Engineer That!

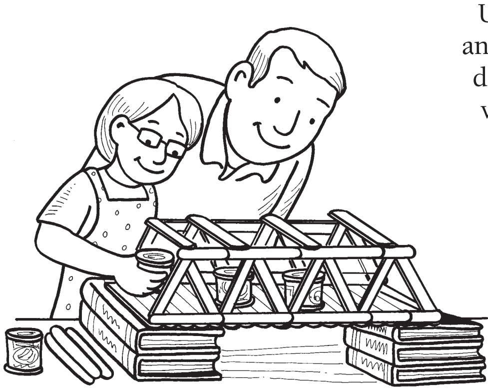
One day, your child may have a job that doesn't even exist yet! She'll need creativity, problem-solving skills, and persistence—qualities that engineers rely on. Share these projects to help your youngster think like an engineer and enjoy taking on challenges.

Build a stronger bridge

Let your child construct a bridge to explore what kind of design supports the most weight.

Materials: *books or internet access, craft sticks, glue or clear tape, soup cans*

Together, look at photos of bridges in books or online. Talk about design elements, such as arches, vertical beams, or triangular supports. This will give your youngster clues on different ways to build her bridge.



Using craft sticks and glue, can she design a bridge that will support one or more cans? To test her bridge, she should rest it atop two stacks of books and add cans, one at a time.

Suggest that your child redesign her bridge so it holds more cans. For instance, a series of connected triangles (called a *truss*) is one design element engineers use to make strong bridges.

Don't stop spinning!

Generations of children have played with spinning tops. No need for your youngster to buy a top to see how its motion keeps it balanced—he can create his own.

Materials: *old CDs, bottle caps, tape, marble, timer, pennies*

Have your child tape a bottle cap over the hole in a CD. He should place a marble on the table and carefully set the CD over it so the marble fits into the hole. To spin the top, he'll need to grasp the bottle cap, twist quickly, and let go. Help him time how long it stays in motion before any part of the disc touches the table.

Now suggest that he tape a penny to the top of the bottle cap, then spin and time the top again. He should stack and tape additional pennies, one at a time, testing and timing the top after adding each coin. What happens? The more pennies he adds, the longer the top spins. That's because a heavier disc stores more energy, which keeps it going longer.

Engineering step by step

How do engineers design rockets that launch into orbit or running shoes that help athletes run faster? Here's a framework your youngster can use to tackle engineering projects.

- **Define the challenge.** Maybe you'd like to play pinball, but you don't have a machine, so you decide to make one.
- **Research.** What designs already exist that you can draw from? You might examine a real pinball machine or look at photos to see what parts they include (ball launcher, tube, obstacles, flippers).
- **Design.** Create a model. Sketch out possibilities, gather materials, and experiment.
- **Test.** Does your design work? Put the model through its paces. Do the flippers move? Does the ball bounce off of obstacles?
- **Redesign and retest.** Use what you learned from your test to improve your model, and test it again. The flippers may need to be longer or sturdier, for instance.
- **Repeat.** Continue to design and test new models until you find the one that lets you play a game of pinball.

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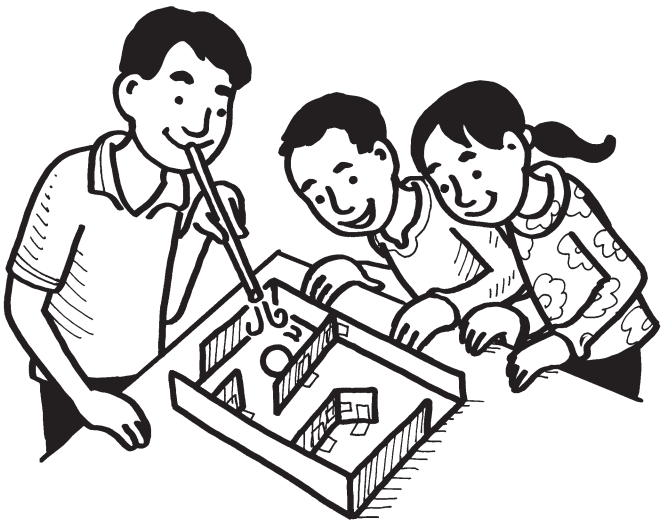


Design a maze

Can your child build a maze and blow a Ping-Pong ball all the way through it?

