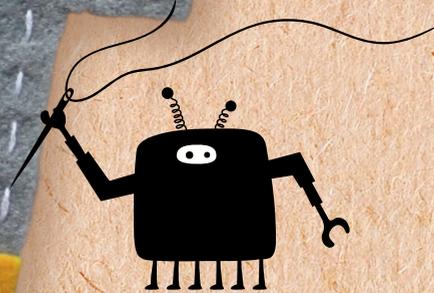


**GEEK
& CO.
CRAFTS!**

INSTRUCTION MANUAL

SeWiNG CIRCUITS



THAMES & KOSMOS



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SAFETY INFORMATION

Warning!

Not suitable for children under 3 years. Choking hazard — small parts may be swallowed or inhaled. Strangulation hazard — long threads may become wrapped around the neck. This kit contains functional sharp needles. Do not injure yourself!

Warning!

Only for use by children aged 8 years and older. Instructions for parents or other supervising adults are included and have to be observed.

Keep the packaging and instructions as they contain important information.

SAFETY FOR EXPERIMENTS WITH BATTERIES

- The conductive thread or other conductive materials (e.g., the needles or safety pins) are not to be inserted into socket-outlets. Never perform experiments using household current! The high voltage can be extremely dangerous or fatal!
- For each felt robot patch, you will need one 3-volt button cell battery (type CR2032) installed in a battery holder, two of which are included in the kit. Activate it as described on page 1, or insert it into the battery holder making sure to have it oriented in the correct polarity direction.
- Avoid a short circuit. Neither the loose batteries, nor the battery holder contacts, nor the conductive thread attached to them should be bridged.
- The supply terminals are not to be short-circuited. A short circuit can cause the wires to overheat and the batteries to explode.
- Be sure not to bring batteries into contact with coins, keys, or other metal objects.
- Be careful to avoid any unintentional short circuit caused by other conductive objects (e.g., coins, keys, buckles, or buttons on clothing) or materials (such as metalized fabrics).
- Do not use any voltage source other than the specified battery.
- Different types of batteries (such as rechargeable and non-rechargeable) or new and used batteries are not to be mixed.
- Non-rechargeable batteries are not to be recharged. They could explode!
- Rechargeable batteries are only to be charged under adult supervision.
- Rechargeable batteries are to be removed from the toy (battery holder) before being charged.
- Exhausted batteries are to be removed from the toy (battery holder).
- Dispose of used batteries in accordance with environmental provisions, not in the household trash.
- Avoid deforming the batteries.

NOTES ON DISPOSAL OF ELECTRICAL AND ELECTRONIC COMPONENTS

As electronic components, the battery holder and LEDs are recyclable. For the sake of protecting the environment, they should not be thrown into the regular household trash at the end of their lifespan. Instead, they must be delivered to a collection location for electronic waste. This is indicated by the following symbol:



NOTE! Used batteries do not belong in the household trash! Please deliver them to the appropriate disposal location.

Dear Parents,

This craft kit will show your child how to create unique LED-illuminated robot patches made of felt. We call these patches glow-bots! Whether used as a pocket patch, a T-shirt brooch, or a decoration on a cap, a shining glow-bot patch is sure to be an eye-catching accessory, especially in the dark!

The sewing project will help your little artist learn how to handle a needle and thread and teach him or her a basic understanding of electrical circuits. On top of that, your child will get an exciting first look into the innovative world of wearable electronics.

Handling needle and thread, as well as embedding electronic components, will pose some challenges at first. Read through the manual together with your child and be prepared to offer help and advice.

Work steps that will definitely require your assistance are marked with the following symbol: **!**

Please start by checking the pattern with the electronic circuit drawn into it, and then check the completed glow-bot created with it as well.

A well-lit, solid table with a surface that can take a little abuse will be a good work area. Do not let the hobby materials get into the hands of small children! The completed glow-bots are also not baby toys, and should be kept out of the reach of children under 3 years of age.

Help your child think about where to attach the glow-bot. It must not come into contact with any metallic items (such as buckles or metal buttons) or metal-plated materials or fabrics, since this could lead to a short circuit. The glow-bot must be protected from dampness, and it must not be washed. If the glow-bot does get wet, remove the batteries from the battery holder and let everything dry out.

We wish all big and small robot fans a lot of fun!

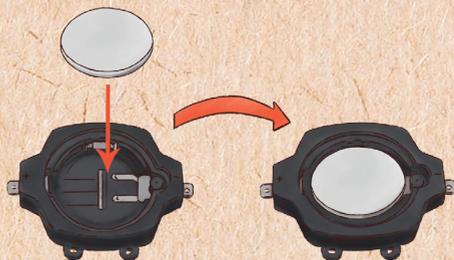
ACTIVATING AND CHANGING THE BATTERIES **!**

The 3-volt button cell batteries (type CR2031) included in the kit are already inserted in the two battery holders and protected against discharging by an insulation strip. To activate the batteries, you will have to pull out the strip.



If a new battery has to be inserted into one of the battery holders, the compartment can easily be opened with a small Phillips-head screwdriver. Lift

off the lid and remove the dead button cell battery. Insert the new battery in the correct polarity direction. The smooth side with writing on it goes up. Then screw the lid back on tightly.



KIT CONTENTS

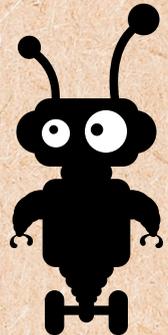


- | | | | |
|---|---|----|----------------------------------|
| 1 | Battery holders (2) | 7 | Bundles of embroidery thread (2) |
| 2 | Conductive thread, 5 m | 8 | Safety pins (2) |
| 3 | Embroidery needle | 9 | Large felt pieces (2) |
| 4 | Sewing needle | 10 | Small felt pieces (2) |
| 5 | 3-volt button cell batteries, type CR2032 (2) | 11 | Green LEDs (2) |
| 6 | Pushbuttons (2) | 12 | Red LEDs (2) |
| | | 13 | Tweezers |

YOU WILL ALSO NEED: Paper, soft pencil, (pointed) scissors, pins, fabric scraps, colored pencils, permanent marker, felt-tip pen, small Phillips-head screwdriver, fabric glue (optional)

Dear Friend of Robots,

Today's robots can handle all kinds of tasks: assembling cars or furniture, helping doctors, and even playing soccer. Usually, they are made of hard materials and wired with metal cables. But did you know that you can also make a soft and cuddly robot without hard metal or wires? This kit will help you invent your own glow-bot inspired by your own imagination. And the best thing about it: You can give him glowing eyes, warning lights, and buttons!

