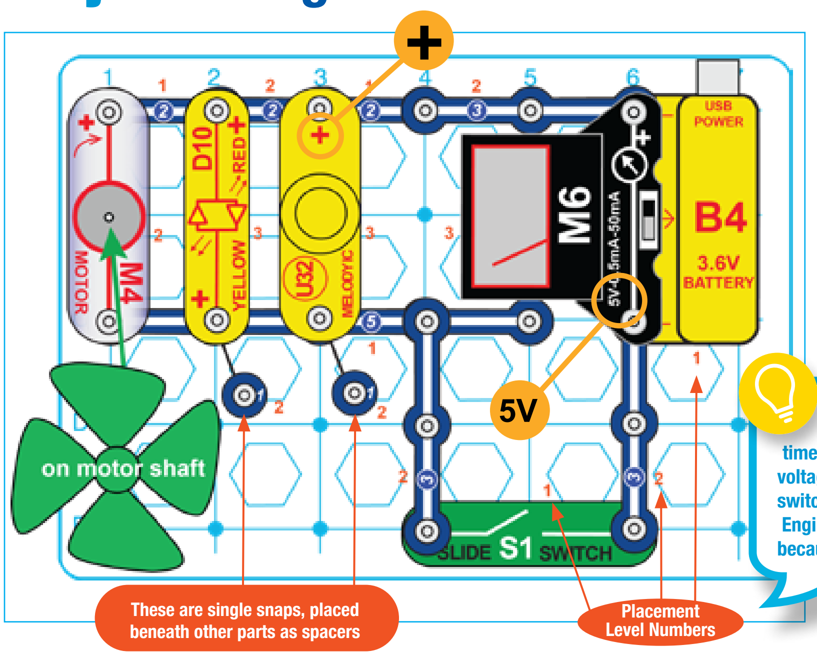
•Build the circuit shown by placing all the parts with a black 1 next to them on the clear plastic base grid first. Then, place parts marked with a 2. Then place the part marked with a 3. Set the **Meter (M6)** to the 5V setting and turn on the **Slide switch (S1)**. The red/yellow **LED (D10)** lights, and the meter measures the battery (B4) voltage.

•Watch the voltage on the meter for a while as the battery runs the red/yellow **LED (D10)**. How quickly does the voltage drop?

•If your battery was recently recharged then you probably found the voltage drops very, very slowly, and thought this was boring. That was the idea - batteries can run things for a long time and (unlike solar or wind power sources) are hardly affected by changing weather conditions. Batteries can provide power whenever you need it - but, eventually, they do run out.

See project 3 if you need to recharge the battery (B4).

Project 2: Lights



•Build the circuit and set the **Meter (M6)** to the 5V setting. Turn off the **Slide Switch (S1)** and read the **Battery (B4)** voltage when it is not running anything.

•Now turn on the slide switch and see what happens to the voltage when everything turns on. If the battery is already weak, some modules may not work. If you watch the voltage for a while, you will see it slowly drop as the battery is discharged. If the battery was already weak, the voltage will drop faster.

•If you remove some of the devices the battery is running (the melody IC, motor, and LED), then the voltage will not drop as much when the switch is turned on. See which device has the biggest effect.

The battery makes electricity using a chemical reaction, but has a limited amount of chemicals and not all of it can react at the same time. When a battery cannot supply as much current as a circuit needs, the voltage (electrical pressure) drops. That is why the voltage drops when the switch connects the battery to the rest of this circuit.
Engineers refer to all the devices a power source is running as the load, because they are the burden the power source is carrying.

See project 3 if you need to recharge the battery (B4).

GREEN ENERGY LAB

Model SC-GMPLY

PARTS LIST

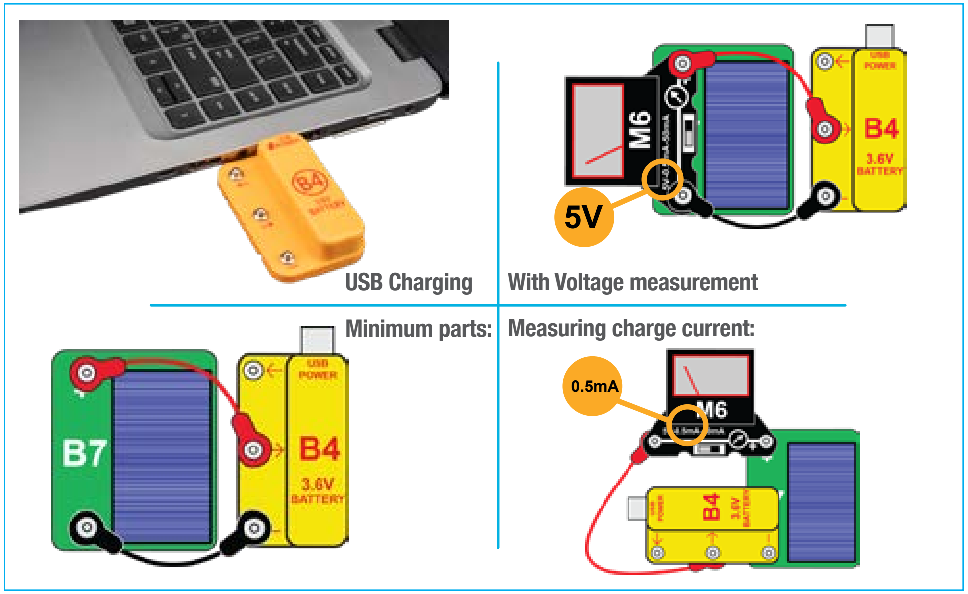
QTY.	ID	NAME	Part #
❒ 1		Base Grid	6SCBGMGR
❒ 2	1	1-snap wire	6SC01
❒ 3	2	2-snap wire	6SC02
❒ 3	3	3-snap wire	6SC03
❒ 1	5	5-snap wire	6SC05
❒ 1	B4	Rechargeable Battery	6SCB4
❒ 1	B7	Solar Cell	6SCB7
❒ 1	D10	Red/Yellow LED	6SCD10
❒ 1		Jumper Wire Black 8”	6SCJ1
❒ 1		Jumper Wire Red 8”	SCCJ2
❒ 1	M4	Motor	6SCM4
❒ 1		Wind Fan	6SCSM4B
❒ 1		Water Wheel	6SCM4C
❒ 1	M6	Meter	6SCM6
❒ 1	S1	Slide Switch	6SCS1
❒ 1	U32	Melody IC	6SCU32

