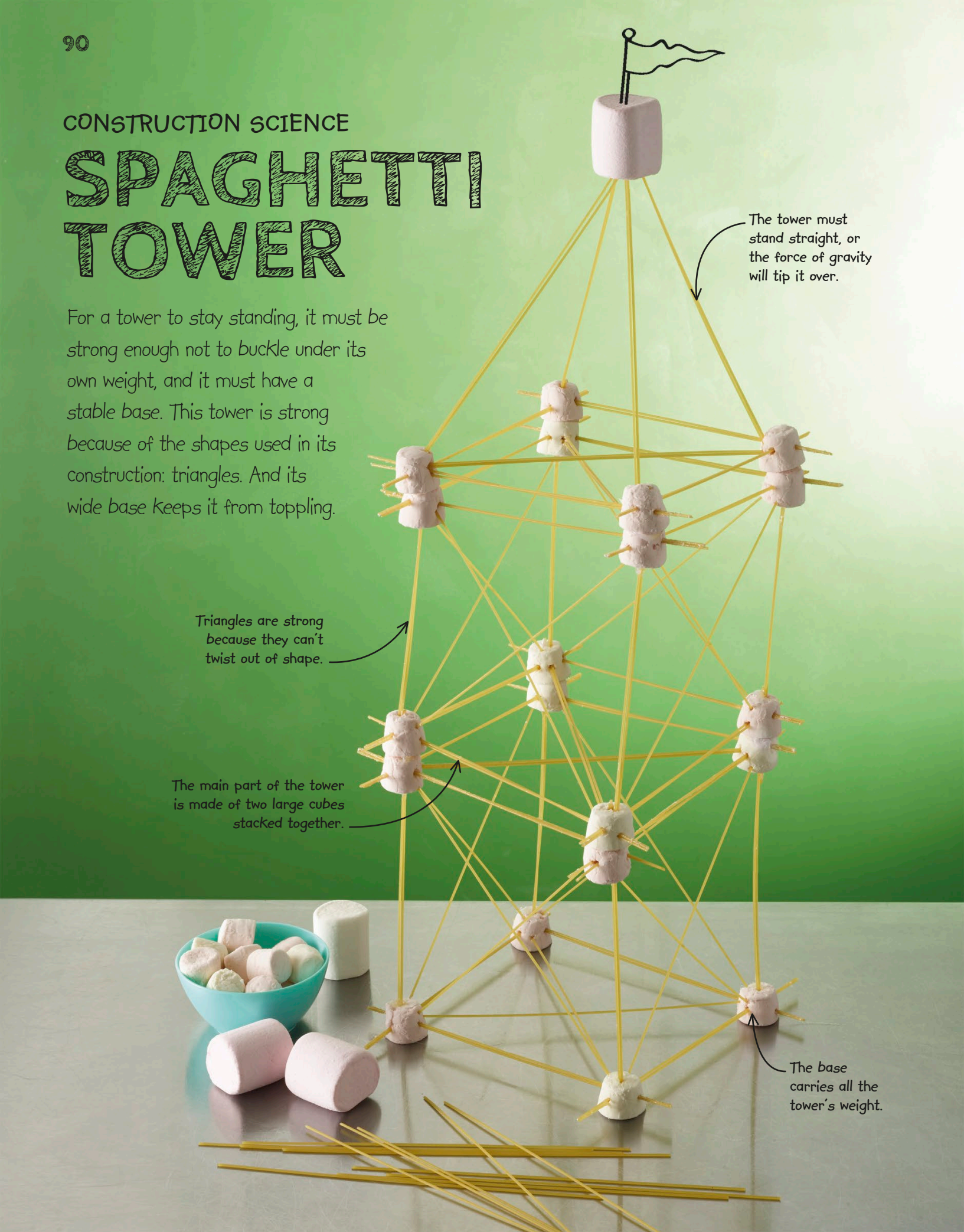
CONSTRUCTION SCIENCE

SPAGHETTI TOWER

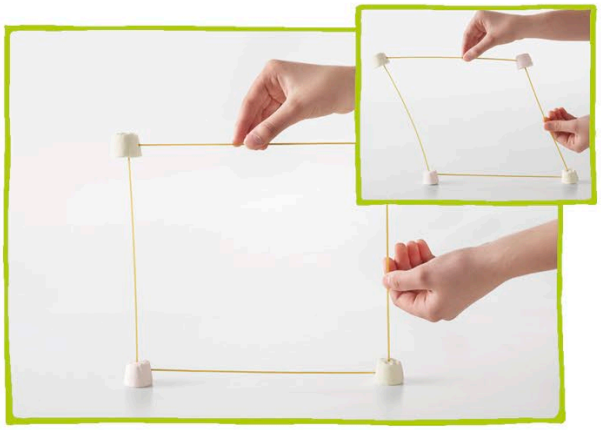
For a tower to stay standing, it must be strong enough not to buckle under its own weight, and it must have a stable base. This tower is strong because of the shapes used in its construction: triangles. And its wide base keeps it from toppling.



