FIRST® LEGO® League Challenge UNEARTHED™ Building Instructions

Build 2: Tip the Scales

This build is 115 pieces, and 36 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.

A note on LEGO Technic™ part names. These parts are somewhat different from regular LEGO bricks. Here are 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.

Lift-arms - A lift-arm 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. lift-arms come in a variety of lengths, including a 1x1 lift-arm which looks like a cylinder. Thick lift-arms are as wide as a LEGO brick, and thin lift-arms are half as wide as a LEGO brick, but not the same thickness as a LEGO plate! The holes in a lift-arm arm may accept axles or pins. They also come in a variety of shapes, including tees, ells 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 lift-arms 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.

Technic™ Bricks and Plates – There are also regular bricks and plates that are adapted for use with Technic™ elements. Technic™ bricks have holes for either pins or axles on the sides and are only one brick wide. One of the most common of these is a 1x2 brick with a single pin hole. Most often, these bricks have pin holes, not axle holes. Technic™ plates have holes on the flat surface between the studs and are a minimum of two bricks wide. The holes in these plates can accept pins or can allow an axle to pass through and still spin.

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.

Sorting Instructions:

This LEGO set comes in the bags labeled 3-4 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.

Build 2
Group A contains all of the black 2L pins from this bag. These pins have friction ridges.
Group B contains all of the blue 3L pins from this bag. These pins have friction ridges.
Group C contains all of the blue 2L axle/pin combos from this bag. These pins have friction ridges.

Bag 3 (2 groups of bricks)
Main Build: Base
Group 1 contains the pieces for steps 1-8. Include a black 3x13 hollow frame from bag 0.
Group 2 contains the pieces for steps 9-15. Include a black 3x13 hollow frame from bag 0.

Bag 4 (5 groups of bricks)
Group 3 contains the pieces for steps 16-17.
Group 4 contains the pieces for steps 18-20. Include two brown 2x2 slope bricks from steps 21 and 22.
Group 5 contains the pieces for steps 21-23.

Sub-build 1: Pull-out Tray
Group 6 contains the pieces for steps 24-33.
Group 7 contains the pieces for steps 34-36.

Building Instructions:

Groups A, B, C and 1. You will use the pins from groups A, B and C throughout the build.

Main Build

1.1. We'll start by building the base. Place a dark gray 3L liftarm, horizontally with the holes facing the front and back, in front of you.

1.2. Find two dark gray 3L axle/pin combos with a 2L pin side and a 1L axle side. Push the pin side, with the pin side at the back, from the front into the left and right holes of the previous piece. Push these all the way back so they extend 1L to the front and back of the previous piece.

2. Push the back axle hole of a dark gray 2L axle connector, from the front, onto the axle of each previous piece.

3. Push a yellow 3L axle, from the front, into the front hole of each of the previous two pieces. They will extend 2L to the front of the previous pieces.

4.1. Slide the leftmost and third from the left holes of a dark gray 9L liftarm, horizontally with the holes facing the front and back, onto the front side of the previous two pieces. Push it all the way back so the axles still extend 1L to the front.

4.2. Push the bushing of a light gray 2L pin with a bushing on one side, with the bushing at the back, from the front onto each of the axles extending from the front of the build.

5. Push a dark gray 3L liftarm, horizontally with the holes facing the front and back, from the front onto the pins of the previous two pieces. Push it all the way back so the pins still extend 1L to the front.

6. Place a black 3x13 hollow frame, standing upright and horizontally, in front of you. Keeping the pins at the front and back, rotate the assembly we made 90 degrees counterclockwise so it stands upright. The 9L liftarm from step 4.1 should be on the top. Push the back two pins, from the front, into the rightmost two holes on the front side of the 3x13 hollow frame.

7.1. Push a dark gray 1L pin with a stud on one side, with the stud on top, from the top into the rightmost, third from the right, and fifth from the right, holes on the top side of the previous piece.

7.2. Push a dark gray 1L pin with a stud on one side, with the stud on the left, from the left into the hole on the left side of the 3x13 hollow frame.

8. Place a green 1x10 plate, horizontally, on the studs on the top side of the 3x13 hollow frame. The right stud should be placed on the right pin with a stud and there should be one free hole on the top side of the 3x13 hollow frame.