IMPORTANT:
If any parts are missing or damaged,
DO NOT RETURN TO RETAILER.

e-mail us at:
support@elenco.com

You may order additional/replacement parts:
elenco.com/replacement-parts

Project 3: Best Charging Circuits



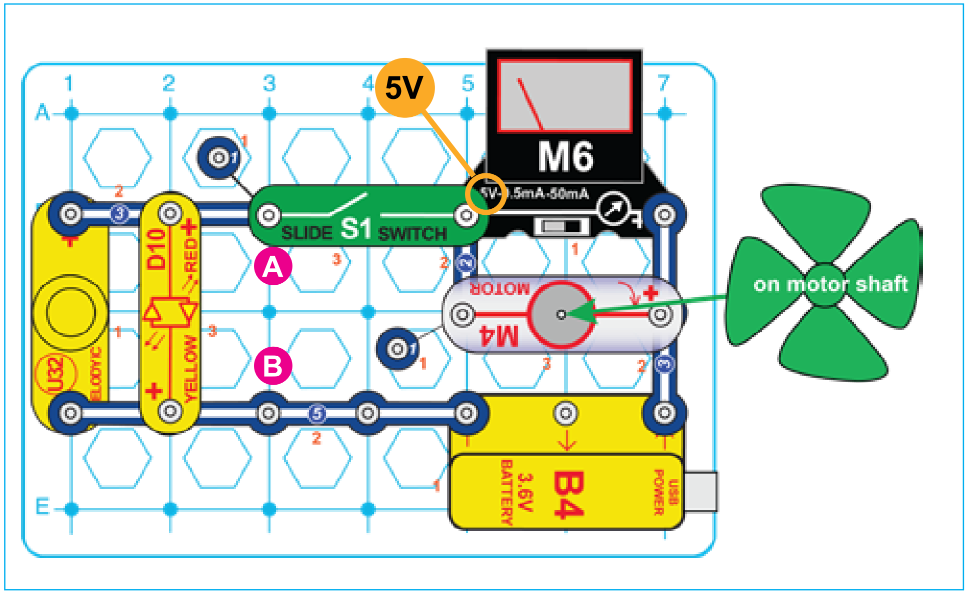
•Your **Rechargeable Battery (B4)** will need to be recharged often; it can be charged with a USB connection or with solar light using any of these circuits. The USB POWER light on B4 comes on when it is charging through the USB.

•For solar charging, place the solar cell in sunlight or about 12 inches from an incandescent light bulb of 60W or more. It takes a few hours to charge the battery. LED, CFL, and fluorescent lights do not work well with solar cells. When measuring charge current, the current will often be too high to measure on the 0.5mA setting but too low to measure on the 50mA setting (you can use either). The current will get lower as the battery approaches full charge.

You can't hurt the battery by overcharging.

Although the battery is rated as 3.6V, it may charge to as high as 4.0V. If you are monitoring the voltage using the meter, you may see the voltage quickly reach 3.6V, but this does not mean that the battery is fully charged. When the battery is discharging to power something, the voltage is nearly steady for a long while then drops off quickly. The same thing occurs when it is charging. Recharging the battery will quickly reach around 3.6V but it needs much more charging to avoid a quick drop-off when discharging. Recharge the battery for several hours.

Project 4: Moving Voltage

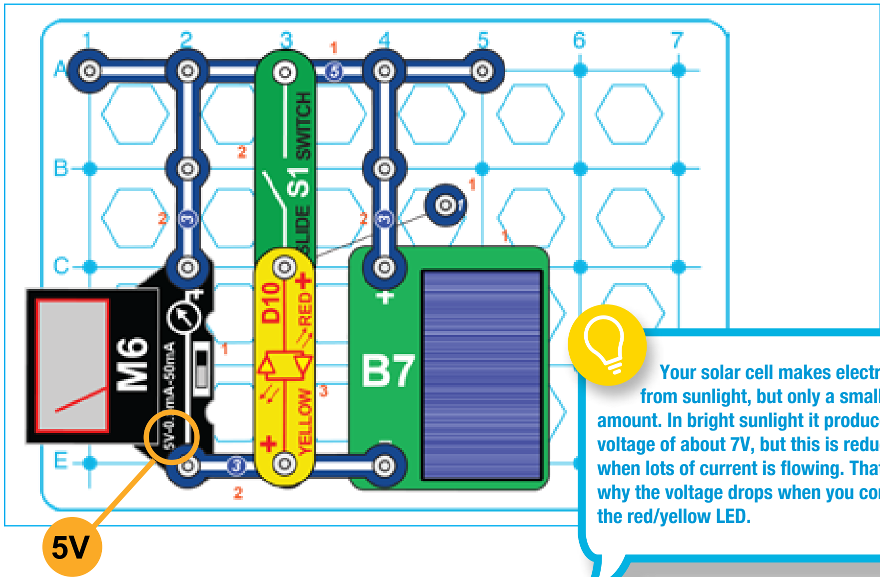


•Build the circuit and set the **Meter (M6)** to the 5V setting. Place the wind fan on the **Motor (M4)**. Turn on the **Switch (S1)**. The **LED (D10)** lights, the **Melody IC (U32)** makes a distorted sound, the fan spins, and the meter shows the voltage across the motor. You may need to give the fan a push to get it started. The voltage produced by the battery is split between the motor and the LEDs and melody IC.

•Connect the red jumper wire across points labeled A & B. The LED and melody IC turn off, the motor speeds up, and the meter shows a higher voltage across the motor. With the jumper wire connected, the full voltage from the battery is available at the motor because the LEDs and **Melody IC** are bypassed.

See project 3 if you need to recharge the battery (B4).

Project 5: Solar Power



Your solar cell makes electricity from sunlight, but only a small amount. In bright sunlight it produces a voltage of about 7V, but this is reduced when lots of current is flowing. That is why the voltage drops when you connect the red/yellow LED.

•Place all the parts with a black 1 next to them on the green plastic base grid first, then parts marked with a 2, then the part marked with a 3. The red/yellow **LED (D10)** may be connected in either direction.