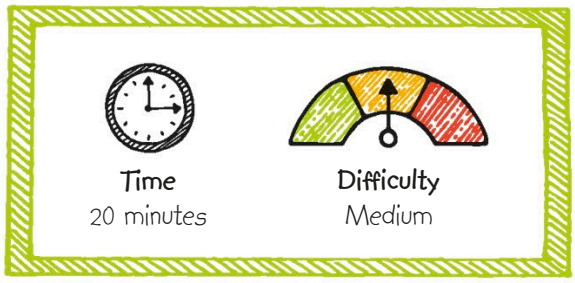
HOW TO MAKE A

SPAGHETTI TOWER

All you need to build this tower is spaghetti, marshmallows, and willpower! The sticky marshmallows hold the ends of the spaghetti in place, and the spaghetti forms a sturdy framework. If you like marshmallows, you'll need willpower to stop yourself from eating your building materials!



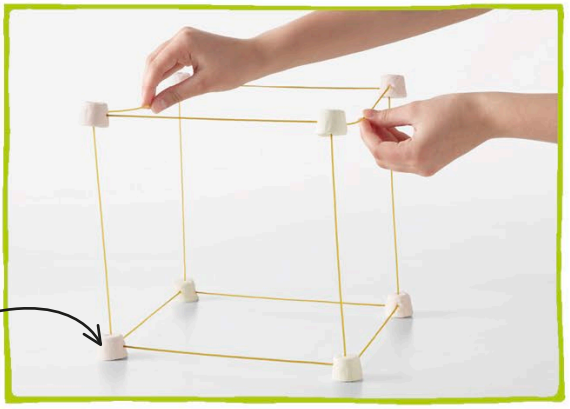
1 Begin by making a square. To see why a square isn't a strong shape, push it gently from one side. It leans easily, becoming a parallelogram.



WHAT YOU NEED

Marshmallows

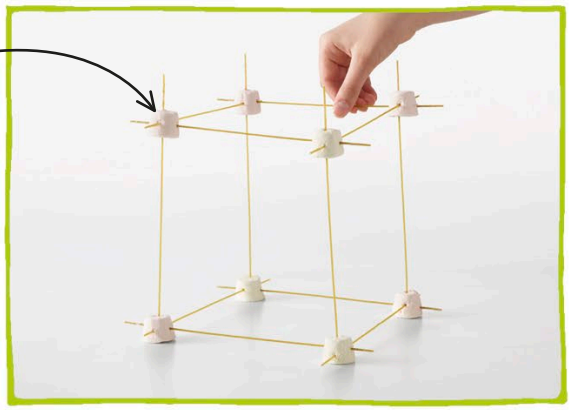
Uncooked spaghetti



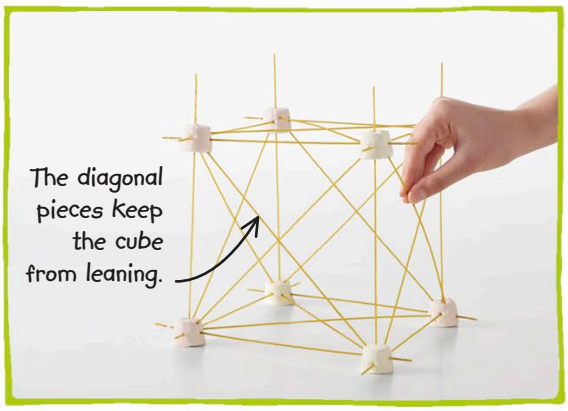
Make sure the bottom marshmallows sit on their flat bases.

2 Make a cube. Try twisting it gently. Because it's made of squares, you'll find it leans very easily and isn't stable.

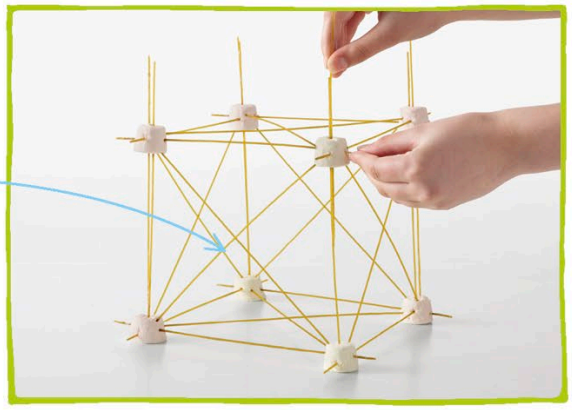
Sliding the marshmallows inward helps to make the cube stronger.



