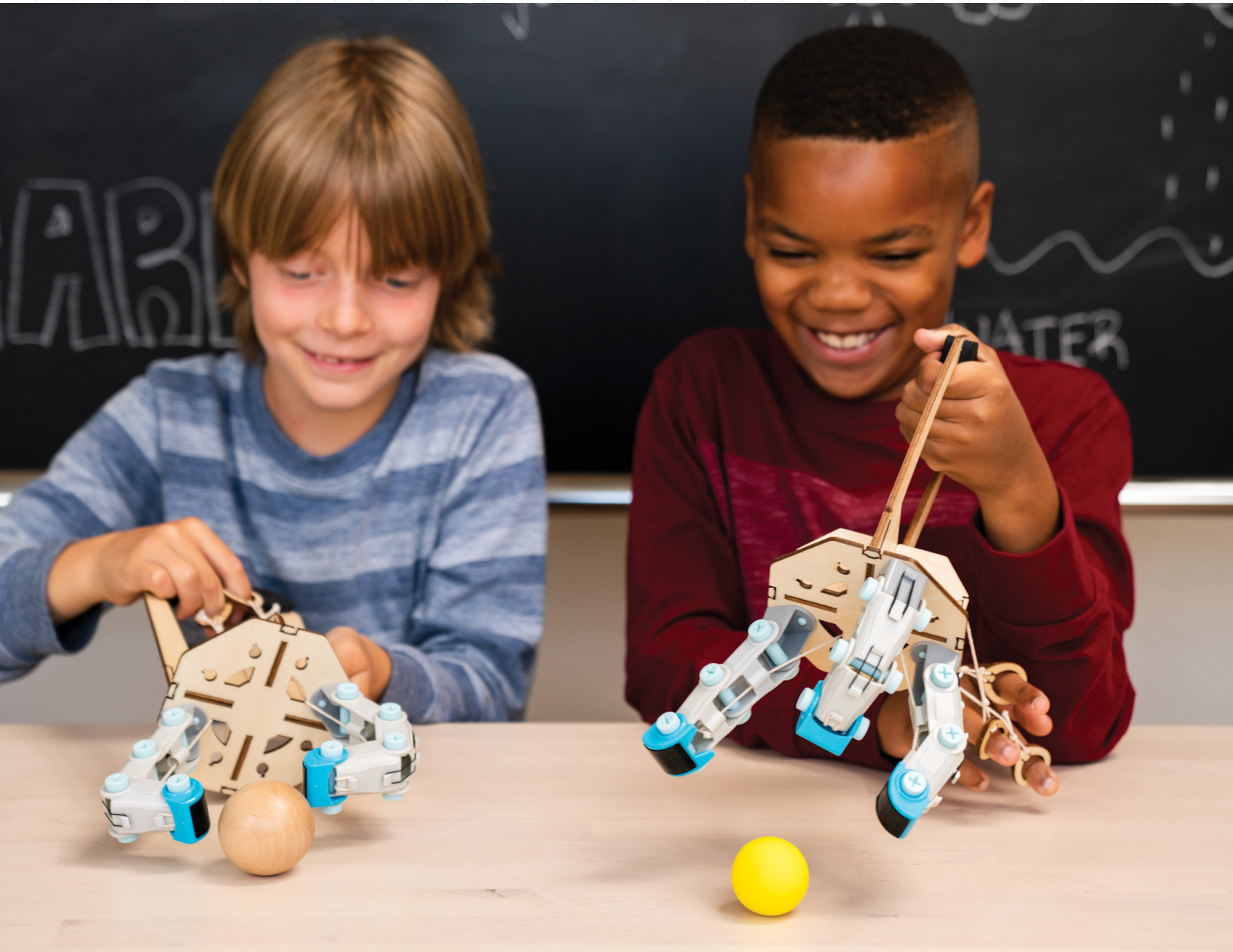
SAMPLE

Kiwi Co

Mechanical Claw

TEACHER GUIDE



Lesson Overview

SECTION 1: Construct the Claw

Build the mechanical claw and discuss how it works.

1.A Pre-Build
Prep materials before building the claw.

1.B Build a Finger
Construct a jointed finger for the mechanical claw.

OPTIONAL Claw Vocabulary
Follow along with new terms and phrases from the project.

1.C Build the Handle
Construct an arm for the claw.

1.D Assemble the Claw
Complete the claw by combining the finger and handle.

30-50 minutes

SECTION 2: Investigate Tension

Explore how tension impacts the claw's movement.