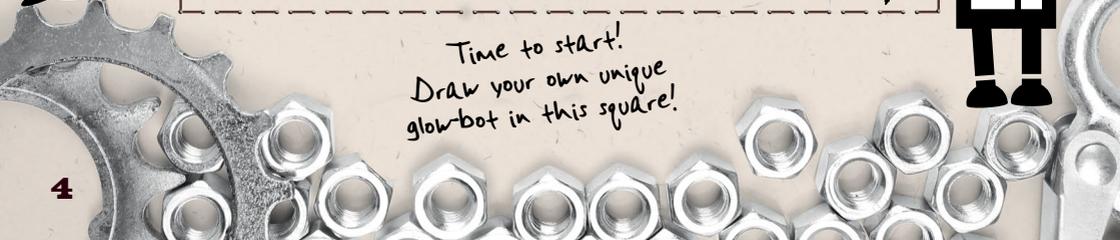




This is the back side of your robot design pattern.
That's why there is nothing here!



Time to start!
Draw your own unique
glow-bot in this square!



PART 1

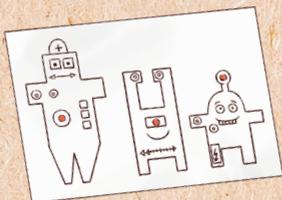
Let's Get GLOWING!

Your glow-bot pattern

What **shape** will your glow-bot have? Is it round or angular? Does it have arms and legs and a head with a neck? Or does it look more like a block of wood?

Spend a little time thinking about which robot parts you will want to decorate with **LED lights**: eyes, antennas, or maybe a robot heart? Your kit comes with red and green LEDs. You can use **one or two** of them for your robot.

Your glow-bot **must** have at least one body part that **sticks out** a little and has **no LED** — for example, an arm or an antenna. That's because you will have to sew a pushbutton component onto a body part that sticks out, so you can switch the LED on and off.

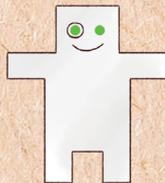


Draw your sketch inside the frame on page 4! Fill the space as completely

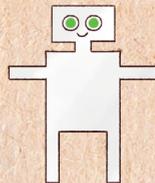
as possible, because you don't want your glow-bot to be **too small**.

It's best to take a **battery holder**, a **pushbutton**, and one or two **LEDs** and lay them on your sketch to make sure that they have enough room. Also, be sure not to make the body parts too thin, or it will be difficult to sew them later on.

Like this:



Not this:



Your glow-bot can look scary or friendly, and it can have several eyes or just one. He can also have a signal, a warning flasher, and a variety of buttons. Let your imagination run free!

When you are happy with your drawing, cut it out with a pair of scissors.

PART 2

SEW THE ROBOT'S BODY

Cut the felt

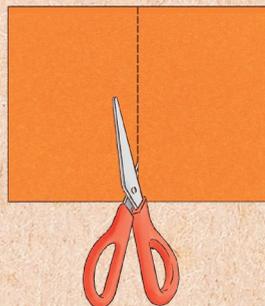
You will need:

Your pattern, large piece of felt, ruler, pins, soft pencil, scissors

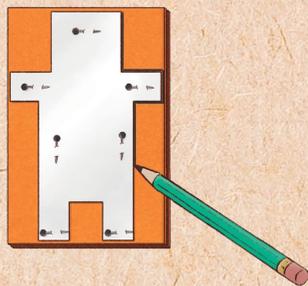
HERE'S HOW:

- 1 Take the gray or orange piece of felt from the box and **cut it in half**.
- 2 Place the two halves on top of one another, position your pattern over them, and secure all three layers together with **pins**. Take your **pencil** and trace the outline of the pattern onto the felt.
- 3 Cut the felt along the line you drew. Be careful not to let the two pieces of felt slip! Then remove the pattern and put it in a safe place.

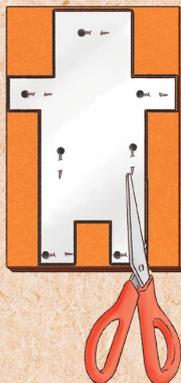
1



2



3



Your little hand-stitch dictionary

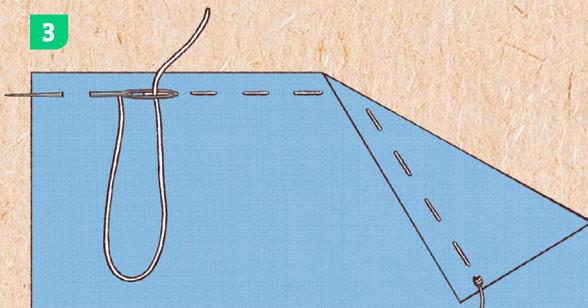
When sewing, you will be using a variety of stitches — the general term for the various ways that you will be guiding needle and thread through fabric. Practice the stitches on a scrap of fabric before sewing your glow-bot.

You will need:

Embroidery needle, embroidery thread, scissors, fabric scrap

Here's how:

- 1 The perfect length of thread:** Take the end of the thread between your thumb and forefinger and wrap the thread once around your elbow and back to your thumb. Then cut that section of thread.
- 2 The starting knot:** Insert the end of your thread into the eye of the needle. Tie a knot in the longer end by winding the thread two to three times around your index finger and pulling the end of the thread through the “ring.” Then cut off the thread right next to the knot.
- 3 The running stitch:** Insert the needle through the fabric **from the back toward the front**. Then, keep inserting the needle through the fabric, **alternating from the front and from the back** and keeping the stitches more or less the same length, pulling the thread through as you go.

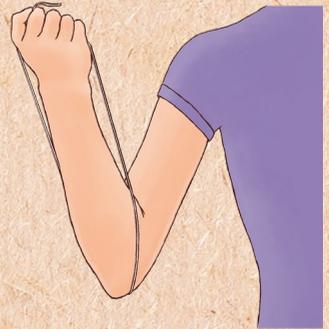


TIP!

