



Little Leonardo's™ MakerLab: Building includes a collection of simple hands-on activities for young readers interested in how bridges, homes, towers, and skyscrapers are created and stay standing. Also includes a glossary of key terms.

With original Renaissance man Leonardo da Vinci as inspiration, the *Little Leonardo's™* MakerLab series of books include fun hands-on activities designed to engage children's hands and minds, which helps them better understand and retain the knowledge gained from the activities.



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LITTLE LEONARDO'S™
MakerLab

BUILDING

King ★ Paprocki

GIBBS SMITH

LITTLE LEONARDO'S™ MakerLab BUILDING

MORE THAN
20
HANDS-ON
ACTIVITIES!



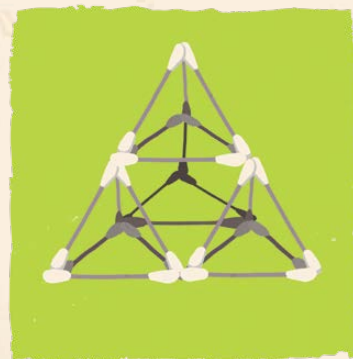
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BART KING

Illustrated by
GREG PAPROCKI

NOT-VERY-ANCIENT PYRAMID

What You Need:

- ✧ 24 Q-tips
- ✧ Rubber cement
- ✧ Wax paper or newspaper or other protective covering
- ✧ Work surface
- ✧ Color markers (optional) to give your project color by marking the ends of Q-tips before starting



What You Do:

1. Use small dabs of rubber cement to connect three Q-tips into one flat triangle. Let dry.
2. Do step 2 three more times. You should have four flat triangles. Let dry.
3. Take one of your triangles. Carefully rest three Q-tips up on each of its corners. The Q-tip heads should rest together in the center. Remember how careful you were making a house of cards? Be that careful! Use rubber cement to keep them in place. Let dry.
4. You just made a pyramid! A pyramid is a structure with sloping sides that has a point at the top. This is a very strong shape.
5. Repeat step 4 on your other three flat triangles. You now have four pyramids. Let dry.
6. Move three of your pyramids next to each other in a row. The one in the center will need to point the opposite direction from the others. Glue the pyramids together at the bottom. Let dry.
7. Carefully set the base of your fourth pyramid above the other three. Glue them together. Let dry. You just made a big **pyramid**!

EXTRA-GENIUS LEVEL: Try combining triangles and pyramids to make other shapes!



TOWER CONTEST

What You Need:

- ✧ 30–40 gumdrops or mini marshmallows
 - ✧ Lots of toothpicks (preferably round, and sharp at both ends)
 - ✧ A stable, flat table
5. Now build another square like you did in step 1. Set it on top of those toothpicks.
 6. Keep going! How tall can your tower get before it starts to lean?
 7. It's time for a new tower with a triangle base.

What You Do:

1. Get four gumdrops or marshmallows. Connect them with toothpicks to make a square.
2. Then do it again to make a second square.
3. You just built a **cube**!
4. Gently set vertical toothpicks into the four corners of the top of your cube.
8. Look carefully at the illustration. See how the design is different? Try to connect your next level like this.
9. But as you build up, look at how you use the toothpicks. Use this design.
10. How far can you go before your triangle tower starts to lean?

What You Should Know:

Triangles are strong, stable shapes. Because they don't get squashed easily, triangles are great for construction.



GIANT FORTRESS OF TRUSSES

As you know, triangles are good shapes to use for building things. If you connect triangles together, you can get a **truss**. Trusses can be seen holding up roofs and bridges. Or forts!

What You Need:

- ✧ Lots of sheets of newspaper
- ✧ Scotch tape
- ✧ 1 to 3 blankets or sheets
- ✧ Cushions from the sofa or chairs

What You Do:

1. Lay down three or more sheets of newspaper. Start at one corner and roll as tight as you can. Make a lot of these. Thirty are not too many!
2. You will make BIG triangles with your tubes. That way you can build something big enough for you to be inside.
3. After making a tube, don't bend it as you did to make a triangle table. Instead, tape the ends of one roll to the ends of two other tubes.



4. Then tape the corners of the other two tubes together. Add enough tape to make a sturdy triangle.
5. Keep making triangles! You need at least five, but ten would be even better.
6. If you want bigger triangles, start with a sheet of newspaper folded in the center. Roll about half of it up. Then lay another folded sheet of newspaper into the unrolled portion. Keep rolling the two double sheets as tight as you can. When you're halfway through the second sheet, add a third folded newspaper sheet to your roll.
7. For big triangles, you may want to bend or cut off the ends to keep them strong.
8. You are ready to create a truss! Look at the pictures. If you made identical triangles, they may slip together perfectly. Use tape to keep them together. If not, trim or bend the end of a triangle before trying to slip it inside the other to connect them.
9. Your trusses can form fortress walls. Help them stay up with cushions and pillows.
10. Optional: Use bedsheets or sheets of newspaper to cover your triangle walls.
11. Experiment with your triangles, cushions, and blankets to make the best living room fort ever!

