

FIRST® LEGO® League Challenge BIOGLOW™ Building Instructions

Mission 4: Lucky Leaves

This build is 65 pieces, and 12 building steps.

Welcome to text-based instructions from Bricks for the Blind. Before you start building, here are some terms we'll be using:

- In Front of/Front: towards you.
- Behind/Back: away from you.
- Up: towards the ceiling.
- Down: towards the floor.
- Stud: the bump on a LEGO brick. Example: A 2x1 brick has two studs on it.
- Vertically: going from front to behind.
- Horizontally: going from left to right.
- Upright: pointing up towards the ceiling.
- That one/ppp: previously placed piece.
- Plate: piece with studs.
- Tile: smooth piece without studs (unless otherwise specified)
- Symmetrically: a mirror image. Example: If you place a 2x1 brick with technic connector on the front wall at the right, connector to the front, and then place another such piece symmetrically on the back wall, at the right, the technic connector of the second piece should point to the back, since it will be placed symmetrically.
- Centered-vertically: even amount of space in front of and behind the piece
- Centered-horizontally: even amount of space left and right of the piece.
- Row: studs lined up horizontally (left to right/side to side).
- Column: studs lined up upright or vertically (top to bottom/back to front).
- Standing upright: the piece is perpendicular to the ground, like a wall.
- Lying flat: the piece is parallel to the ground, like a piece of toast which fell off the table.
- Anti-stud: the portion of a piece which accepts studs, like the bottom of a plate.
- Jumper plate: a 1x2 plate with a single stud on top, or a 1x3 plate with only two studs on top.

For builders with low vision, or a sighted building partner who may want to follow along with the printed visual instructions that come with each set. As low vision users may benefit from viewing the instructions on a personal device where they can zoom in on content and use assistive technologies to enhance the visuals.

A note on LEGO Technic™ part names. These parts are somewhat different from regular LEGO bricks. I'll include some definitions in case the builder or helper is not familiar with LEGO Technic™.

Axles - An axle is a connector which has an X shaped cross-section. Because their cross section is not round, anything connected to an axle using an axle-hole will rotate with that axle. Axles are longer than they are wide, and the length of an axle corresponds with how many bricks long it is. Aka a 3L axle is three bricks long. Axles come in a variety of lengths, with a 2L axle being the shortest available. They may be combined with pins, or have circular stops on them. A stop prevents the axle from sliding through an axle-hole at a specific point on the axle.

Pins - A pin is a connector which has a circular cross section and a flanged notch out of one or both ends. This flanged notch allows them to click into bricks with a pin-hole. Pins come with and without friction ridges, which are small bumps on the pin which prevent them from rotating freely. For standard pins, black is a high friction pin, and gray is a low friction pin. A standard length pin is two brick lengths long, with a stop in the middle. This prevents a brick from being pushed from one side of the pin to the other. A 1L pin is one brick long and still retains the stop, however it also includes a hollow stud at the other end. A 3L pin is three bricks long, and only contains a stop at one side, allowing two bricks to be pushed onto the other side of the pin. Pins may also have one side which is an axle.

Lifarms - A lifarm is a basic structural element, similar to a brick or a plate, but usually without any studs. It is a beam with rounded ends and with holes in it, with the same spacing as the studs on a LEGO brick. lifarms come in a variety of lengths, including a 1x1 lifarm which looks like a cylinder. Thick lifarms are as wide as a LEGO brick, and thin lifarms are half as wide as a LEGO brick, but not the same thickness as a LEGO plate! The holes in a lifarm arm may accept axles or pins. They also come in a variety of shapes, including tees, els and triangles.

Gears - A gear is a functional element. They are typically discs with teeth on the outside, there are also worm gears which look like a spiraling cylinder! Gears connected by axles transmit or even transform rotational motion!

Axle and Pin Connectors - These elements are typically smaller than lifarms, and are used to connect some combination of pins or axles. They might have pins or axles, as well as axle or pin-holes. They have a lot of different angle combinations! The simplest just connects two axles or pins together in a straight line.