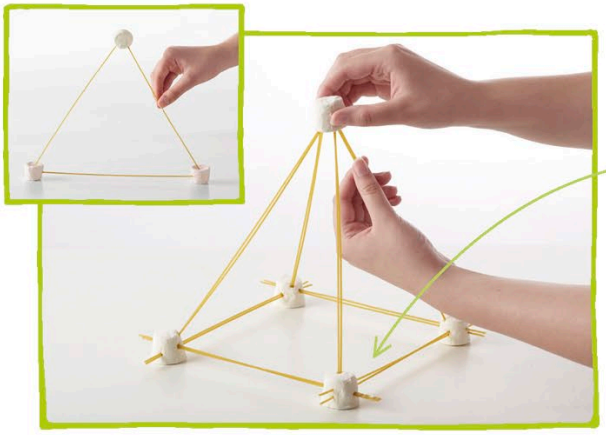
3 To make the cube stronger, you'll need to add diagonal pieces. To fit them, first make the cube smaller by sliding the marshmallows inward so the spaghetti strands poke out the other side.



4 Add the diagonal pieces, called braces, across each face from corner to corner.

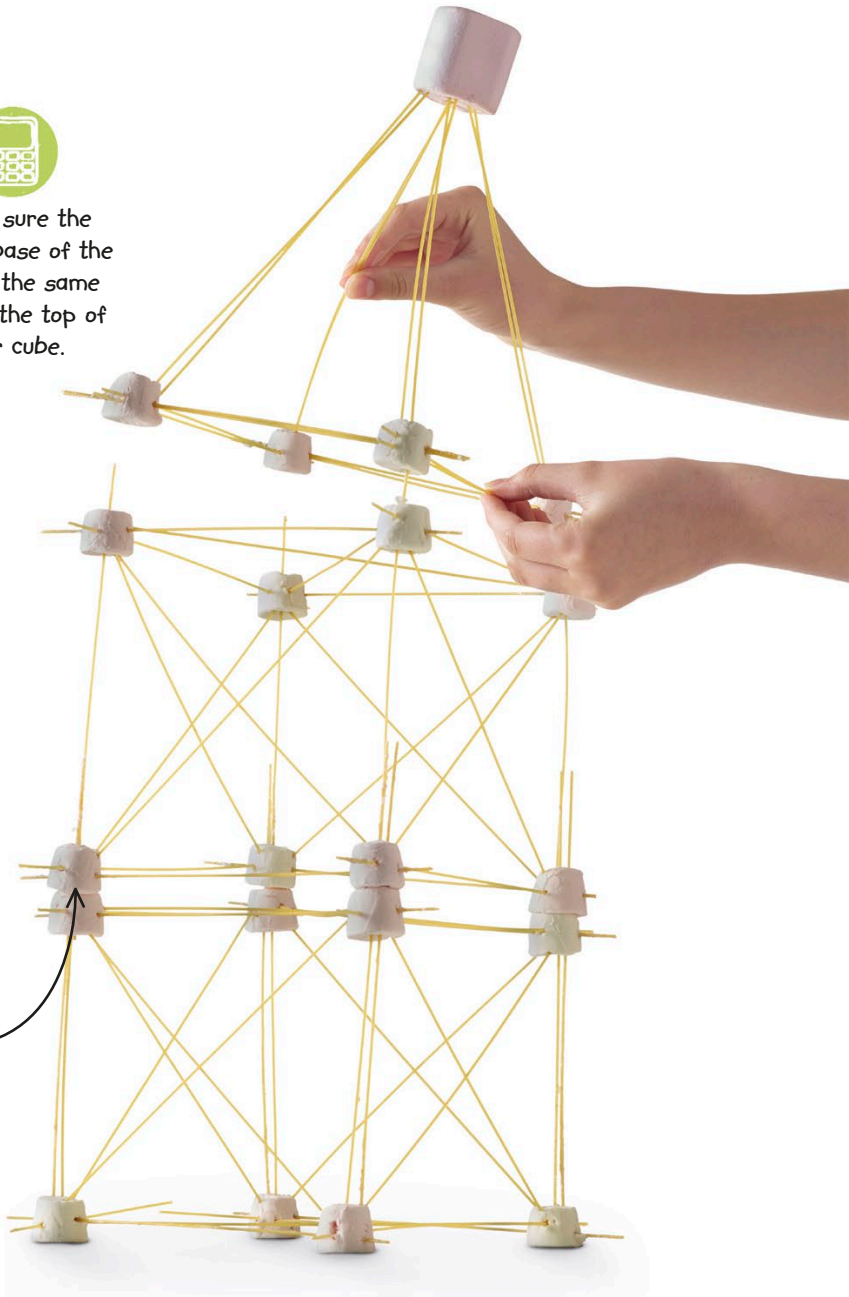


5 Strengthen the vertical edges by feeding a second piece of spaghetti down through the marshmallows at the top corners.



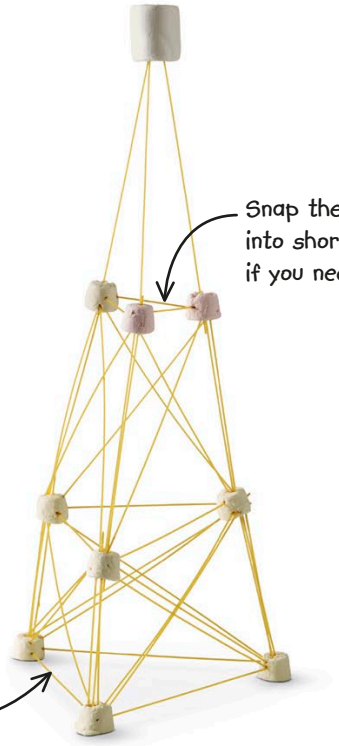
6 Make the roof, starting with a triangle. You'll notice this is stronger than a square, as it doesn't lean. Add more spaghetti and marshmallows to form a pyramid with a square base.

7 Build a second braced cube and fit it very carefully on top of the first one. Then, just as carefully, fit the pyramid on top. Your tower is now complete!



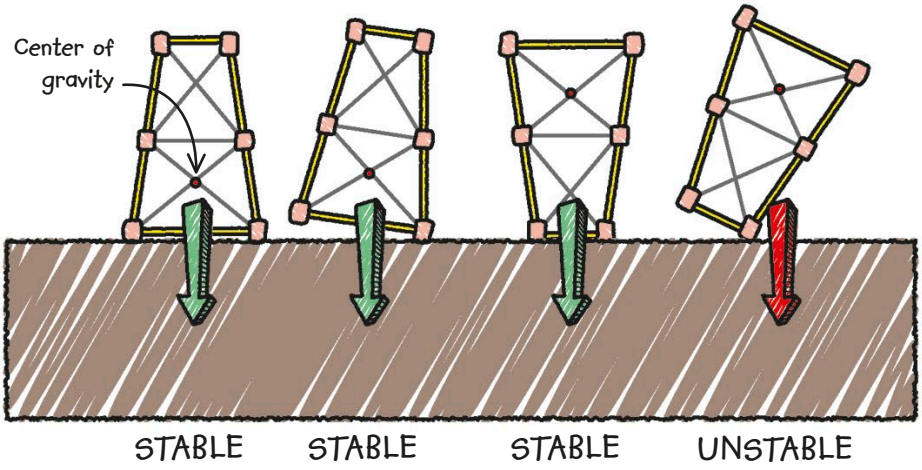
TEST AND TWEAK

Now that you've mastered the art of building spaghetti towers, why not try different designs? You could try building a tower that is one big pyramid. You'll need to plan the shapes carefully to make sure they all fit together. You might want to try to make your tower much taller. Can you make a tower that stands taller than you? The spaghetti pieces bend less if they're shorter—can you make a taller tower by using shorter pieces of spaghetti? If you want your tower to be stable, you'll need to make the base wide and the top the same width or narrower.



HOW IT WORKS

Triangles are the key to the strength of your tower. Unlike a square, which can lean over and turn into a parallelogram when pushed, a triangle can't change shape, so it remains upright and rigid. The base of your tower must also be wide. All objects have something called a center of gravity. This is the midpoint of an object's mass, where all its mass appears to be concentrated. Objects are stable if the center of gravity is within the base. If an object leans so much that the center of gravity is outside the base, it will fall.



REAL WORLD: ENGINEERING
TOKYO SKYTREE

With a height of 2,080 ft (634 m), the Tokyo Skytree in Japan is the tallest tower in the world. It's made of steel tubes arranged as strong triangles, and its base is much wider than its top.