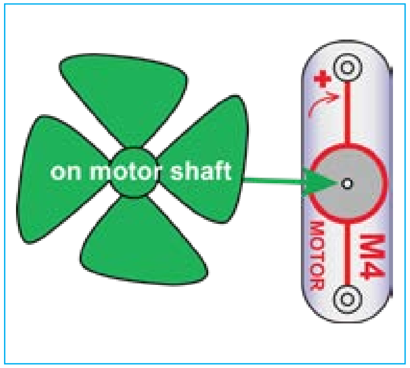
•Place the circuit so the solar cell is in bright sunlight or close to an incandescent light bulb. Set the **Meter (M6)** to the 5V setting.

•The meter is measuring the voltage produced by the solar cell. Adjust the position of the solar cell to see how the voltage produced changes depending on the angle to the light source and the brightness.

•Position the solar cell to make the highest voltage you can. Now turn on the slide switch to run the red/yellow LED with the solar cell. Notice how the voltage produced drops when the LED is connected.

•Compare the voltage and LED brightness when using different light sources (sunlight, incandescent bulbs, LED bulbs, fluorescent bulbs) to see which work best with solar cells.

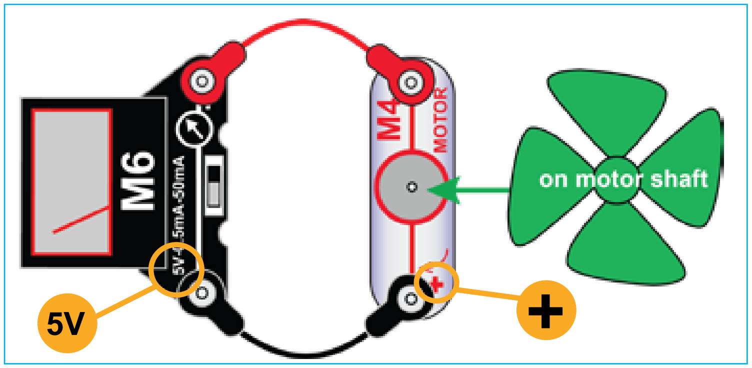
Project 6: Solar Motor



In the preceding circuit, replace the **Red/Yellow LED (D10)** with the **Motor (M4)**, in either direction) and place the wind fan on it. Now turn on the switch and watch how the voltage changes as the solar cell runs the fan. Depending on your light source, the fan may need a push to get started or may not work at all.

The motor needs less electricity from the solar cell as it speeds up, so the solar cell voltage is higher as the motor gets faster.

Project 7: Windmill

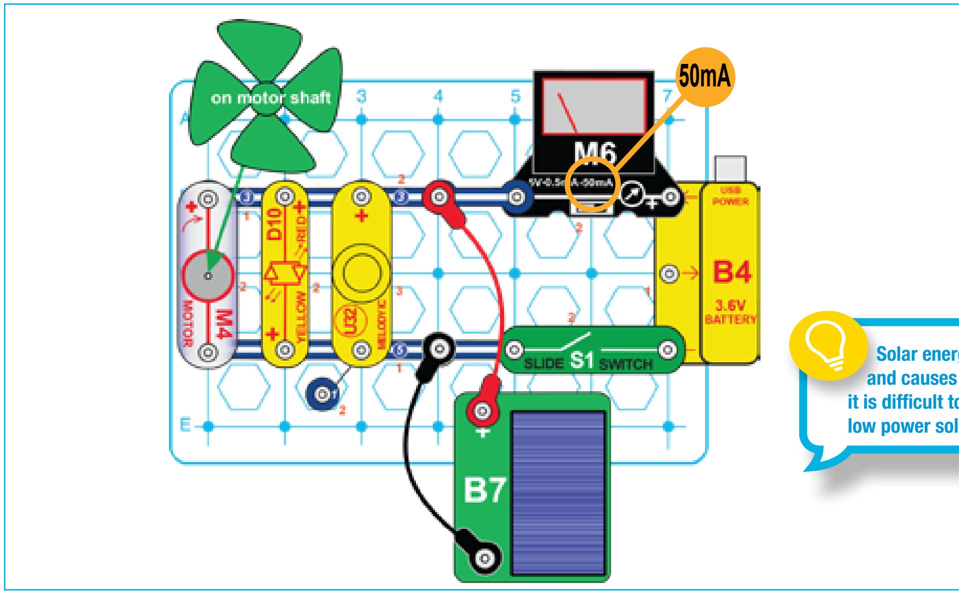


•Mount the **Wind Fan** on the **Motor (M4)** and connect it to the **Meter (M6)** using the red and black jumper wires. Set the meter to the 5V setting.

•Blow on the fan or place it in a strong wind (either outside or near an electric fan). You may need to give the fan a push to get it started. The meter measures how much voltage your “windmill” produces. See how the voltage produced changes with the angle to the wind.

The windmill uses magnetism to change the mechanical energy of the spinning shaft into electricity. The voltage it produces is usually lower than the solar cell, but the current is higher.

Project 8: Solar & Battery



•Build the circuit, set the **Meter (M6)** to the 50mA setting, and turn on the slide **Switch (S1)**. The **Motor (M4)** and fan spin, the **Red/Yellow LED (D10)** lights, the **Melody IC (U32)** plays a tune, and the meter measures the current from the **Battery (B4)**.

•Place the **Solar Cell (B7)**, which is connected using the **Red & Black jumper wires** in direct sunlight or a few inches from an incandescent light bulb. If the sunlight on the solar cell is very bright then the solar cell helps to power the **Motor, LED, and Melody IC**, and the meter shows lower current because less current is being drawn from the battery. Cover the solar cell with your hand and see how much the current measured on the meter changes.