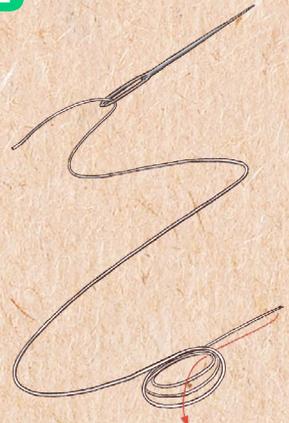


You will be sewing in no time! When selecting the thread, be sure to pay attention to the difference between the **non-conductive thread** (material no. 7) and the **conductive thread** (material no. 2)! Always use the type of thread indicated under the “You will need” heading.

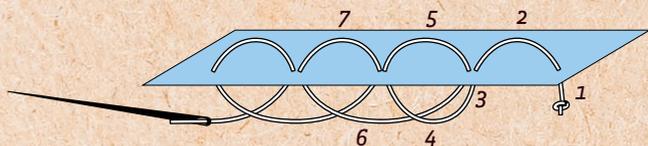
1



2

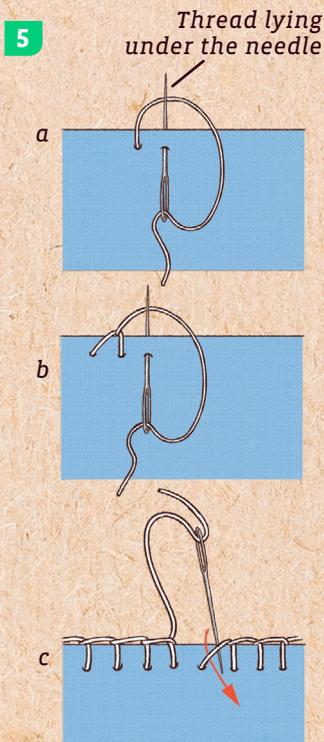
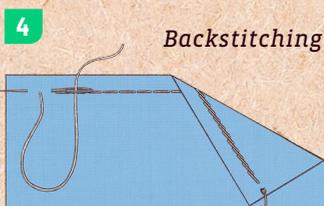


4 The backstitch: Here you will be sewing a little bit backwards with each stitch, creating a seam without gaps. In this example, the stitch is going from right to left. Start as you would for a running stitch: Begin by inserting the needle and thread through the fabric **from the back to the front** (1), move the needle one stitch length to the left (2), and then guide the thread **from the front to the back again** (3). Now move the needle one stitch length to the left again and guide the thread **from the back to the front again** (4). Now it's time to go **backwards!** Move the needle one stitch length **to the right** and stitch from the front to the back (5), just to the left of the first stitch. Guide the thread on the back side **two stitch lengths to the left** (6), one stitch length past your previous back-to-front hole, and thread the needle from the back to the front again. Now move one stitch backwards (7), and thread the needle from the front to the back just to the left of the second stitch. Again, guide the thread on the back side two stitch lengths to the left, and thread the needle from the back to the front again. Now go back to the right again. Keep stitching in this way.



5 The blanket stitch: Leave a space of about half a centimeter from the edge of the piece of fabric and stitch **from the back to the front**. Now leave a small space to the right and stitch **from the front to the back**. At this point, you have to be sure that the thread is lying under the needle (a). Pull the thread through tightly. Now leave a small space again to the right and stitch **from the front to the back**, with the **thread lying under the needle** (b). Continue like this.

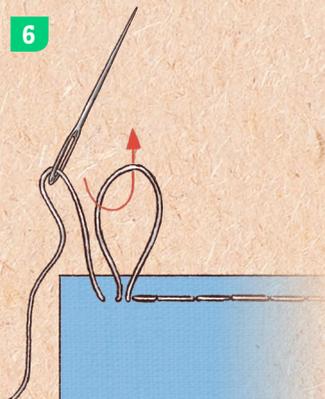
TIP!
Pull the thread tight after each stitch, but not too tight. The fabric should always remain smooth and not pucker. If it puckers, it means you have pulled the thread too tight.



>>> Continue reading on page 9!

This stitch can be used to sew once around the edge of your robot, for example. When you reach the end, stitch one more time through the first loop (c) and bury the thread on the back side.

6



- 6 Bury the thread:** Your seam will only hold properly if you bury your thread at the end. To do that, make two or three very **small stitches**. Each time, create a small loop of thread, guide the needle **through the loop** and pull the thread tight. Then you can cut the thread.

Sew the glow-bot together

You will need:

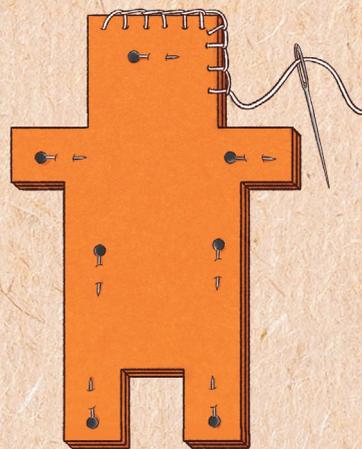
Your robot shape made of felt, embroidery needle, embroidery thread, *pins*, *scissors*

Here's how:

- 1** Lay the front and back side of your robot one on top of the other so they fit together exactly. Secure the two pieces with **pins**.

Choose one of the hand stitches from pages 7 and 8 and sew together the front and back sections of the glow-bot all around the edge. The **blanket stitch** is the best one for this. You do not have to leave an opening in the seam, since the robot will not need to be stuffed. All of the electronic components will be sewn onto the outside.

1



TIP!

For a **robot pendant**, you will also need a key ring with a loop made out of a strip of felt. Before sewing together the front and back sections of the glow-bot, push the strip of felt between the two layers and sew it in with the rest of the fabric.



PART 3

YOUR GLOW-BOT SHINES

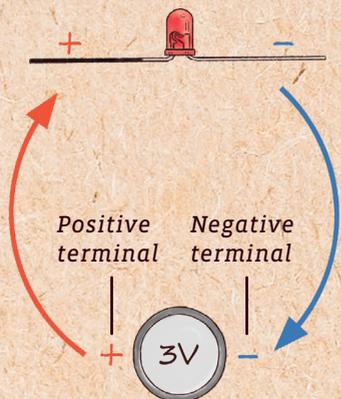
Fundamentals of electricity

In order to be sure your glow-bot really does light up, let's start by taking a look at the basic principles of electricity. To construct a **circuit**, we will need a **current source** (the battery) along with **conductive elements**. Those are components that conduct the electrical current, such as bulbs, resistors, motors, sensors, and switches.