2.A Tension Design Challenge
Change how the finger bends by adjusting the tension.

2.B Redesign the Claw
Modify variables of the claw and reimagine its design.

OPTIONAL Handed Down Through History
Read about prosthetic hands and how their designs evolved.

30-45 minutes

SECTION 3: Engineer with the Claw

Make predictions and test multiple designs to solve specific problems.

3.A Dexterity Design Challenge
Optimize the claw to pick up objects of different sizes and materials.

30-40 minutes

SECTION 4: Wrap-Up

Extend investigation with more discussion and activities.

OPTIONAL Board Game Design Challenge
Play a game while moving and stacking tokens with your claw.

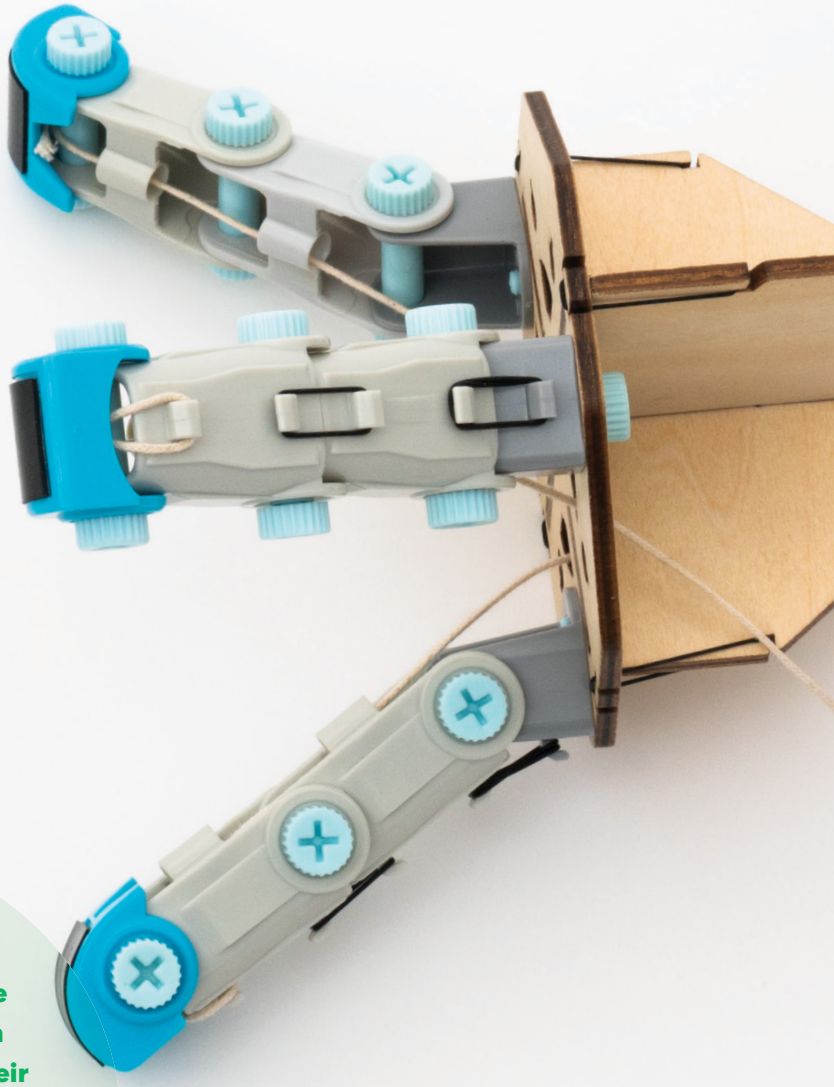
optional!

Kick it off!

Start the project by asking students these questions! You'll spark their curiosity and help draw connections to real-world examples.

True or false? There are 27 individual bones in the human hand.

True! Those bones help us raise our hands in class, grab handfuls of candy, do handstands, and so much more. Our hands were the inspiration behind the mechanical claw!



Did you know humans are the only animals that can make their thumb touch their ring finger and pinky?

Our fingers can rotate across our palms, but chimpanzee and gorilla fingers aren't as flexible.

3. Assemble the Claw

Combine the finger and handle to finish your mechanical claw.