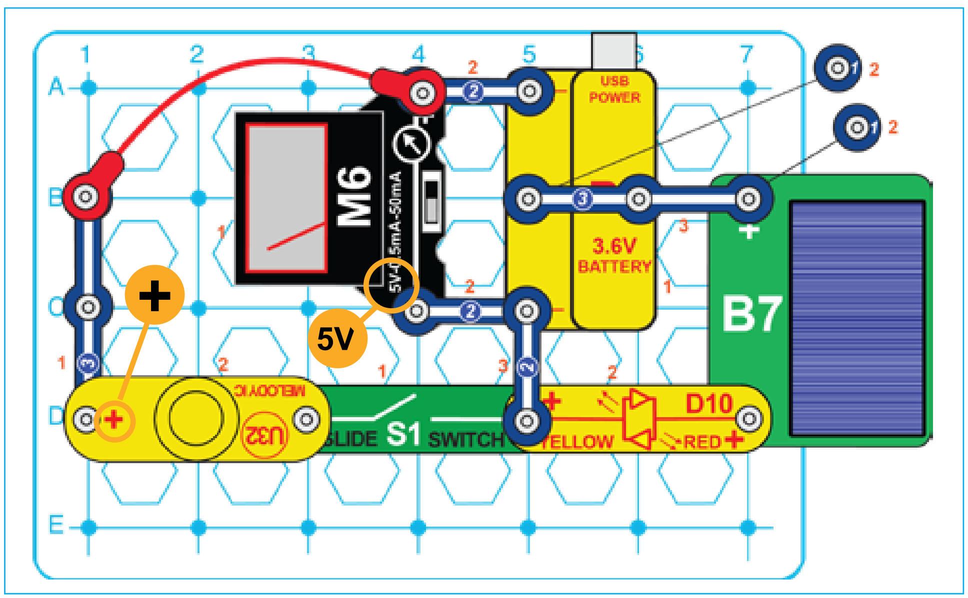
Solar energy is free, abundant and causes no pollution. However it is difficult to harvest because even low power solar cells are expensive.

Part B: You can make the battery last longer if you turn off some things. Remove the **Melody IC, LED, or Motor** from the circuit, and see how much the current drops. Then remove another. Some devices use more current than others, so it helps most if you disconnect the highest current device - find out which one it is.

See project 3 if you need to recharge the battery (B4).

Reducing how much energy we use is just as important as finding new sources of clean energy.

Project 9: Charge & Play



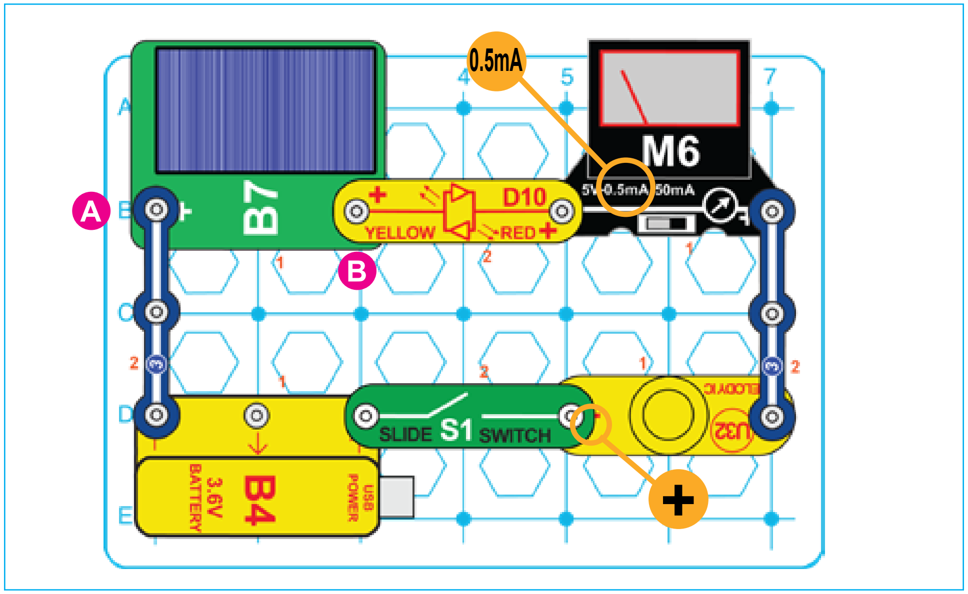
•Build the circuit shown here, set the **Meter (M6)** to the 5V setting, and leave the **Slide Switch (S1)** off. The meter will measure about 3.6V if the **Battery (B4)** is charged up.

•Place the **Solar Cell (B7)** in sunlight or a few inches from an incandescent light bulb to charge the battery. The **Red/Yellow LED (D10)** lights if the battery is being charged.

•Turn on the switch to play music on the **Melody IC (U32)**. The voltage measured may drop a little as the **Melody IC** slowly drains the battery.

See project 3 if you need to recharge the battery (B4).

Project 10: Voltage Adder



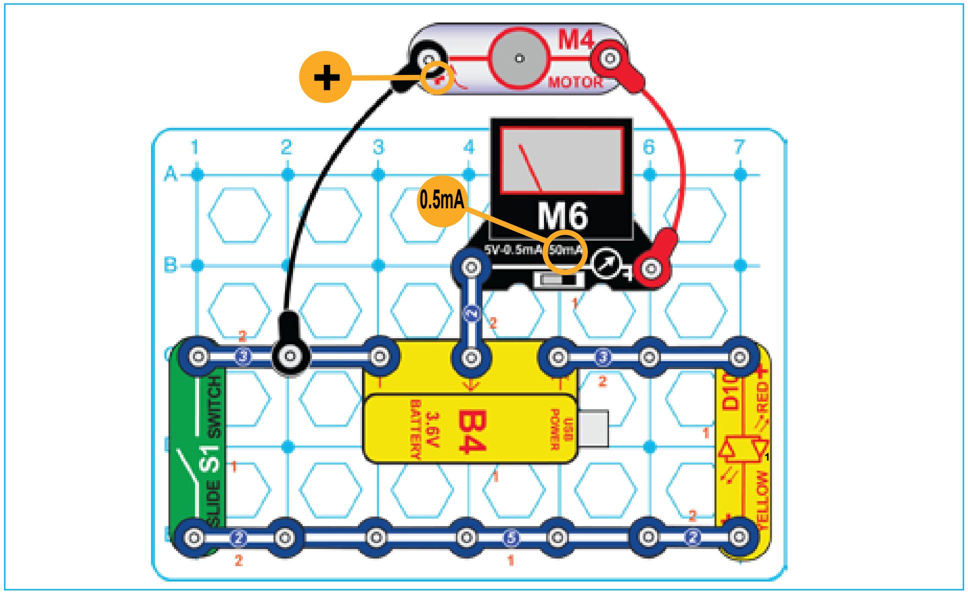
•Set the **meter (M6)** to the 0.5mA or 50mA setting and turn on the **Switch (S1)**. Place the **Solar Cell (B7)** in bright sunlight or near an incandescent lamp. If the light is bright enough, the **Red/Yellow LED (D10)** will be bright and the **Melody IC (U32)** will play a tune. If the current is too high to measure then change the meter to the 50mA scale.