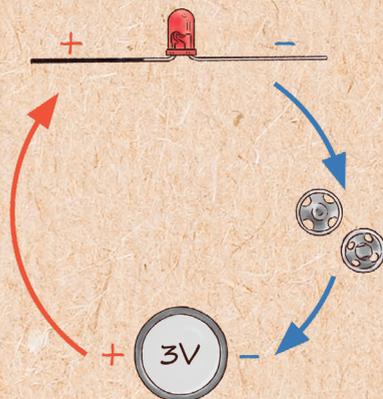
In this project, we will be using a **3-volt button cell battery**, one or two **LED lights**, and a **pushbutton switch**.

Our pushbutton consists of two conductive metal parts. That way, you can close the electrical circuit and make the LED bulbs light up by pressing the two parts together!

You can picture electricity in a circuit as flowing like water in a stream. It flows in one direction: from the positive to the negative terminal. This is the direction of conventional current, which is the flow of positive charge from positive to negative. Electricity can also be understood as



Simplest circuit with battery and LED



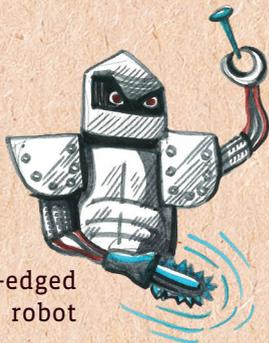
Our circuit with battery, LED, and switch

a flow of negatively charged electrons, which actually move in the opposite direction of the positive charge, from negative to positive. But for the purposes of this kit, we are going to say electricity is the flow of positive charge from the positive terminal to the negative terminal.

Because electricity flows in one direction, you always have to be sure that the LED bulb is connected in the right direction relative to the battery. The LED **has one long “leg” and one**

short one, with the **long leg** always having to be connected to the positive terminal and the short leg having to be connected to the **negative terminal**.

Normally, all the parts of the circuit are connected with metal wires. However, in this project we will be using soft, conductive thread blended with metal. That’s how we can make a typically hard and stiff robot so soft and flexible!



Hard-edged robot



Soft and gentle robot

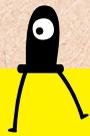
Important!

*If the current just travels directly from the positive to the negative terminal of the battery rather than through a resistor, a sensor, a bulb, or some other conductive element in the circuit, the battery will quickly break down or may even start burning on the inside. This is known as a **short circuit**.*

*With your glow-bot, the battery won’t be able to burn out because the **battery holder** has a **built-in resistor**. If the two terminals are short-circuited, though, the battery will still discharge very quickly and go dead.*

A short circuit must be avoided at all costs!





Preparing the LED lights

The time has now come to give your glow-bot glowing eyes, warning lights, or other exciting lighting effects. To do that, you will first have to prepare your LEDs.

You will need:

LED(s), tweezers, permanent marker

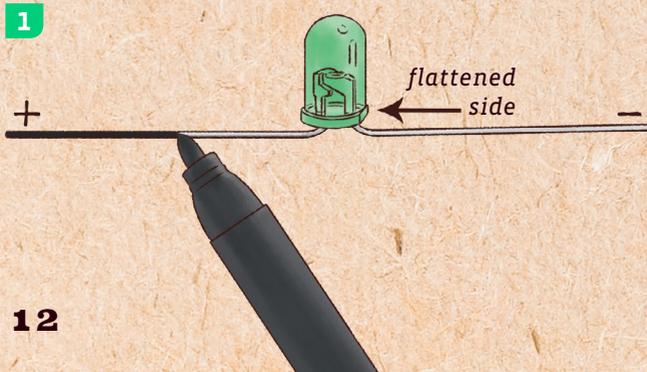
Here's how:

1 As you already know, the LED bulb has one long and one short leg. **The longer one** is the **positive terminal** (marked with a plus sign in the picture), while the **shorter one is negative** (marked with a minus sign in the picture).

Color the **longer leg** with a **permanent marker** so you will know later on which end goes where. Let it dry well.

2 Take the **tweezers** and clamp one **LED leg** between its two tips. Holding the **tweezers** tightly closed, **carefully rotate the tweezers** to wind up the leg in a coil, continuing until you reach the head of the LED.

3 The rolled-up leg should look more or less like in the picture, and it should have a hole in the center. Do the same with the other leg.

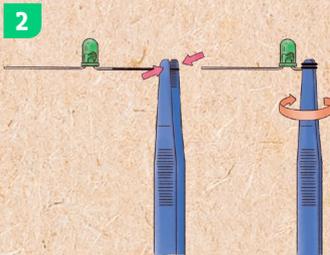


TIP!

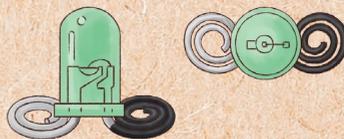
If you have a hard time recognizing which leg is longer, there are two other tricks you can try (see Image 1):

First, the lower edge of the green or red LED housing is a little bit flattened on the negative side.

Second, if you look closely, you will be able to see the small metal elements inside the LED, which will show you which way the positive and negative terminals go.



3 From the side: From the top:



Planning the circuit

Now that you have prepared everything and you know how a circuit is constructed, you can create a sketch of your own circuit for your glow-bot. It is important to have a precise circuit diagram beforehand. That will save a lot of time later on, since you always have to follow very specific rules with electronics.

You will need:

Your pattern, colored pencils

Here's how:

- 1 Take the paper pattern of your glow-bot and draw a small **colored circle** in the spot where you will be sewing an **LED bulb** on your actual robot. If you want to use two LEDs, draw two circles.

Flip over the pattern and draw the two curled legs above and below each of the LEDs. Draw a plus sign by the upper leg and a minus sign by the lower one. Use two different colors: **red for positive** and **blue for negative**.

- 2 Where do you want the two parts of your **pushbutton**? On the front side of the pattern, draw a **double circle** on the arm or some other flexible glow-bot body part.

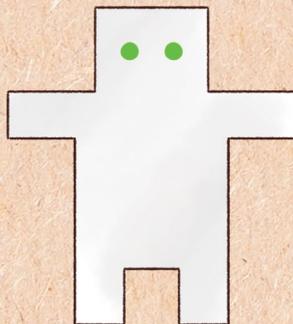
Now you will have to measure where to position the other pushbutton part so that the pushbutton components can be pressed together later on. To do that, fold the body part (the arm, for example) that has the drawn-on pushbutton onto the body.

Make a small dot there to mark the point where the double circle touches the body. Draw a **second double circle** at this spot. Turn the pattern over and draw a double circle at this same location on the rear.