Open group 2.

9.1. Find a dark gray axle and pin connector #1. This piece has a 1L axle connector on one side, and a perpendicular pin hole on the other. Place this in front of you, with the axle connector at the front and the pin hole at the back facing left and right.

9.2. Push the axle side of a blue 2L axle/pin combo from group C, with the axle at the back, from the front into the front axle hole of the previous piece.

9.3. Slide the axle of a dark gray 4L axle with a stop on one side, with the stop on the left, from the left into the pin hole of the #1 axle and pin connector. Slide it all the way to the right.

9.4. Push a light gray thick bushing, from the right, onto the axle of the previous piece. Push it all the way to the left until it touches the #1 axle and pin connector from step 9.1. The axle will extend 2L to the right.

9.5. Rotate this assembly so the pin is at the bottom and the axle extends to the front. Push the pin, from the top, into the hole on top of the 3x13 hollow frame to the left of the 1x10 plate.

10.1. Now we'll make a flapper. Find a lime green 3x5x3 curved panel. This looks kind of like a chair with no legs. It has two flat panels at an angle close to 90 degrees, with pin holes on two opposite sides. Rotate this so the long panel is upright and the short panel is horizontally pointing to the left. Slide the top hole, from the front, onto the axle extending to the front of the frame.

10.2. Now we'll make a crossbar for the bottom of the flapper. Push the back hole of a green 2L axle connector onto the axle to hole the previous piece in place.

10.3. Push the axle side of a blue 2L axle/pin combo from group C, with the axle at the right, from the left into the left hole of the previous piece. Repeat symmetrically on the right side.

10.4. Rotate the crossbar so the pins are at the front and back and push the back pin, from the front, into the bottom hole on the 3x5x3 curved panel.

11. Push the bottom hole of a lime green 3x5x3 curved panel, in the same orientation as the first one, onto the front pin of the crossbar. The top hole of the panel should be aligned with the axle connector at the top of the first curved panel.

12.1. Push the right two holes on the back side of a black 3x13 hollow frame, standing upright and horizontally, onto the two pins on the right side of the base.

12.2. Push a dark gray 1L pin with a stud on one side, with the stud on top, from the top into the rightmost, third from the right, and fifth from the right, holes on the top side of the previous piece.

12.3. Push a dark gray 1L pin with a stud on one side, with the stud on the left, from the left into the hole on the left side of the 3x13 hollow frame from step 12.1.

12.4. Place a green 1x10 plate, horizontally, on the studs on the top side of the 3x13 hollow frame. The right stud should be placed on the right pin with a stud and there should be one free hole on the top side of the 3x13 hollow frame.

13.1. Now we'll make the front mount for the flapper. Place a dark gray axle and pin connector #1, with the axle connector at the front and the pin hole at the back left and right, in front of you.

13.2. Push the axle side of a blue 2L axle/pin combo from group C, with the axle at the back, from the front into the front axle hole of the previous piece.

13.3. Slide the axle of a dark gray 4L axle with a stop on one side, with the stop on the right, from the right into the pin hole of the #1 axle and pin connector. Only slide it in so it extends a little bit to the left.

13.4. Push a light gray thick bushing, from the left, onto the axle of the previous piece. Only push the axle into the bushing until its left side is even with the left side of the bushing.

13.5. Rotate the mount so the pin is at the bottom and the bushing is at the back. Push the pin, from the top, into the hole on top of the front 3x13 hollow frame to the left of the 1x10 plate.

14. Line up the axle on top of the flapper mount with the top hole of the front 3x5x3 curved panel, then push the axle all the way to the back.

15.1. Now we will widen the base a little bit. Place a dark gray 1x4 technic brick, horizontally, in front of you.

15.2. Push a blue 3L pin from group B, with the stop ring at the front, from the front into the left and right holes of the previous piece. Push the pin all the way to the back so it extends 1L to the front and back of the previous piece.

15.3. Push a dark gray 1x4 technic brick, from the back onto the previous pieces so it is even with the first 1x4 technic brick.