•Now place a 3-snap wire across points A & B, to bypass the solar cell. Now the LED is dimmer and the melody IC makes no sound or very distorted sound,

When the solar cell is in the circuit its voltage combines with the battery voltage to make both the LED and melody IC work.

See project 3 if you need to recharge the battery (B4).

Project 11: Wind Charger with Light



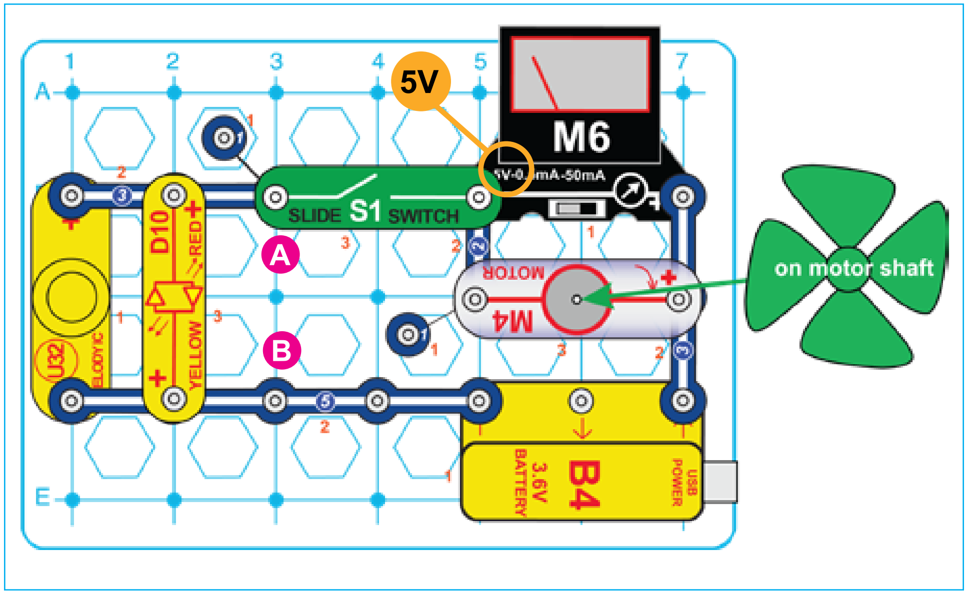
•Build the circuit shown. Set the **Meter (M6)** to the 0.5mA setting. Blow hard on the fan or place it in a very strong wind (either outside or near an electric fan). The “windmill” charges the **Battery (B4)** when the wind is blowing hard, and the meter measures the charging current. Turn on the **Switch (S1)** to turn on the **LED (D10)**.

•Part B: Replace the **Red/Yellow LED (D10)** with the **Melody IC** (U32, “+” on top). The circuit works the same except turning on the switch makes sound. Here the **Melody IC** is run using wind power, by using the battery for storage.

A problem with using wind to power a light is that the wind isn’t always blowing when you need the light on. On the other hand, the wind is often blowing when you don’t need the light on. So here you use the battery to store energy from the windmill when the wind is blowing, and then run the LED when you need the light on. This way light is always available from clean, free wind power.

See project 3 if you need to recharge the battery (B4).

Project 12: Moving Voltage

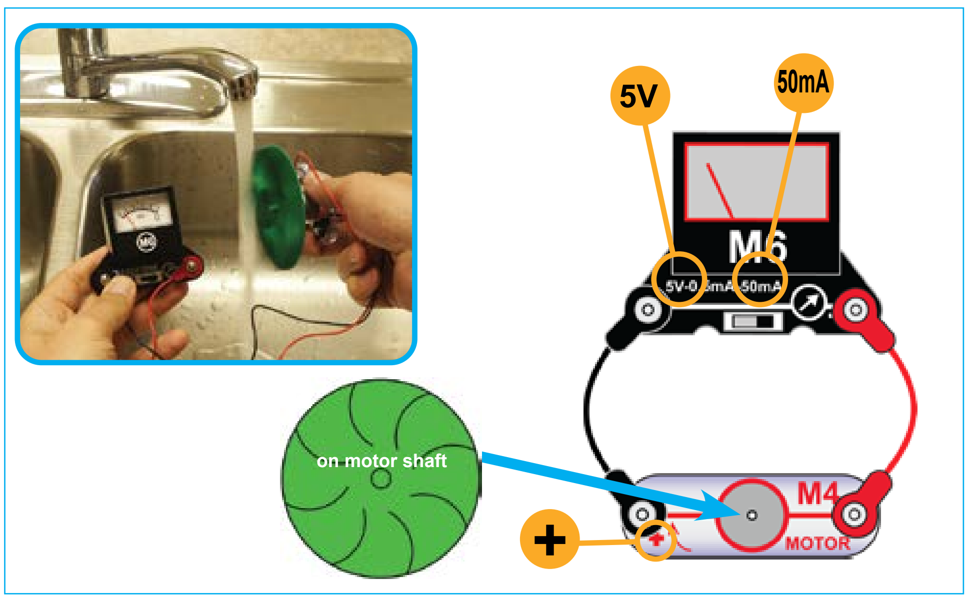


•Build the circuit and set the **Meter (M6)** to the 5V setting. Place the wind fan on the **Motor (M4)**. Turn on the **Switch (S1)**. The **LED (D10)** lights, the **Melody IC (U32)** makes a distorted sound, the fan spins, and the meter shows the voltage across the motor. You may need to give the fan a push to get it started. The voltage produced by the battery is split between the motor and the **LEDs and Melody IC**.

•Connect the **Red Jumper Wire** across points labeled A & B. The **LED** and **Melody IC** turn off, the motor speeds up, and the meter shows a higher voltage across the motor. With the jumper wire connected, the full voltage from the battery is available at the motor because the LEDs and melody IC are bypassed.