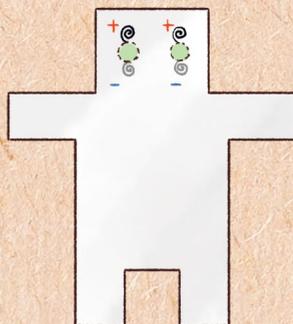
>>> **Continue reading on page 14!**

1

Front:

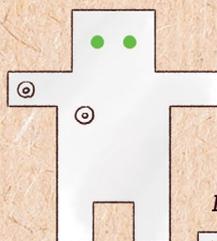


Rear:

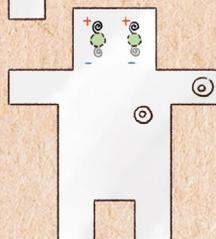


2

Front:



Rear:

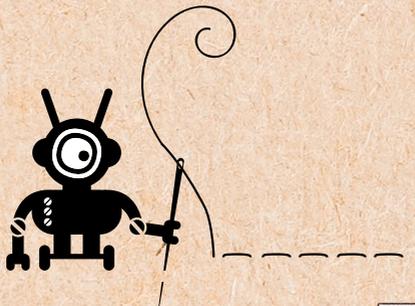


3 The **battery holder** will be mounted on the rear. Draw a **rectangle** on the back of the pattern. Make a plus sign just to the left of it and a minus sign to the right. Use the same colors as in Step 1.

4 Now it's time to plan all the connections that will later be sewn on with conductive thread. Take a **red pencil** and connect the first LED leg's plus sign to the plus sign of the battery.

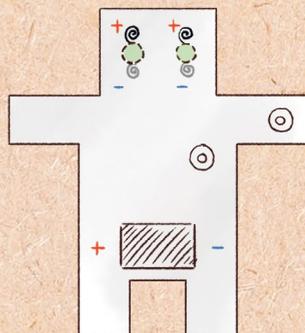
Next, take a **blue pencil** and trace a line from the LED leg's minus sign to one part of the pushbutton. Then make a **new blue line** from the second part of the pushbutton to the negative pole of the battery.

Important: Even if you decided to use two LED lights, you should start by sewing on just one and making sure that everything works right. So we won't be connecting the second light with the other elements just yet. It will only be added later. The instructions on page 19 will show you how.



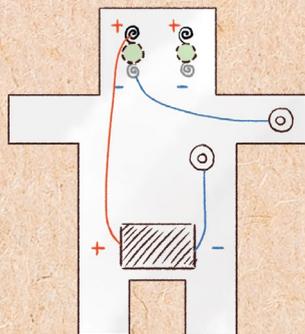
3

Rear:



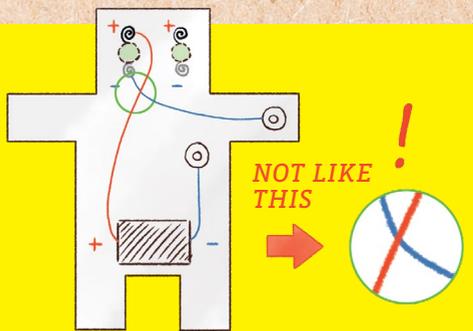
4

Rear:



Important!

The positive (red) and negative (blue) thread paths should never cross each other — including when the pushbutton is activated! Otherwise there will be a short circuit, your LEDs will not light up, and the battery will quickly go dead.



Sewing on the LED

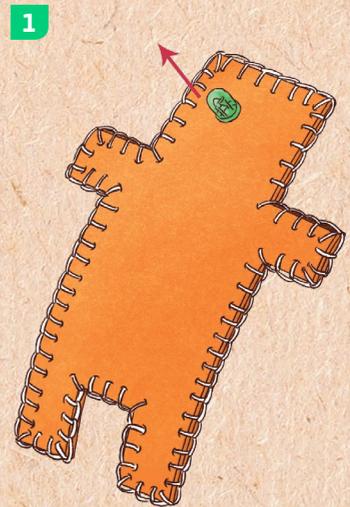
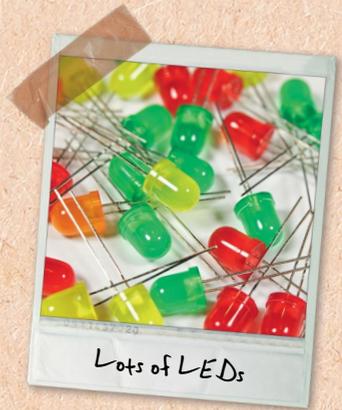
You will need:

Your pattern with the circuit diagram, your felt robot, sewing needle, conductive thread, prepared LED, *felt-tip pen*, *pointed scissors*

Here's how:

- 1 Take your pattern as a guide and use the felt-tip pen to make a dot on the felt robot where your first LED is going to be. **! Have a grownup help you!** Use the scissors to make a hole through both layers of felt at the marked spot, and insert the head of the LED through the fabric from behind.
- 2 **Pay attention to the plus and minus signs!** Turn the LED so the **LED leg's positive leg is pointing up** and is aligned with the positive leg you drew in the pattern.

Now, sew both LED legs firmly in place with some conductive thread. **Make at least four stitches!** It is important **not to let any individual thread stitch** connect both legs. Otherwise, the current will "jump over" the bulb and it won't light up. Start by sewing on just one leg, and bury the thread and cut it off. **Then** sew on the second leg.



2



LIKE THIS



NOT LIKE THIS!



The pushbutton switch

In this step, you will be sewing on your pushbutton switch. When the pushbutton components are pressed together later on, your glow-bot will light up. Otherwise, he will not.