You'll need:


completed finger


completed handle

Box 1

Box 4

Box 5

1 Grab these materials.

Box 1


rubber bands
(x11)

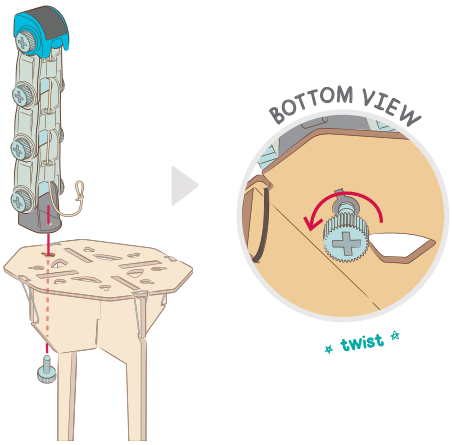
Box 4


screw
(x1)

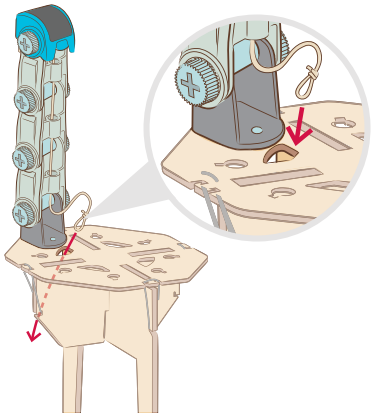
Box 5


wood ring
(x1)

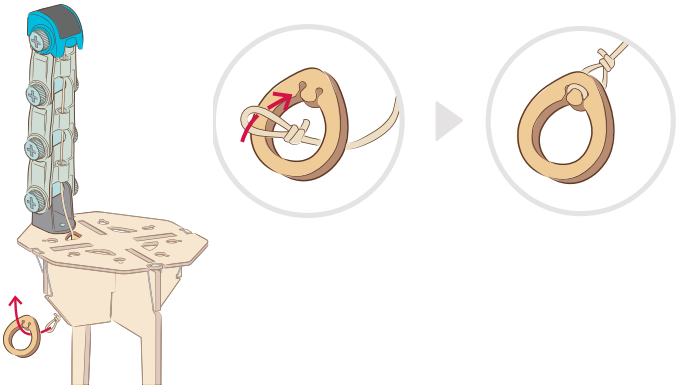
2 Line up the bottom of the finger with a round hole on the handle. Twist a screw up into the finger to secure.



3 Thread the string down through the closest opening in the handle.



4 Loop the string onto a **wood ring**. Pull to tuck the string into the notches.



Flip to other side to finish building.

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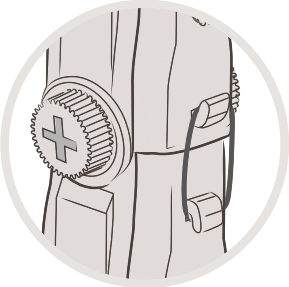
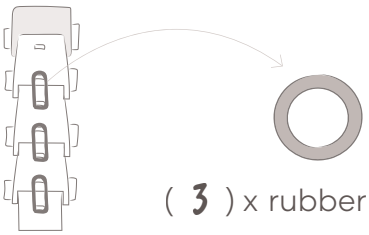
Name(s): _____ Date: _____

Tension Design Challenge



The claw finger has three joints — just like your finger! By looping **more rubber bands around the joints**, you can change how the finger bends. Check out the finger bends below and **try to recreate each one**.

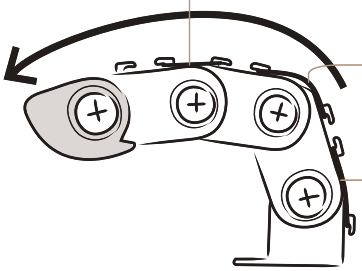
Example:



Record how many rubber bands you used and where!

CHALLENGE #1 : FINGER BENDS IN THE MIDDLE

How many rubber bands did you use?



( ) x rubber bands

( ) x rubber bands

( ) x rubber bands

Discussion Time!

Notes For The Teacher

Apollo 13 had a famous example. To fix the air filter, astronauts had to make a square peg fit in a round hole, using only what was on board: plastic bags, cardboard, and tape.

A. There are countless ways to modify the mechanical claw, but groups are constrained by the materials. They only have three mounts and three strings, which means they can only build three fingers. Groups can't keep adding to each finger because they'll run out of joints, pegs, and screws. Engineers face similar challenges on a daily basis: they have to build a working product using limited resources.

B. The rubber bands stretch, but they always want to spring back to their original shape. Adding more rubber bands along the joints creates more tension. When you let go of the string, the rubber bands pull back and make the finger go back to where it was.

C. Friction is a force that fights slipping and sliding. Smooth surfaces, like ice or glass, are easy to slide over because they don't create much friction. Rough surfaces, like rubber or pavement, create more friction.