Materials: *empty cereal box, scissors, masking tape or duct tape, straw, Ping-Pong ball or another lightweight ball*

Help your youngster lay the box flat and cut off the front panel, setting it aside. The rest of the box (back and side panels) is the base for his maze. He can cut out two doors to create an entrance and exit. Then, have him make walls to tape onto the base by cutting the front panel into different-sized strips.

Encourage him to create twists and turns, adding ways for the ball to get around corners. He might tape cardboard squares to corners for the ball to bounce off of.

Your child can test his maze by placing the ball at the entrance and blowing air through the straw to make the ball move. Does it get stuck? Time for a redesign!

Create a toy swing set

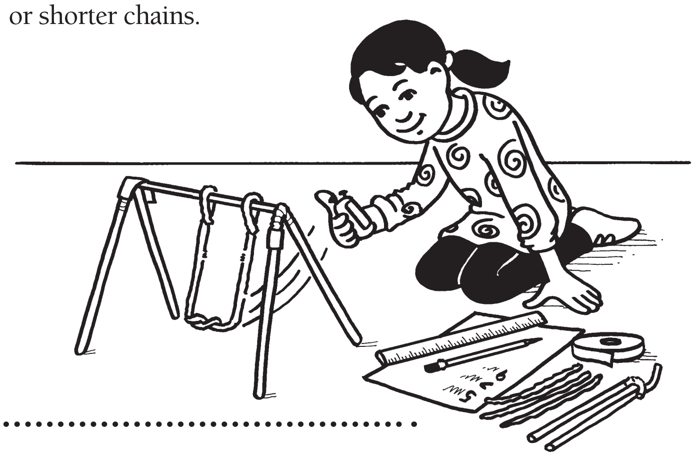
This homemade swing set shows your youngster how pendulums work.

Materials: *flexible straws, scissors, tape, pipe cleaners, timer, ruler, paper, pencil*

Suggest that she tape together straws (or straw pieces) to form a swing set frame. She can wrap the ends of 2 pipe cleaners around the top of the frame to make "chains" for the swings, then bend and connect their bottom ends to create a "seat."

The swing is a *pendulum*—a suspended weight that swings freely. Have your child hold onto the frame with one hand and, with the other, pull the swing back and up so it's parallel to the ground. Start a timer for her as she lets go of the swing. She can count how many swings (back and forth) the pendulum completes in 30 seconds. She should measure the chains and record their length and the number of swings. To redesign, she can make the pendulum shorter by wrapping the pipe cleaners around the top of the swing set a second time. Again, she could measure the chains and test the swing.

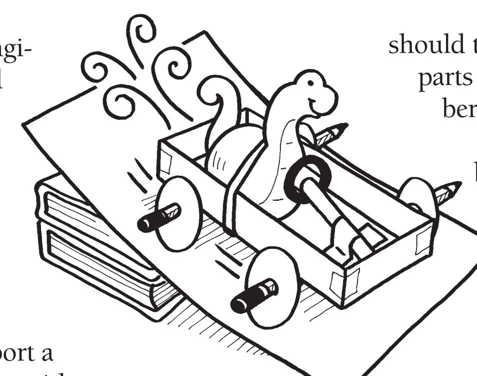
How does length affect the pendulum's speed? The next time your youngster is at the playground, she can use what she discovered to decide whether she'd prefer a swing with longer or shorter chains.



Buckle up

Designing a vehicle is a fun way to engineer for safety—and to show your child why he should always wear a seat belt.

Materials: *piece of cardboard, books, index cards, scissors, tape, pencils, rubber bands, lightweight plastic toy*



Have your youngster prop the cardboard at an angle against a stack of books to make a ramp. Then, challenge him to construct a vehicle that will support a toy passenger and carry it down the ramp without ejecting it. He can tape index cards together to make the bottom and sides of the car. Suggest that he cut circles out of more index cards to create wheels and use pencils as axles. He should think carefully about how he'll connect the parts of the car together and how he'll attach a rubber band seat belt.

Let your child conduct a vehicle safety test by rolling the car down the ramp. Does his passenger stay in place? If not, he should redesign so that the seat belt restrains the toy.

What's the science behind a seat belt? Newton's first law of motion states that an object in motion stays in motion, and an object at rest stays at rest, unless an outside force acts upon it. So a passenger would keep moving when the car stops—unless a force (a seat belt) prevents it.

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