You will need:

Your pattern with the circuit diagram, your felt robot with LED, sewing needle, conductive thread, pushbutton, felt-tip pen, scissors

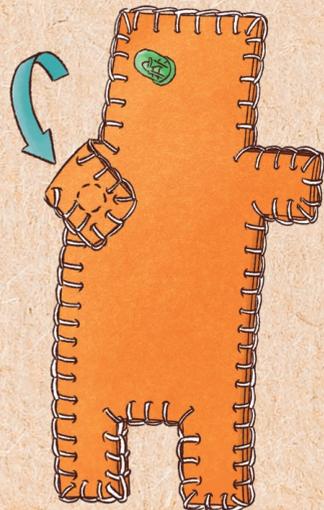
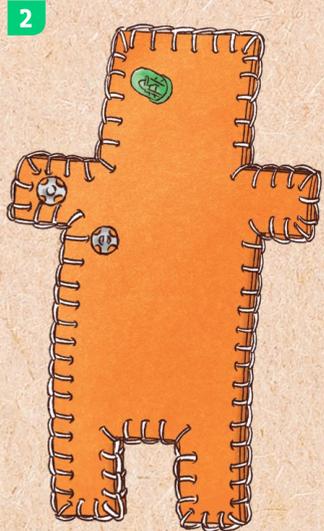
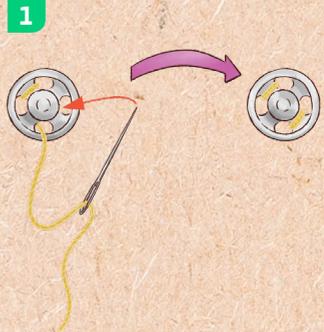
Here's how:

- 1 Take your pattern as a guide and use the **felt-tip pen** to make a dot on the robot where you drew the double circle for the pushbutton.

Your **pushbutton** consists of **two parts**: a thinner part with a small **head** and a thicker part with a **hole**, into which the head will be pushed. The two pushbutton parts also have **four small holes along the edge** through which your needle can be inserted.

Sew the head portion of your pushbutton with conductive yarn to the **front side** of the flexible body part by stitching **from the rear to the front** through the felt and through one of the small holes. Stitch from front to rear through the next hole, and so on. Sew a total of **two times around in a circle**.

- 2 Secure the “hole” part of the pushbutton in the same manner to the other point that you marked with the felt-tip pen. Test to make sure that the two parts of the button connect together well.





TIP!

Test your robot before sewing everything together by laying loose sections of conductive thread between the elements to complete the circuit. That way, you can detect errors beforehand and you won't have to sew twice! **Important:** To activate the battery in the battery holder, you have to remove the insulation strip before sewing on the compartment. Have a grownup help you!

Finalizing the electronics: battery and connections

You will need:

Your pattern with the circuit diagram, felt robot with LED and pushbutton, battery holder, embroidery needle, embroidery thread, sewing needle, conductive thread, scissors

Here's how:

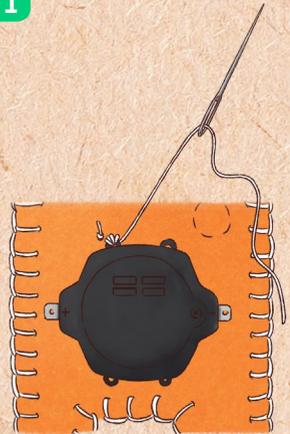
- 1 Place the battery holder on the rear side of the glow-bot, with the side with the cover and the small screw pointing toward you. The **positive end** (plus sign) should be to the **left** and the **negative end** (minus sign) should be to the **right**, just as you drew in your circuit diagram.

Secure the battery holder with **embroidery thread** by sewing several times through the two **plastic eyelets** at the top. Then repeat with the two eyelets at the bottom.

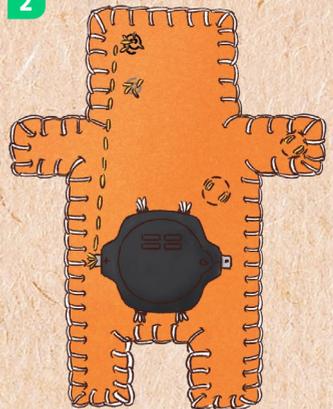
- 2 Now sew on the positive end of the battery holder with **conductive thread**. Make at least **four stitches** to sew it on tight!

Then connect the positive end of the battery holder with the **positive leg** of the LED (top leg). To do that, use a **running stitch** to sew all the way to the LED leg. Finally, stitch from front to rear through the hole of the leg and bury the thread.

1



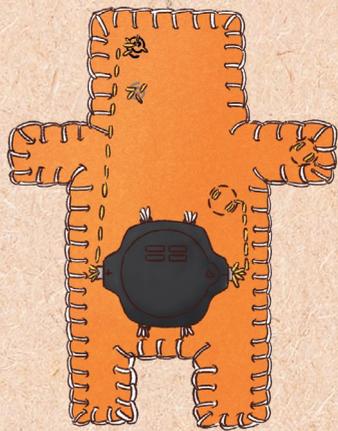
2



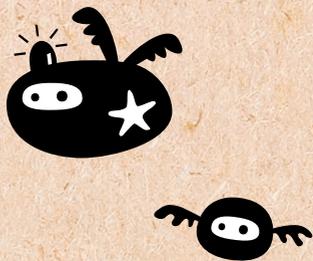
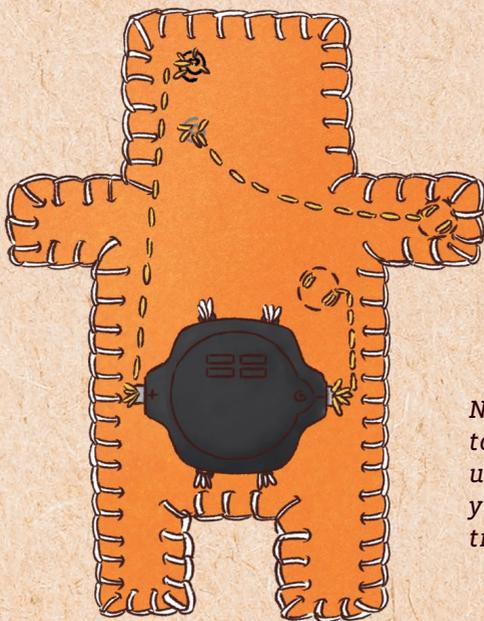
3 Now you will have to sew the negative end of the battery holder on tightly with **conductive thread**. **Make at least four stitches again!** Next, make a series of **running stitches** to one of the pushbutton parts and stitch once through one of the holes from the front. Then bury the thread and cut it off.

4 Now, continue sewing with conductive thread from the other pushbutton part. Stitch from the rear through one of the holes and continue a line of **running stitches** to the **negative leg** of the LED (lower leg). Finally, stitch through the hole of the leg from front to back and bury the thread.

3



4



Now press the two pushbutton parts together and . . . your glow-bot lights up! If not, don't panic. On page 22, you will find tips and tricks for troubleshooting your glow-bot.