See project 3 if you need to recharge the battery (B4).

Project 13: Changing Water Pressure to Electrical Pressure



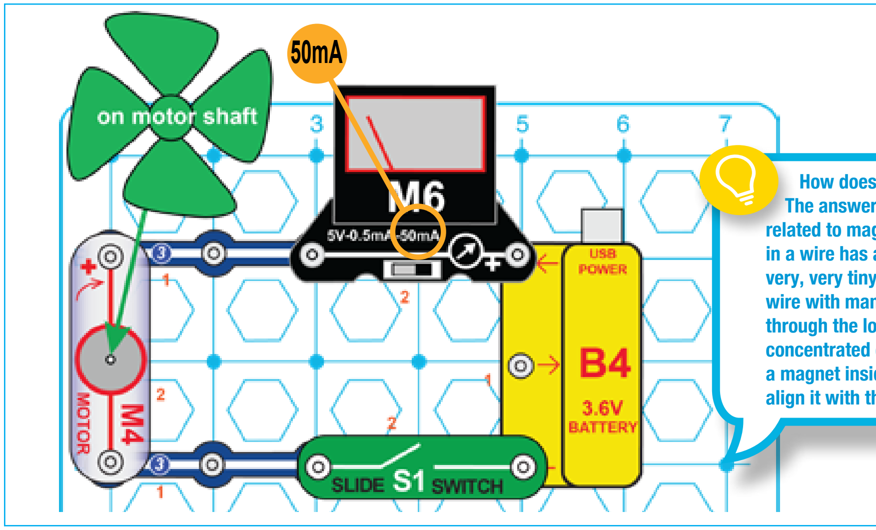
•Place the water wheel on the **Motor (M4)** and connect it to the **Meter (M6)**, as shown. Set the meter to the 5V or 50mA setting. Hold the motor under a water faucet so the water wheel will “catch” the water as it falls. See how much voltage and current you can produce.

•Using the water pressure from your faucet to make electricity using the motor (used as a generator here) is just like using water pressure from a lake to run an electric generator in a dam.

•Your parts might stop working if water gets inside them. Let them dry out and they should be fine.

Hoover Dam has a lake that is 500 feet deep on one side to provide great pressure to turn the generators that make our electricity.

Project 14: Motor



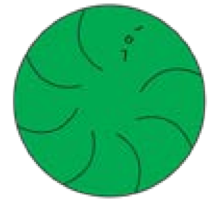
•Build the circuit shown. Set the **Meter (M6)** to the 50mA setting and place the wind fan on the **Motor (M4)**. Turn on the **slide switch (S1)** and watch the current on the meter as the motor speeds up.

•Do you know why the current drops as the fan speeds up?

How does electricity turn the shaft in the motor? The answer is magnetism. Electricity is closely related to magnetism and an electric current flowing in a wire has a magnetic field similar to that of a very, very tiny magnet. Inside the motor is a coil of wire with many loops. If a large electric current flows through the loops, the magnetic effects become concentrated enough to move the coil. The motor has a magnet inside, so as the electricity moves the coil to align it with the permanent magnet, the shaft spins.

See project 3 if you need to recharge the battery (B4).

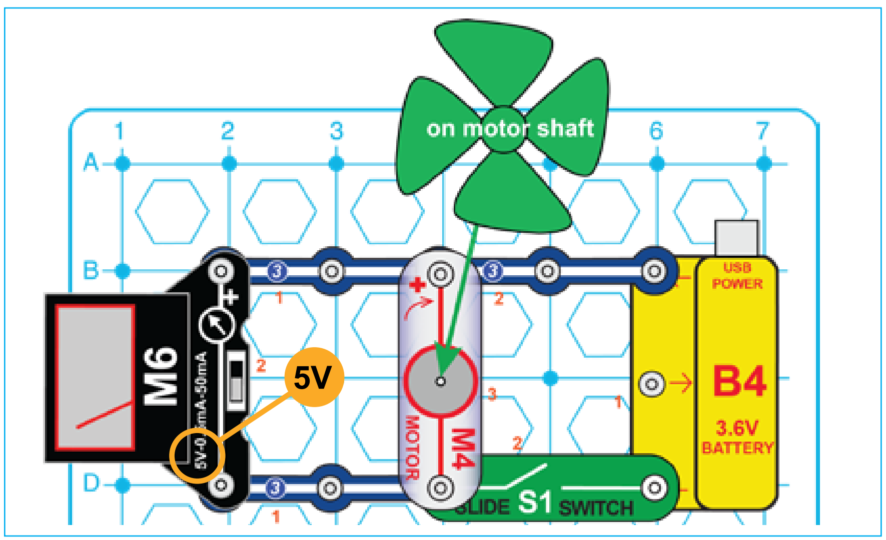
Project 15: Water Wheel



•Remove the wind fan from the motor shaft and replace it with the **Water Wheel**. Watch how the current is different with the larger water wheel.

•The water wheel is heavier, so it takes more current to spin it, and doesn't get as fast. Try laying something on the water wheel to give it even more weight.

Project 16: Motor Voltage



•Modify the preceding circuit into this one. Set the **Meter (M6)** to the 5V setting and place the wind fan on the **Motor (M4)**. Turn the **Slide Switch (S1)** on and off and watch the voltage on the meter as the motor speeds up and slows down.