D. The finger pad is made of smooth plastic, so it can be slippery when they're trying to pick up a smooth object. That's why you add rubber squares! The rubber creates more friction and makes it easier to pick up objects. (Students can stick clear tape over the rubber to see the difference.)

Thought-Starters

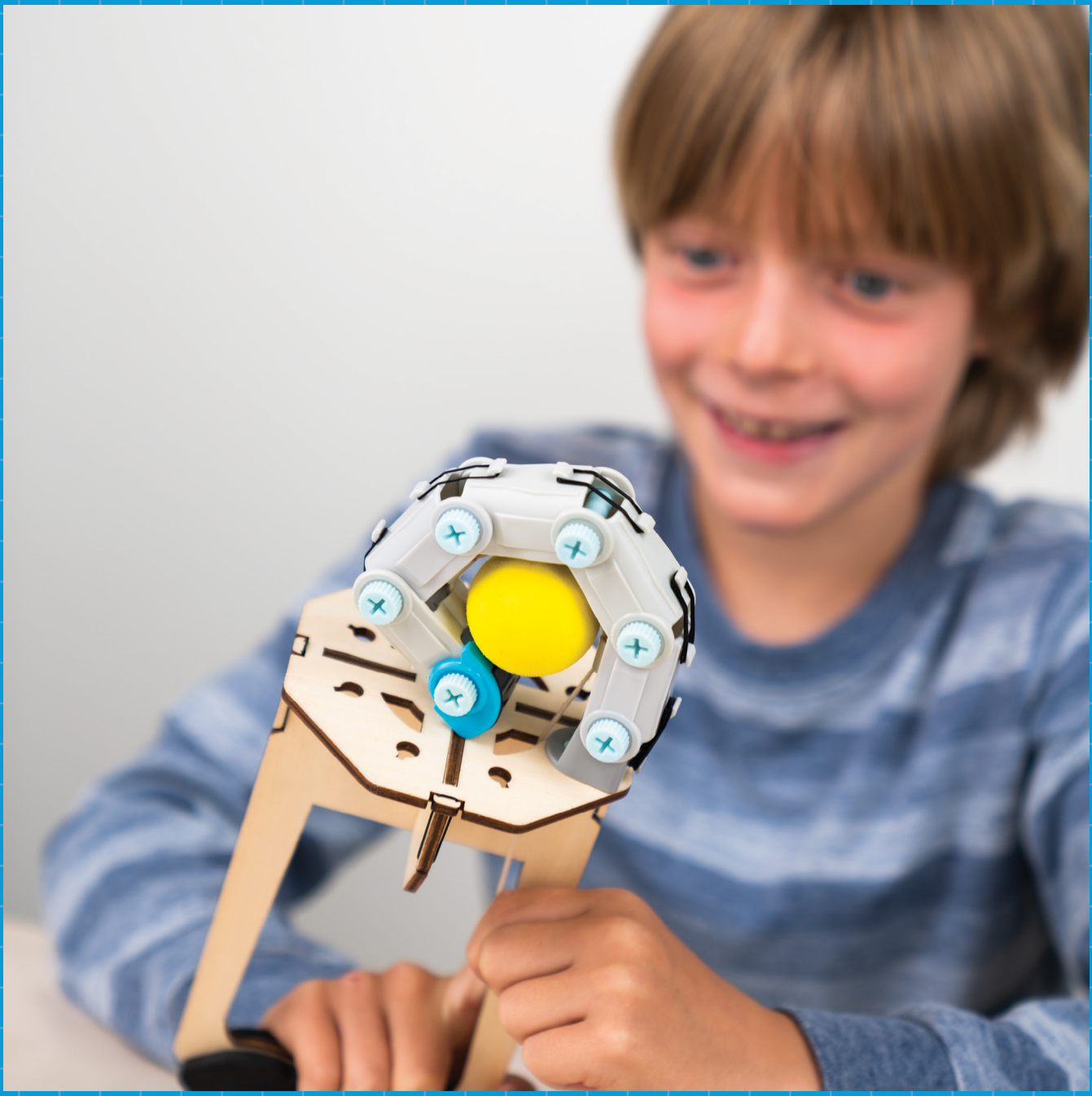
What materials do you wish you had more of?

If you're limited by materials and can't get more, how does that change the way you solve a problem?

What happens when you add more tension to the finger?

What do you think the rubber squares do?

What's the greatest number of fingers you can build?



Tinker, Create, Innovate

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