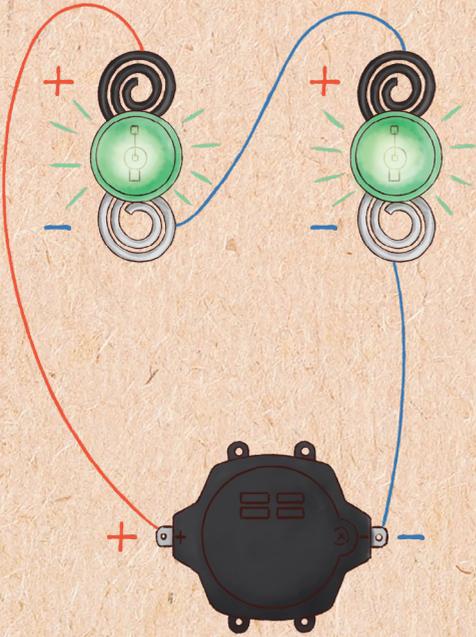
Sewing on a second LED

If you have decided to design your glow-bot with two LEDs, you will also have to make a decision about how to integrate it into your circuit diagram: in a **series connection** or a **parallel connection**.

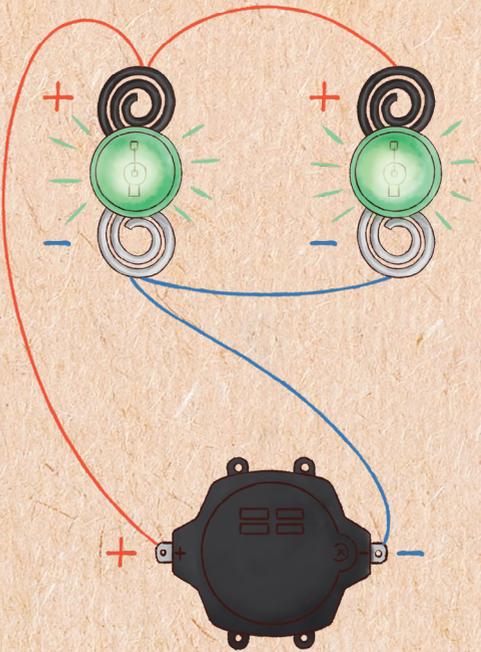
Series connection means that both LEDs are installed **one after the other** in the circuit. Then, just like with a string of lights on a Christmas

tree, neither one will light up when something goes wrong with the other.

So we recommend a **parallel connection** instead, with each LED connected to the battery independently of the other. That way, if one breaks down, the other LED will still work.



Series connection



Parallel connection

Important!

If you decide to have two LEDs, it will have to be two red ones or two green ones!



You will need:

Your pattern with the circuit diagram, your felt robot with LED, pushbutton and battery holder, sewing needle, conductive thread, two prepared LEDs, colored pencils, felt-tip pen, pointed scissors

Here's how:

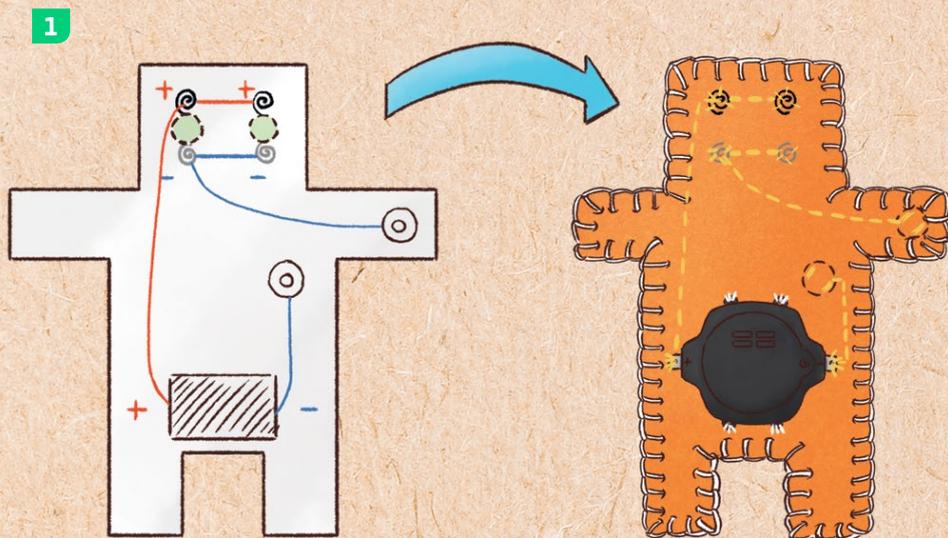
- 1 Grab your **pattern** again. Now complete the connection to the rest of the circuit: Draw a **red line** from the **positive terminal** of the first LED to the **positive terminal** of the second LED and a **blue line** from **negative terminal** to **negative terminal**.

Secure the second LED to your robot with **conductive thread** by repeating steps 1 and 2 from page 15. Then stitch from back to front through the positive leg of the second LED and sew a running

stitch to the positive leg of the first LED. Bury the thread and cut it off. Now sew the connection between the two negative legs.

Important: Do not let the running stitch paths cross!

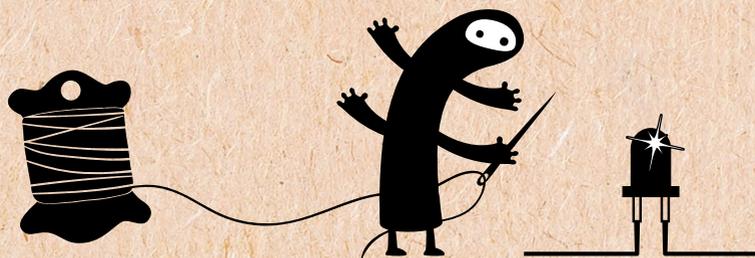
Now the second LED should also light up when you press the pushbutton switch! (If it doesn't, take a look at the tips and tricks on the next page.)



Tips and tricks

If the LED does not light up, try checking the following:

- Did you **remove** the **insulation strip** from the battery holder, and did you insert the **battery** in the **right polarity** direction in the battery holder?
- Is the **pushbutton** open? If so, press the two parts together to **close** (or complete) the circuit.
- **Correct polarity**: Are all the running stitch paths in your circuit going **from positive to negative**?
- The **LED bulbs**: Did you **sew on both LED legs separately**? If you stitched through with a piece of thread, you will have to cut the connection between the legs.
- Are the **running stitch paths crossing** each other anywhere?
- Are there any **loose thread ends** or **loops** touching the wrong place? That can happen if you didn't cut off the thread close enough to the starting knot, for example. Or if you failed to pull the thread tight enough in a stitch, so it forms a loop.
- Is the **battery** still working? As a test, try inserting a **new button cell** into the battery holder. **! Have a grownup help you!**
- If you have ruled out all other errors, the **LED** might not be working any more, in which case you will have to **replace** it.