What You Should Know:

Walls are good for keeping a house cool or warm. That's why they have **insulation** inside them. Insulation is material that helps keep the heat indoors. Foam and **cellulose** plant fibers are often used for insulation. In a very cold place, ice can even be a good insulation! In the arctic, pockets of air in ice can help keep an igloo warm inside.

COVERED BRIDGE

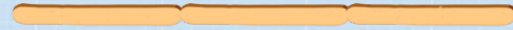
Below are instructions for making *one* truss. But to finish the activity, you will need to make *two* trusses. You can make these trusses one at a time. Or you can double the directions in each step of the instructions as you go along.

What You Need:

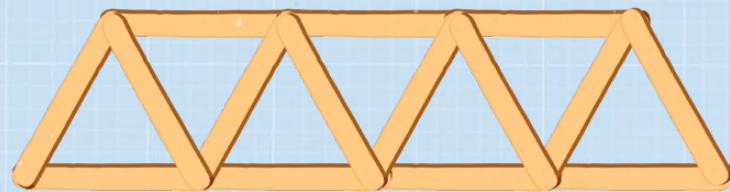
- ✧ About 50 craft sticks or popsicle sticks
- ✧ Glue (wood glue if possible)
- ✧ Some big blocks, or large books, or even bricks
- ✧ A level work surface (table or floor)
- ✧ Masking tape
- ✧ Patience!

What You Do:

1. Lay out three sticks in a row, end to end, for each of the trusses you are building.
2. Below that, lay out four sticks in a row. Make sure the top row is centered over the lower row.



3. Glue two end sticks at an angle to connect the two sides, like below. Just a dab will do it. You can also put a dab of glue to connect the end-to-end sticks. Put a book over the sticks while they dry.



4. As you work, use masking tape to strengthen bridge pieces and help sticks stay in place while drying.
5. After your shape dries, flip it over. If your end-to-end sticks come undone, no problem. Just move the sticks back to the right spots.



6. Look at the picture. Next, you will glue six sticks in the middle to make these triangles. That is a truss!
7. If you didn't already double this recipe, make a second truss the same way. Wait until both trusses are dry.
8. Prop up your two trusses, long side down. They should be about one popsicle stick length apart. Make sure they are straight!
9. Glue 4 stick beams across the top of the bridge, as shown. Let dry.
10. Next, carefully glue 5 sticks across the bottom. Let dry.
11. Cut a cardboard roof large enough to cover the top of your bridge. Now you have a **covered bridge**!

TRY THIS: If you have a lot of extra sticks, you can also glue sticks to the outside of the trusses to turn them into solid walls.

EXTRA-GENIUS ACTIVITY: If you have a backyard, create a river and set your bridge across it!

DRAWBRIDGE

A drawbridge can be raised or lowered. This is a good way to keep enemies out of your project!

What You Need:

- ✧ Roll of string
- ✧ Hole punch
- ✧ Scissors
- ✧ Empty cereal box (or other cardboard box)
- ✧ (Optional) a flat rock or small heavy book

What You Do:

1. Use your scissors to cut the flap off your box's top.
2. Punch two holes near the back corners of the box.
3. Punch two more holes near the front corners of the box.
4. Cut carefully down the sides of the front of the box. Fold its crease at the bottom a few times. This will let your drawbridge raise and lower easily.
5. Lower the drawbridge and lay it flat.
6. Keeping the string on its roll, thread the string through one of the holes in the box back.



7. Now feed enough string through to reach the front hole on the same side.
8. Pull the string through and across to the other hole on the front of the box.
9. Now pull that string all the way back to the other back hole in the box.
10. Feed enough string through so that you can raise and lower the drawbridge by pulling the string behind the box.

11. Make sure you have enough string coming out the back of the box. Then cut it and tie the two ends to something big enough not to get pulled through the cereal box holes.
12. If the box wants to tip over, weigh it down with your flat stone or book. Or you can glue it down by using it for the entrance to the next project!

GENIUS LEVEL: Use cardboard tubes, sugar cubes, and boxes to build an entire castle. Or use your new drawbridge as the entrance for the next activity!

DID YOU KNOW? A castle is a home that is meant to protect people against invasion. A fort is a place for soldiers to be stationed. But both castles and forts are usually built on high ground. (Or in the case of a tree fort, a high tree!)