Bushes/Bushings - LEGO Technic™ uses bushes largely as spacers, but they also can reduce friction between rotating parts, or can form useful elements such as handles. Bushes are typically light gray, generally cylindrical, and have an axle-hole running through the middle. They have a flange at the front and back to make them easier to pull on and off.

Sorting Instructions:

This LEGO set comes in the bag labeled 6 and some large pieces from bag 0. Sort the pieces into groups as described below. Note that where there are multiple colors of the same brick in a step, the colors will be split across two groups to make telling the difference easier for the builder! LEGO includes a few spare parts in case you lose something. Set these into their own group away from the rest, in case you need them later.

Mission 4: Lucky Leaves

Bag 6 (2 groups of bricks)
Main Build

Group 1 contains the pieces for steps 1-8.

Group 2 contains the pieces for steps 9-12. Include three light brown 21L flexible hoses from bag 0.

Building Instructions:

Group 1.

Mission 4: Lucky Leaves

Main Build

1.1. This build looks like three large leaves connected together with hoops at each end. Let's start by building the leftmost leaf! Place a green 4x6 plate, vertically, in front of you.

1.2. Place a light gray 1x2 brick, vertically and centered vertically, on the rightmost column of the previous piece.

2. Place a light gray 1x6 brick, horizontally, behind the previous piece so the right sides are even. The left two studs will overhang.

3.1. Place the back row of a green 2x4 plate, vertically, under the overhanging left two studs of the previous piece.

3.2. Place a light gray 1x2 brick, vertically, on the left column of the previous piece and in front of the 1x6 brick.

4.1. Place the leftmost stud of a light gray 1x6 plate, horizontally, in front of the previous piece.

4.2. Place a dark gray 1x2 plate, horizontally, on the left two studs of the previous piece.

5.1.1. Set the leftmost leaf aside. We'll build the middle leaf now! Place a green 4x6 plate, vertically, in front of you.

5.1.2. Find a light gray A-shaped plate with two rows of four studs. This piece is two 1x4 plates that are connected at an angle. Rotate it so the point of the A is at the right. Place the front 1x4 plate, horizontally, on the back row of the previous piece.

5.2. Place a light gray 1x6 plate, horizontally, in front of the front row of the previous piece so the right sides are even. The left two studs will overhang.

5.3. Place the back row of a green 2x4 plate, vertically, under the overhanging left two studs of the previous piece.

5.4.1. Place a light gray 1x2 brick, vertically, on the left column of the previous piece and in front of the 1x6 plate. Repeat symmetrically on the right side.

5.4.2. Place a light gray 1x6 plate, horizontally, in front of the previous two pieces.

5.5. Place a dark gray 1x2 plate, horizontally, on the left two studs of each of the two 1x6 plates.

5.6. Place the first leaf assembly, horizontally with the 1x6 brick at the back, in front of you. The front row will be a plate with four studs. Place this row under the back row of the A-shaped plate on the back side of the second leaf. This means that the leftmost leaf will be at an angle to the middle one.

6.1.1. Now we'll build the rightmost leaf. Set the first two leaves aside. Place a green 4x6 plate, vertically, in front of you.

6.1.2. Place the front 1x4 plate of a light gray A-shaped plate, with the point of the A at the right, on the back row of the previous piece.

6.2. Place a light gray 1x6 plate, horizontally, in front of the front row of the previous piece so the right sides are even. The left two studs will overhang.

6.3. Place the back row of a green 2x4 plate, vertically, under the overhanging left two studs of the previous piece.

6.4. Place a dark gray 1x2 plate, horizontally, on the left two studs of the 1x6 plate.

6.5.1. Place a light gray 1x2 brick, vertically, in front of the previous piece. Repeat symmetrically on the right side.

6.5.2. Place a light gray 1x6 brick, horizontally, in front of the previous two pieces.

6.6. Place the first two leaf assemblies in front of you, with the middle leaf vertically at the front. The leftmost leaf is the one with a 1x6 brick on its leftmost column. Rotate the last leaf assembly so the back 1x4 plate of the A-shaped plate is vertically on the left. Place it on the rightmost column of the middle leaf.