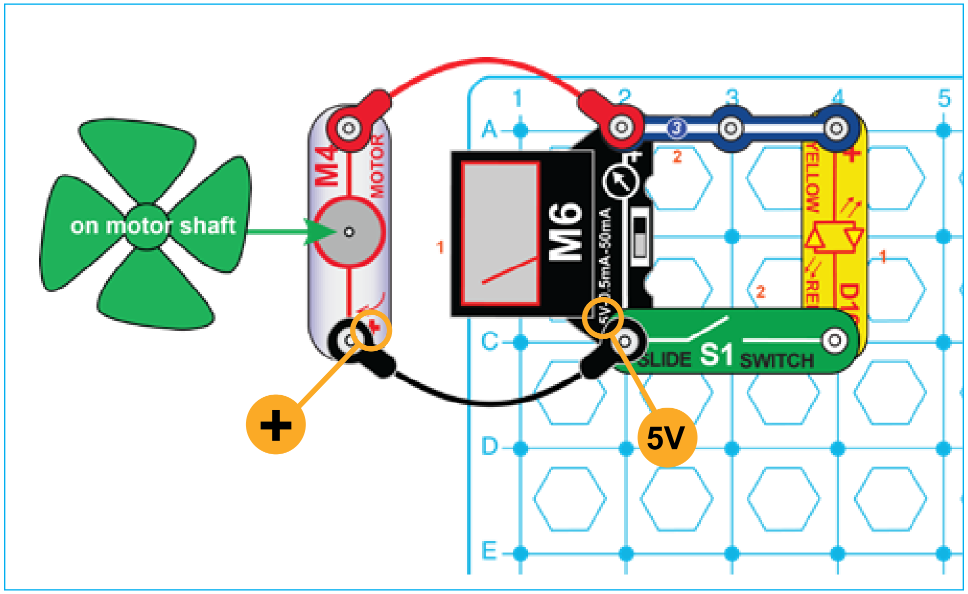
•Without pressing the switch, spin the fan clockwise with your finger and watch the voltage. In the preceding project, the current dropped as the fan sped up - now you see why. The spinning fan produces a voltage in the motor; this voltage opposes the voltage from the battery, reducing the current as the motor speeds up.

•How will the voltage and current change if you replace the wind fan with the water wheel? Try it.

Electricity is generated when you spin the motor shaft. A coil of wire is on the shaft and as it spins past the permanent magnet an electric current is created in the wire.

See project 3 if you need to recharge the battery (B4).

Project 17: Windy Lights

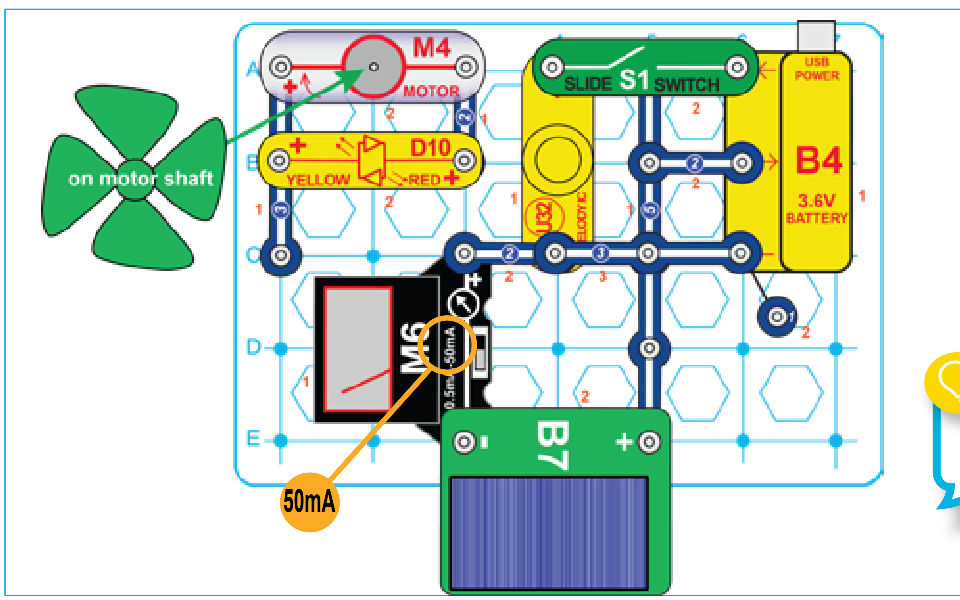


•Build the circuit shown. Set the **Meter** to the 5V setting, and keep the **Slide Switch (S1**) off. Blow on the fan or place it in a strong wind (either outside or near an electric fan). The meter measures how much voltage your "windmill" produces. You may need to give the fan a push to get it started.

•Now turn on the **Slide Switch (S1)** to connect the **Red/Yellow LED (D10)** to the **Windmill**. The voltage produced drops a little, but not as much as for the solar cell circuits. Compare the brightness of the LED at different wind speeds.

•If the wind reverses direction then the meter will measure less than zero voltage, and the **Red/Yellow LED** will light red. You can see this by spinning the fan in both directions using your finger.

Project 18: Box Cover Circuit



•This project combines several circuits to demonstrate what you can do with **Snap Circuits® Green Energy Lab**. This circuit may be shown on your box or manual cover.

•Assemble the circuits shown. Set the **Meter (M6)** to the 50mA setting. Turn on the **Slide Switch (S1)**. The **Battery (B4)** runs the **Melody IC (U32)**.

•Place the **solar cell (B7)** in sunlight or near an incandescent light bulb to charge the battery. The meter measures the changing current.

•Blow on the fan or spin it with your finger to light the **Red/Yellow LED (D10)**. The **Motor (M4)** acts as a generator, producing electricity to light the LED.

There are many ways to generate electricity, and many more ways to use it!

See project 3 if you need to recharge the battery (B4).

For Additional Projects:

Go to: www.elenco.com/scgrneng-manuals/ to download projects 19 - 44

Download projects 19-44, more information about your parts and how circuits work, and our Think Green – Learn About Energy book.

Basic Troubleshooting

1. The battery (B4) will only work if it is charged. Project 3 shows how to recharge it.
2. Most circuit problems are due to incorrect assembly, always double-check that your circuit exactly matches the drawing for it.
3. Be sure that parts with positive/negative markings are positioned as per the drawing.
4. Be sure that all connections are securely snapped.

ADULT SUPERVISION RECOMMENDED

Advanced Troubleshooting

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

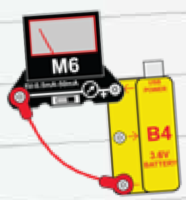
If you suspect you have damaged parts, you can follow this procedure to systematically determine which ones need replacing:

1. To Test:
Battery (B4)
Meter (M6)
Red/Yellow LED (D10)
Motor (M4):

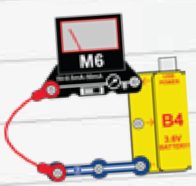
- Plug B4 into a powered USB port; the “USB POWER” light on B4 should come on, indicating that it is being charged by the USB. Next, set the meter to the 5V setting and touch it across B4; the meter pointer should move. If the meter measures 3V or less then recharge B4 using project 3. If B4 cannot be recharged then it is damaged. Set the meter to the 0.5mA and 50mA scales; the reading should be maximum. Touch the D10 directly across B4, it should light red or yellow (depending on which way you oriented it). Touch the motor across the snaps on B4, it should spin.
- If the meter, LED, and motor all do not work then B4 is damaged; if one of them did not work then that device is damaged.
- You should also confirm that B4 can be charged using the solar cell (B7). Confirm that B7 works, then use the “Measuring Charge Current” circuit of project 3. If the meter measures any current then B4 is fine.