15.4. Repeat steps 15.1-15.3 three times.

15.5. Rotate one of the assemblies we just made so the pins are extending to the back. Push the pins into the leftmost and second from the left holes on the bottom row of the front side of the front 3x13 hollow frame. Repeat symmetrically on the back side with another assembly.

15.6. Rotate another of the assemblies so the pins are extending to the back. Push the pins into the second and third holes from the right side on the bottom row of the front side of the front 3x13 hollow frame. Repeat symmetrically on the back side with another assembly.

Open bag 2.

Open group 3.

16.1. Place a tan 2x2 slope brick, with the slope on the left, on the left two columns on the front left pair of 1x4 technic bricks.

16.2. Place a brown 2x8 plate, horizontally, to the right of the previous piece.

16.3. Place a brown 2x2 plate to the right of the previous piece.

17.1. Place a brown 2x4 slope brick, horizontally with the slope on the right, on the previous piece so the right sides are even.

17.2. Place a lime green 1x1 tile on the back stud of the previous piece.

Open group 4.

18.1. Place a brown 2x2 slope brick, with the slope at the front, in front of you.

18.2. Place a brown 1x2x3 tall slope brick, with the slope on the right, on the previous piece.

18.3. Place a tan 1x1 slope tile, with the tall side on the left, on the previous piece.

18.4. Place this assembly on the front two rows to the left of the 2x4 slope brick from step 17.1.

19.1. Place a brown 2x4x6 rock panel, horizontally with the open side at the back, to the left of the assembly we just placed.

19.2. Place a tan 1x1 slope tile, with the tall side at the right, on the leftmost stud of the previous piece.

20.1. Keeping the studs on top, rotate the base 180 degrees so the previous piece is at the back. Place a brown 1x2 tile, vertically, on the leftmost column of the front left pair of 1x4 technic bricks.

20.2. Place a brown 1x2 plate, vertically, to the right of the previous piece.

You will have two brown 2x2 slope bricks leftover when you finish this group.

Open group 5.

21.1. Place a brown 2x8 plate horizontally in front of you.

21.2. Place a leftover brown 2x2 slope brick, with the slope on the left, on the left two columns of the previous piece.

21.3. Place a tan 2x2 slope brick, with the slope at the front, to the right of the previous piece. This is not one of the leftover 2x2 slope bricks.

21.4. Place a brown 1x2x3 tall slope brick, with the slope on the left, on the previous piece.

21.5. Place a brown 2x4x6 rock panel, horizontally with the open side at the back, to the right of the previous piece.

21.6. Place a tan 1x1 slope tile, with the tall side on the right, on the leftmost stud of the previous piece.

21.7. Place a green 1x1 plate on the rightmost stud of the 2x4x6 rock panel.

21.8. Place the assembly we just made on the front pairs of 1x4 technic bricks on the base, to the right of the 1x2 plate from step 20.2. There should be two free columns to the right.

22.1. Place a leftover brown 2x2 slope brick, with the slope on the right, to the right of the assembly we just placed.

22.2. Place a tan 1x1 slope tile, with the tall side at the back, on the back stud of the previous piece.

23. Set the base aside for now.

Sub-build 1: Pull-out tray

Open group 6.

24.1. Now we'll build a tray that pulls in and out of the base! Place a dark gray 6x8 plate horizontally in front of you.

24.2. Place a brown 1x6 tile, horizontally and centered horizontally, on both the front and back rows of the previous piece.

25. Place a dark gray 2x8 plate, horizontally, under the second and third rows from the front so the 2x8 plate extend 1 column to the left. Place another behind the first.

26. Place a dark gray 1x8 plate, vertically and centered vertically, on the leftmost column of the previous two pieces.

27. Find a dark gray 2x3 bracket. This piece looks like two 2x2 plates connected by a 1x2 brick. Rotate it so it's vertical with the front plate higher than the back one. Place the lower plate on the second and third rows from the front of the 6x8 plate so the right sides are even. The front of the higher plate should be even with the front of the 6x8 plate. Repeat symmetrically on the back side.

28.1. Place a brown 1x2 slope tile, vertically with the tall side on the left, on the front two studs of the rightmost column of the front previous piece. This is on the higher 2x2 plate. Repeat symmetrically on the back side.