7. Next, we'll add some plates to reinforce the connections between leaves. Place the right column of a green 2x4 plate, vertically, on the left 1x4 plate of the A-shaped plate between the left two leaves. Place another symmetrically on the right 1x4 plate. Repeat between the middle and right leaves.

8.1. Place a light gray 1x6 plate, vertically, on the leftmost column of the leftmost piece from the previous step so the back sides are even. Repeat symmetrically on the rightmost piece from the previous step.

8.2. Place a light gray 1x6 plate, vertically, on the right column of the second 2x4 plate from the left from step 7 so the back sides are even. Repeat symmetrically on the right side.

Group 2.

9.1. Place a green 1x4 tile, horizontally, on the front row of each of the three leaves.

9.2. Place a green 1x4 tile, vertically, behind each of the three previous pieces so the left sides are even. Repeat symmetrically on the right side of each of the three leaves.

9.3. Place a green 1x4 plate, horizontally, behind each of the pairs of 1x4 tiles from the previous step.

10. Place a green 1x4 tile, horizontally, on each of the previous three pieces.

11.1.1. Now, we'll add some more leaves on top of the first three. Set the main leaf assembly aside for now. Find a green 3x12 long hexagonal plate with two click fingers on one side. Place this, upside down and horizontally with the click fingers on the right, in front of you.

11.1.2. Place a brown 1x4 plate with rounded ends, upside down and horizontally, on the left four anti-studs of the previous piece.

11.2. Place a green 2x4 tile with two studs, upside down and horizontally, centered vertically on the previous piece so the left and right sides are even.

11.3.1. Keeping the click fingers on the right, flip the assembly right side up. Clip the click finger of a black 1x2 plate with a click finger on one long side, upright with the studs on the left, into the two click fingers on the right side of the assembly.

11.3.2. Place a green 1x2 plate with a handle bar, upright with the handle bar on the top, on the left side of the previous piece.

11.4. Find a light brown 21L flexible hose with a hole on each end. Push one hole of this piece onto the front side of the handlebar of the previous piece. Push the hole on the other side onto the bar on the back so it forms a loop upright over the right column of the assembly.

11.5. Repeat steps 11.1.1-11.4.

11.6. Place the rest of the leaf assembly, horizontally with the points of the A-shaped bricks at the back, in front of you. Rotate one of the assemblies we just made so it's vertical with the loop near the back. Drop the 2x4 plate under the assembly into the 2x4 recess in the left leaf. Repeat on the middle leaf. These do not actually connect to anything, and will not sit perfectly flat.

12.1.1. Now we'll make the final leaf. Set the main leaf assembly aside for now. Place a green 3x12 long hexagonal plate with two click fingers on one side, upside down and horizontally with the click fingers on the right, in front of you.

12.1.2. Place a brown 1x4 plate with rounded ends, upside down and horizontally, on the left four anti-studs of the previous piece.

12.2.1. Place a brown 1x2 plate with rounded ends, upside down and horizontally, on the left two anti-studs of the previous piece.

12.2.2. Place a green 2x2 tile with one stud, upside down and horizontally, centered vertically to the right of the previous piece.

12.3. Push the stem of a black T-shaped bar, vertically with the stem on the bottom, into each of the two hollow anti-studs of the 1x2 plate with rounded ends.

12.4.1. Keeping the click fingers on the right, flip the assembly right side up. Clip the click finger of a black 1x2 plate with a click finger on one long side, upright with the studs on the left, into the two click fingers on the right side of the assembly.

12.4.2. Place a green 1x2 plate with a handle bar, upright with the handle bar on the top, on the left side of the previous piece.

12.5. Find a light brown 21L flexible hose with a hole on each end. Push one hole of this piece onto the front side of the handlebar of the previous piece. Push the hole on the other side onto the bar on the back so it forms a loop upright over the right side of the assembly.

12.6. Place the rest of the leaf assembly, horizontally with the points of the A-shaped bricks at the back, in front of you. Rotate the assembly we just made so it's vertical with the loop near the back. Drop the 2x2 plate and T-shaped bars under the assembly into the 2x4 recess in the right leaf. The loops of all three leaves should be at the back.

Congratulations! Now this build is complete!

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