2. **Solar cell (B7):** Place the meter directly across the solar cell and set it to the 5V setting. Place the solar cell in sunlight or near a bright light source (incandescent light bulbs are best); the meter pointer should move. Be sure you used a bright light source and removed any protective plastic wrap covering the solar cell.

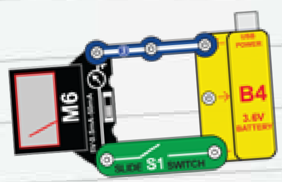
3. **Red & Black Jumper wires:** Set the meter to the 5V setting and use this circuit to test each jumper wire. The jumper wire is damaged if the meter pointer does not move.



4. **Snap wires:** Set the meter to the 5V setting and use this circuit to test each snap wire, one at a time. The snap does not move.



5. **Slide switch (S1):** Set the meter to the 5V setting and build this circuit. If the meter pointer does not move when you turn on the switch, the switch is damaged.



6. **Melody IC (U32):** Touch the melody IC directly across the snaps on the battery (B4), U32 “+” to battery “□”. You should hear a tune. If the sound is distorted then recharge the battery.

IMPORTANT:
If any parts are missing or damaged,
DO NOT RETURN TO RETAILER.
Go to elenco.com/replacement-parts or e-mail us at support@elenco.com.
Note: A complete parts list is on page 2 in this manual.

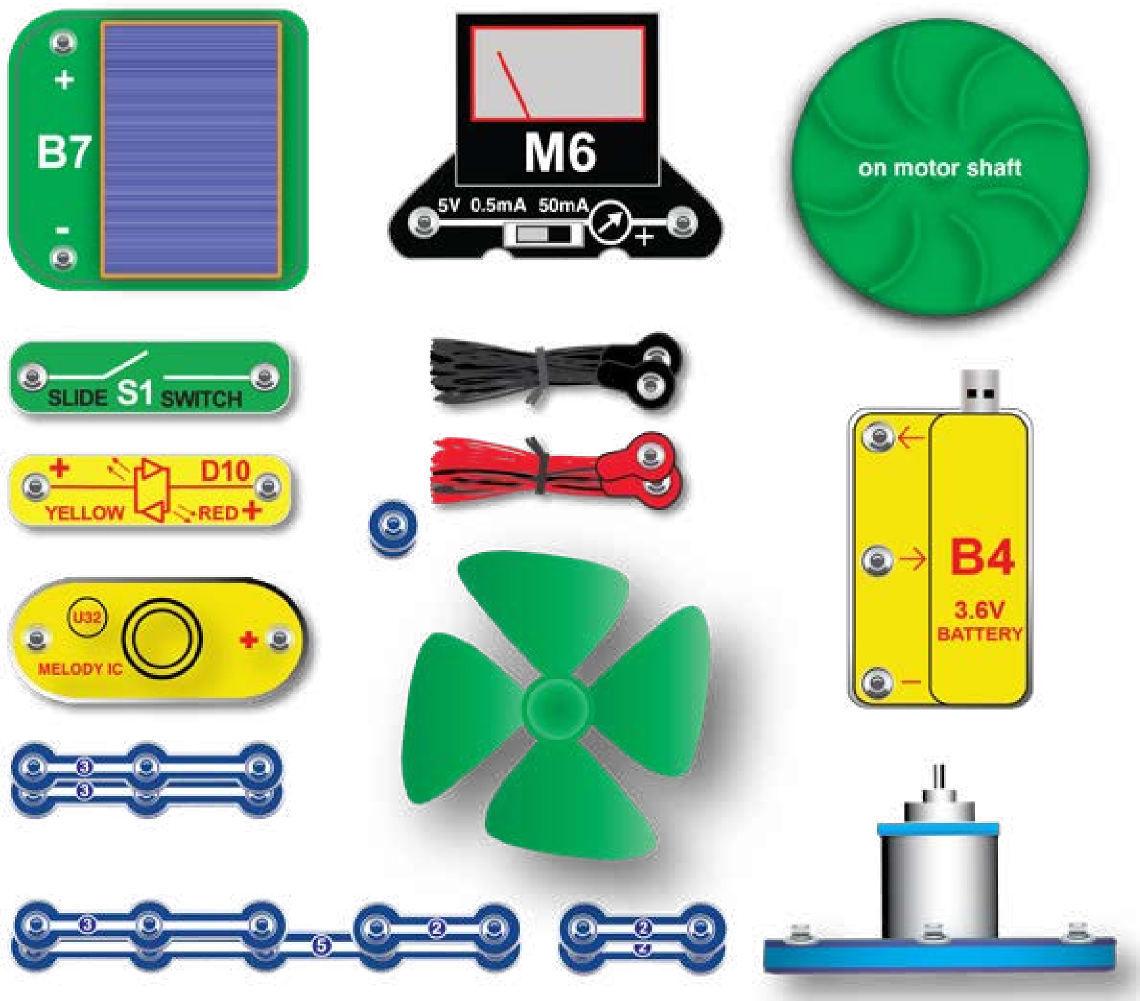
If you have any problems, contact: ELENCO® ELECTRONICS, LLC
150 Carpenter Ave. Wheeling, IL 60090 l (800) 533-2441
e-mail: support@elenco.com z

Snap Circuits® Green Energy Lab Parts Layout

IMPORTANT:

If any parts are missing or damaged, DO NOT RETURN TO RETAILER. Go to elenco.com/replacement-parts or e-mail us at support@elenco.com.

Note: A complete parts list is on page 2 in this manual.



Base Grid (7.7” x 5.5”) overlays some parts.

If you have any problems, contact: ELENCO® ELECTRONICS, LLC

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