28.2. Place a light gray 2x2 tile, centered vertically, on the right two columns. This should connect the lower plates of the two 2x3 brackets.

29. Place a light blue 1x1 round tile to the left of the back row of the previous piece.

30. Place a dark gray 1x2 brick with an axle hole, vertically and centered vertically, on the leftmost column. Place another to the right of the first.

31.1 Place a brown 1x2 brick, horizontally, in front of the previous two pieces. Repeat symmetrically on the back side.

31.2. Place a brown 2x2 corner brick, with the corner at the back left so the studs form a braille letter F, in front of the front previous piece. Repeat symmetrically on the back side.

32.1. Place a green 2x6 tile, vertically and centered vertically, on the left two columns.

32.2. Place a tan 1x1 slope tile, with the tall side on the right, on the leftmost column in front of the previous piece. Repeat symmetrically on the back side.

33.1. Place a dark orange 4x4 half barrel in front of you. This piece has four studs inside.

33.2. Place a light blue 1x1 round plate on each of the left two studs of the previous piece.

33.3. Place a light blue 1x1 round tile on the front previous piece.

33.4. Place a light blue 1x1 round tile to the right of the previous piece.

33.5. Place the half barrel, centered vertically, on the tray to the right of the 2x6 tile from step 32.1.

Open group 7.

34.1. Find a black 7x7 ring with two 1L axle connectors. This piece is a large ring which has two axle connectors opposite each other. Rotate this piece, so that it is flat like a basketball hoop, with the axle connectors on the left and right.

34.2. Push a red 2L axle into the axle hole of a red ball.

34.3. Push the axle from the previous step, with the ball on the right, from the right into the left axle hole of the 7x7 ring.

34.4. Find a light gray 3L axle and pin connector. This looks like a 3L axle which has a perpendicular pin connector on one end. Push the axle portion of this piece, with the pin connector on the left with the holes facing up and down, from the left into the right axle hole of the 7x7 ring. Push it all the way in so the axle extends 2L to the right.

34.5. Find the axle hole on the left side of the tray. Push the axle on the right side of the ring into this axle hole.

35.1. You will need to do the next couple of steps with the set placed on a smooth, flat surface. Place the base back in front of you, with the upright 9L liftarm on the right. Rotate the two 3x5x3 curved panels counter clockwise until they are in the middle of the base. These panels are on the left side of the build.

35.2. Slide the tray, with the ring on the left, into the gap on the left side of the base. The curved panels should ride up over the two slope tiles on the right column of the tray, then fall down so that you can't pull the tray back out without lifting the curved panels up.

36.1. Now we'll build a lever to lift the curved panels and let you pull the tray out. Find a light gray axle and pin connector #2. This piece has two 1L axle connectors on opposite sides, and a perpendicular pin hole between them. Place this in front of you, with the axle connectors at the left and right and the pin hole facing the front and back.

36.2. Push a light gray 9L axle into each of the axle connectors of the previous piece.

36.3. Push the axle connector of a red #1 axle and pin connector, with the pin hole facing the front and back, from the right onto the right previous piece.

36.4. Push a light gray 2L pin, from the front, into the two pin holes on the front of the lever. These pins do not have friction ridges and should spin freely.

36.5. Place a dark orange 4x4 half barrel in front of you.

36.6. Push a brown 3L axle with a stop on one end, with the stop at the bottom, from the bottom through the centered hole on the bottom of the previous piece.

36.7. Push the axle connector of a red #1 axle and pin connector, with the pin hole facing the front and back, from the top onto the previous piece.

36.8. Connect the pin hole of the previous piece to the rightmost pin from step 36.4.

36.9. Now, connect the middle pin, with the half barrel on the right, from the back to the top hole of the upright 9L liftarm on the right side of the base. The half barrel should just fall straight down. To use the lever, lift up the curved panels holding the tray in place, lift up the half barrel on the lever we just made until the left side of the lever touches the tray, then set the curve panels back down so they hold the left end of the lever in place. Now, pushing down on the right side of the lever will lift the panels and allow the tray to be removed!

Congratulations! Now this build is complete!