If your LED keeps going on and off, it means you have a loose connection somewhere. Check to be sure that the LED legs, pushbutton parts, and battery holder are all tightly sewn on. If necessary, sew them on tighter with conductive thread.

PART 4

DECORATING YOUR GLOW-BOT

The mouth

You will need:

Your glow-bot, felt pieces, embroidery needle, embroidery thread, *soft pencil*, *scissors*

Here's how:

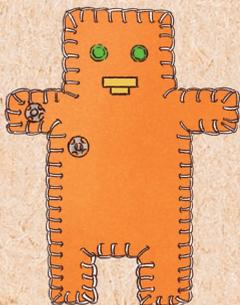
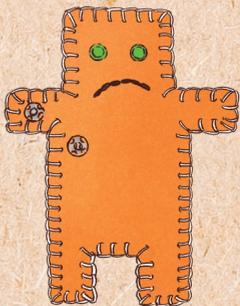
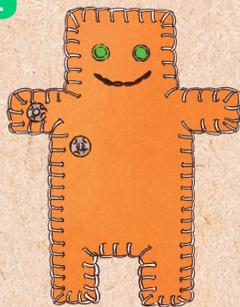
- 1 The **backstitch** is the easiest stitch to use for making a **mouth**. First draw the mouth on the felt with a soft pencil. The line of the mouth will determine your glow-bot's expression and mood: Is he **happy**, **sad**, or maybe a little **saucy**?

You can also cut a **laughing mouth**, a **protruding tongue**, or **sharp teeth** out of felt and sew them on.

Note!

In the pictures on pages 22 through 24, we omitted the running stitch paths on the front side of the robot so you can clearly see the various embellishments. When you actually sew the robot, you will be able to see the stitches on the front.

1



The eyes

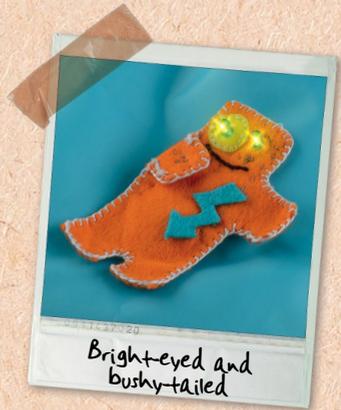
Your glow-bot can have just one eye, or two, three, or even more. Maybe you already sewed on LED bulbs for eyes that you would still like to decorate. And there are other options for making eyes as well.

You will need:

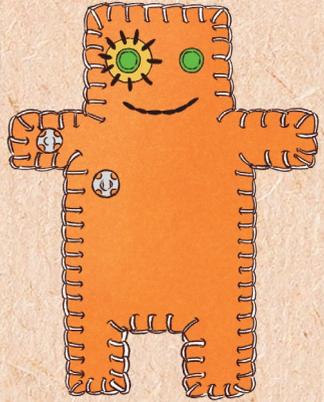
Your glow-bot, felt pieces, embroidery needle, embroidery thread, soft pencil, scissors

Here's how:

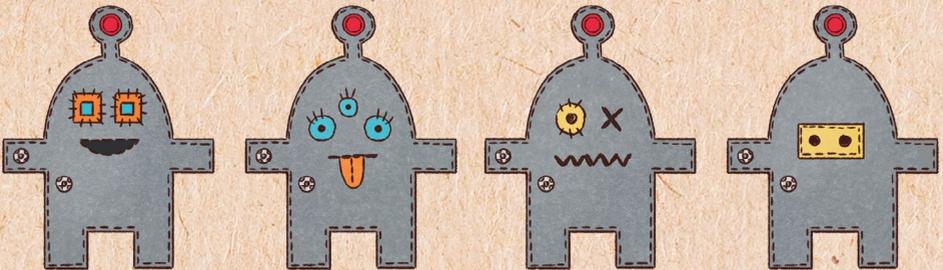
- 1 If you have sewn on an **LED** for an eye, you can now try circling it with stitches. First cut a small disk out of felt (using a coin as a template, for example). Cut a hole in the center big enough to let you insert the LED through it, and mount the felt circle over the LED. Then you can sew on the circle with stitches all around the edge.
- 2 If you have sewn on the LED in a different location, try making the eyes out of **disks or squares** of felt, or simply a **stitched-on X**. The eyes can look different from each other or be different sizes. And, of course, there can also be **three or more eyes!** Use your imagination!



1



2



Technical elements and decorations

You will need:

Your glow-bot, felt pieces, embroidery needle, embroidery thread, safety pin, soft pencil, scissors, small Phillips-head screwdriver, possibly textile glue

Here's how:

- 1 The easiest way to add extra **decorations** to your glow-bot is to use the **backstitch** to sew them on. First mark their locations with a **pencil**. You can also cut **technical elements** out of **felt** and sew them in place. For example, why not try making a scale with a pointer out of a **half-circle**?

If you have a lot of little felt decorations to attach, try gluing them on. You will need **textile glue**. **!** Have a grownup help you!

- 2 **!** To clamp the safety pin into the battery holder, **have a grownup** open the lid with a screwdriver and remove it. Then the safety pin can be clamped in as shown in the illustration. **Finally, replace the lid and screw it on.**

And now your robot is ready! Attach your glow-bot to your **jacket**, your **backpack**, or wherever you want him to be!

TIP!

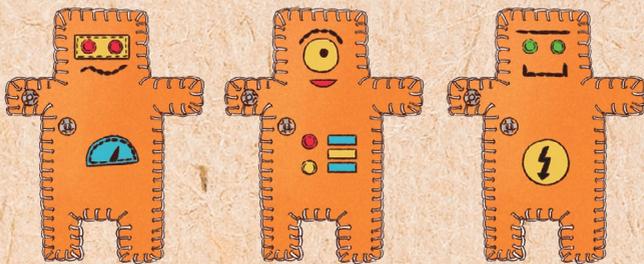
Keep in mind that you should never let your glow-bot come into contact with metal objects such as buttons or buckles, and never let him get wet.



2



1





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